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THE

JOURNAL OF THE SOCIETY OF ARTS,

AND OF THE

INSTITUTIONS IN UNION.

VOLUME VIII.

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THE INSTITUTIONS IN UNION.

No. 365. FRIDAY, NOVEMBER 18, 1858. Vol. VIII.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 18, 1859.

COUNCIL.

The Council have elected Vice-Chancellor Sir William Page Wood as a Vice-President of the Society, in the place of the late Robert Stephenson, Esq., M.P.

FIRST ORDINARY MEETING.

WEDNESDAY, NOVEMBER 16, 1859.

The first Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 16th inst., Sir Thomas Phillips, F.G.S., Chairman of Council, in the chair.

The following Institution has been taken into Union since the last announcement:—

Darlington, Church of England Institute.

The Chairman delivered the following

ADDRESS.

It appears to be a time-honoured custom of the Society that your Session should be opened by an address from the Chairman of the Council, in which he is required to acquaint the members with the policy which it is the design of the Council to pursue during the Session on which they have entered.

Notwithstanding the warning given by an eminent philosopher, that speakers should avoid prefaces, excuses, and apologies, which, though they seem to proceed from modesty, are often signs of bravery, I would bespeak your indulgence, not alone for the present occasion, but during the continuance of my term of office, contrasting, as I must do, my limited experience as a member of Council as well as my imperfect acquaintance with those subjects of a scientific character which properly belong to the deliberations of the Society, with the valuable services and eminent qualifications of many of my predecessors. Guided, however, by the example of those who have preceded me in the chair, it shall be my constant endeavour to realise the designs of the Council, and whilst I retain their good opinion, and receive their kind co-operation, I may rely with some confidence that the interests of the Society will suffer no detriment in my person.

Although the period which has elapsed since the close of our last session is brief, we have to mourn the loss of men, who had shared the labours and extended the influence of the Society, who were eminent for their scientific knowledge, and distinguished for the works they had achieved and the reputation they had gained.

The first in order of time, as well as the senior in years, was Andrew Ross, distinguished by his contributions to optical science, and by the improvements which he introduced in the construction of telescopes, miscroscopes, and photographic lenses. Mr. Ross contributed to the Transactions of the Society, several papers of great merit connected with optical science, and his services, frequent and long continued, on Committees of the Society, were justly valued. For a paper on an improved method of dividing astronomical and mathematical instruments, and for his circular dividing engine, brought under the consideration of the Society, and published in the 48th volume of the Transactions, he received the Gold Isis Medal and 50 guineas; for improvements in achromatic objectives of microscopes, of which a full explanation may be found in the 51st and 52nd volumes of the Transactions, he again received the Gold Isis Medal; for his invention called the spherometer, mentioned in vol. 53 of the Transactions, he received a silver medal; and the thanks of the Society were given to Mr. Ross on several occasions.

Isambard Kingdom Brunel had inherited, from his distinguished father, a name illustrious for the successful application of scientific principles to the advancement of mechanical arts; and although the son's life was terminated at a comparatively early age, he had won for himself a reputation amongst the foremost men of a generation, remarkable—for the grandeur, the extent, and the importance of the works they have accomplished, and—for the genius and perseverance with which the resources of science have been employed in the triumph over natural obstacles.

Scarcely had the grave closed over Brunel, than we were called upon to mourn the loss of Robert Stephenson, one of our own Vice-

Presidents, the only surviving descendant of George Stephenson, that self-taught genius, whom we regard as the creator of the present railway system, to the rapid growth of which the son has so largely contributed. Carefully trained in the principles and practice of mechanical engineering, thoroughly acquainted with the problems to be solved by the scientific engineer, as well as with the agencies placed at his disposal by modern art, Robert Stephenson joined to an accurate perception of the difficulties to be encountered in the practice of his profession, a patient discrimination in the selection of the means by which those difficulties could be best overcome. And if to those qualities be added a judgment which rarely erred, modesty in estimating his own powers, generosity in making known the merits of other men, thorough integrity of character, and a genial nature, which enlisted in his favour the sympathies of every one within the circle of his acquaintance, we can apprehend the causes of his success, and account for the absence, in his professional rivals, of those envious feelings which are so often manifested towards men who largely succeed in the struggle for fame and fortune. He was taken from life in the vigour of his days, and his remains now rest by the side of one of those fathers of modern engineering, whose memory he loved to honour, within the walls of that noble abbey where are interred so many of England's mighty dead.

Other names are recalled to our recollection, on which I must not, however, long dwell. Jacob Bell, the founder of the Pharmaceutical Society, will be honoured for his liberal encouragement of modern artists, and for the munificent bequest made by him to our National Gallery of several valuable examples of the British school of painting. Professor Henfrey, the distinguished botanical teacher, was a valued member of your Board of Examiners; and Hetherington Henry, a fellow of the Royal Society, and a skilful and experienced practical chemist of high reputation, possessed a knowledge of the resources of chemistry, when employed in the industrial arts, which obtained for him a large share of public confidence.

The death of Stephenson having created a vacancy in the list of Vice-Presidents, the Council has nominated Vice-Chancellor Sir William Page Wood to the vacant seat.

The subject of International Exhibitions of works of industry and art, having been brought under the notice of the Council in the Session of 1858, received their careful consideration, and occupied much of their time in that as well as the following Session; and in the address of my predecessor at the beginning of the last Session, and in the Report of the Council presented at its close, narrative of the proceedings of the Council in relation to the subject was presented to the members of the Society.

The Council having bestowed on the question that grave deliberation at repeated meetings which the importance of the subject deserves, resolved, on the 14th April, 1858, that the institution of Decennial Exhibitions in London, for the purpose of showing the progress made in industry and art during each period of ten years, would tend greatly to the encouragement of Arts, Manufactures, and Commerce, and that the first of those Exhibitions (which it was then intended to hold in 1861) should consist of works selected for excellence, illustrating especially the progress of industry and art, arranged according to classes and not countries, and should comprise music and painting.

The investigations of the Council led them to conclude that an International Exhibition in 1861 would elicit even more valuable results than had been achieved in 1851, if managed with the same spirit and intelligence as its great predecessor. I cannot bring before the present meeting some of the considerations which influenced the decision of the Council more forcibly than by repeating language already employed by them:—"Since 1851, commerce has been so extensively developed, not only at home and with the colonies, but with foreign countries, that a knowledge of the productions of different nations has become everywhere a necessary part of mercantile education. In manufactures there have been numberless inventions and improvements. Population and wealth have greatly increased. In the metropolis alone, in 1861, 500,000 persons will have been added to the population, and 700,000 persons, who were young in 1851, will have become adults. The means and popular habits of locomotion have been immensely extended at home and abroad. In England, railways have increased from 6,000 miles in 1851, to 9,000 in 1858; and railway travellers from 85 millions in 1851 to 148 millions in 1858. On the Continent the increase has been far greater. The desire to see, and, by seeing, to attain knowledge, coupled with the love of art, has received an extraordinary stimulus in all civilized countries. The same influences will be at work in 1861 as in 1851 to induce manufacturers and inventors to exhibit their productions. Those who are insufficiently known, young, and enterprising, will be foremost to meet the competition. Those who are better known and established will not be left behind."

It was not intended by the Society of Arts that the Exhibition of 1851 should be the last as well as the first International Exhibition of Industry; but, on the contrary, as far back as 1849, in a letter addressed, on behalf of the Society, by his Royal Highness the President, to one of her Majesty's Principal Secretaries of State, it was

expressly notified that the Society's object was to ensure the establishment of Quinquennial Exhibitions of Industry.

In France, five years is deemed a sufficient interval between one exhibition and another, whilst the Royal Agricultural Society of England meets, each successive year, with ever increasing utility; and the Society of Arts well knew that the beneficial influence of the Exhibition of 1851 could be fully ascertained, only when the condition of art and industry should be again tested at suitable intervals. Great changes have taken place in the position of many classes of manufactures since 1851. Manufacturers have increased and improved their productions. Mechanical ingenuity has been employed in devising novel and useful combinations, having for their aim the invention of new, and the improvement and extended use of old machinery; whilst the application of scientific and artistic knowledge to the production of objects of art and industry has been largely extended to the great advantage of manufactures and commerce.

Whilst the Council was actually preparing to originate the Exhibition, hostile gatherings, of which Italy was the centre and object, threatened to involve the principal continental states in active and protracted warfare.

The probable influence on an International Exhibition of this unexpected interruption to the peaceful relations of the States of Western Europe, led the Council in the month of May last to determine that the International Exhibition proposed to be held in 1861 should be postponed to a more favourable opportunity.

That decision was arrived at by the Council with much regret. An exhibition which should present an adequate picture of the progress and triumph of arts and industry, when employed in extending the blessings of peace, and promoting the progress of civilisation, might prove of special utility at a season of strife and warfare; and even if war were again to interrupt the peaceful intercourse of Continental states, it is obviously within the power of the United Kingdom, including the colonies and dependencies of the empire, to produce an Exhibition deserving of national patronage. The progress of art and industry is not suspended, however much it may be interrupted, by actual warfare; and the loom and the forge may pursue their wonted activity even amidst the din of arms. The past history and present position of our country alike impose on Englishmen duties which cannot be evaded with dignity; and they surely may decide themselves whether and when they will hold Exhibitions of Art and Industry, although warlike preparations may seem to occupy neighbouring nations.

The war in Italy having terminated, the Council has anxiously resumed the consideration of this important subject, and notwithstanding the present aspect of Continental affairs, which they do not regard as the most favourable to Arts, Manufactures, or Commerce, it is nevertheless the intention of the Council, interpreting aright, as they believe, the feelings of their countrymen, to originate measures for carrying into effect an International Exhibition of Works of Art and Industry, to be holden in 1862; and they propose to invite the manufacturers, merchants, public companies, and other capitalists willing to promote such an Exhibition, to unite in raising a guarantee fund (not less in amount than £250,000), to be vested in Trustees whose position, character, and qualifications will secure the confidence of those capitalists who are prepared to share the responsibility of the undertaking. It is the intention of the Council that full and absolute power to originate and conduct the Exhibition shall be vested in such Trustees, and that the permanent buildings which may be found necessary shall vest in the Society of Arts, in order that such buildings may be devoted to future Exhibitions, and when not so occupied may be employed for purposes tending to the promotion of Arts, Manufactures, and Commerce. The Trustees will doubtless seek the assistance of her Majesty's Government, in order the better to obtain the friendly assistance of foreign governments, secure the co-operation of foreign exhibitors, and otherwise promote the success of the Exhibition of 1862, and will also apply to the Royal Commissioners for the Exhibition of 1851 to grant a convenient portion of the ground purchased at Kensington out of the surplus funds of the Exhibition of 1851, for the next and future international Exhibitions.

It is obvious that the corner-stone of the undertaking is a guarantee fund of adequate amount which shall afford ample protection to the Trustees, as well as indicate the favourable opinion with which the undertaking is regarded by those eminent men in the various walks of active life, who, best appreciating the arts and industry, are ever the most ready to promote the manufactures and commerce of this great country. The subscription to the guarantee fund will shortly be opened.

The Council has published and circulated, amongst the various bodies engaged in the work of adult instruction, its Programme of Examinations for 1860. In the report made by the Secretary to the Council, and read at the Eighth Annual Conference between the Council and representatives from the Institutions in Union with the Society, detailed particulars were given of the results of the examinations of the candidates for the Society's rewards at 54 centres of examination, in England, Wales, Scotland, and Ireland, in the present year.

Those results are encouraging, presenting as they do a large increase in the number of candi-

dates who proceeded to the Final Examinations, a large addition to the number of Local Boards by whom the preliminary examinations were conducted, an improvement in the papers worked by the candidates, and a large increase in the number of certificates of every class awarded by the Examiners. The distribution of the prizes and certificates of the Society has been made this year at large and influential meetings, presided over by well-known friends of education; and the Council entertain a confident expectation that a wholesome stimulus has been given to the important subject of adult instruction, and that the usefulness of the various educational bodies which have been brought into union with the Society will thus be largely extended.

The Council remains of opinion that no more effectual means can be employed for the promotion of Arts, Manufactures, and Commerce, than the intelligent instruction of our working men, not alone in the mechanical arts, and in the application of science to the business of life, but also in the language, the literature, and history of their own country.

In connection with this subject the Council invite attention to the statement that, although the papers worked for the final examination were 766 in number, those worked in English History and Literature were only 68. The Council has no desire to prescribe particular subjects of study, but they would, nevertheless, express their own sense of the importance to the mechanic and artizan of an intelligent acquaintance with his own language, not only, as a valuable discipline for the intellect, but, as the best, may it not be said the only, sufficient preparation for the employment of reading as a recreation for his leisure hours.

The organisation of Local Boards, to conduct the preliminary examination of candidates, and co-operate with the Society in promoting adult instruction, has been an object of much solicitude with the Council, who have frequently signified their anxious desire that such Boards should not be unnecessarily multiplied in one place, and should be so constituted as to afford a fair representation of the various educational institutions in each centre of examination, and command the respect and confidence of the neighbourhood.

The presence at Leeds of a deputation from the Council on the occasion of the recent distribution of prizes and certificates, 51 in number, awarded by the Council to candidates belonging to the Young Men's Christian Institute of Leeds, afforded the deputation an opportunity of meeting the members of several Local Boards in that town, with the view of promoting the formation of a single Joint Board.

The conference between the Boards was characterised by a friendly spirit, and resolutions recognising the advantages of a Joint Board were agreed upon; but the endeavour to promote the formation of a united Board in Leeds has not for the present succeeded.

The formation of Local Boards, which should embody the educational agencies of their several neighbourhoods, uniting together for common objects various bodies who might still pursue their distinctive plans of action, and preserving the zeal and active energy which characterise the spontaneous organizations of our age and country, would, in the opinion of the Council, contribute in large measure to the extension of adult instruction, and, at the same time, increase the efficiency and extend the operations of elementary schools. The Union of Institutions with the Society will continue to receive a due share of the attention of the Council.

Impressed with the importance, to the interests of Arts and Manufactures, of opening the National Collections of the Fine Arts as freely as possible to the public, the Council, in April last, directed the attention of the Trustees of the National Gallery to the advantageous employment which had been made of the collections in the Museum at South Kensington, including the Sheepshanks Gallery of Paintings and Drawings, by opening them systematically to the public as well during the evening as by day; and the Council earnestly requested the trustees to afford the same facilities for the exhibition of the Turner and Vernon Collections at South Kensington, and allow them to be open to the public in the evening as well as by day.

The Council has received, with much gratification, the information that the paintings and drawings which constitute the Turner and Vernon Collections will shortly be opened to the public at suitable hours in the evening; and those national collections will thus become accessible to the large class of persons, whose avocations would otherwise deprive them of the gratification and advantage of becoming acquainted with many of the most valued productions of their countrymen. A copy of the correspondence, between the Council and the Trustees of the National Gallery, was laid on the table of both Houses of Parliament during the last session, on the motion of the Earl of Shaftesbury in the House of Lords, and the Right Hon. W. Cowper, a Vice-President of the Society, in the House of Commons; and it is matter for congratulation that the efforts of the Council were aided by very many of the associations engaged in the work of adult instruction, which thus manifested their sense of the importance of affording to the people in their leisure hours access to the national museums and galleries. By extending to all classes an acquaintance with those works of Art which have improved the tastes and refined the manners of the educated members of the community, the force of those temptations is lessened which beset the young, the indolent,

the thoughtless, and the irresolute, especially in our great cities; and by multiplying the opportunities for mental improvement and intellectual recreation, we may look for the correction of evil habits, the formation of right principles, the diffusion of good manners, and an increased reverence for salutary authority.

In the last annual report, from the Council to the Society, the members were informed that the recent dissolution of Parliament and the consequent interruption of public business, had prevented the introduction into Parliament of the bill for the better protection of copyright in works of Art, and for amending the laws relating to artistic copyright, which was prepared under the direction of a committee of the Society, of which Sir Charles Eastlake was chairman.

The Council will take an early opportunity of introducing, in the coming session, the Bill which has been thus sanctioned; and when they regard the evils occasioned by the present defects in the law, as well to artists as to the purchasers of their works, whereby the reputation of the one class is endangered, and the pecuniary interests of both are injured, the Council entertain a confident expectation that the Legislature will at length extend to artists that protection, in the enjoyment of the fruits of their labour, which is afforded by the laws of the land to other productions of genius and industry, and which it is the special duty of Government to afford to all classes of its subjects. The Council would recommend to the thoughtful consideration of the members of the Society, the report of the Artistic Copyright Committee; which (framed with great care, and characterised by much ability) was published in the Society's *Journal* of the 26th March, 1858: convinced as they are that to ensure an amendment of the laws which regulate artistic copyright, little more is necessary than an accurate knowledge, by the public and the Legislature, of the evils which have resulted from confused and ineffective legislation.

The Council will resume measures for inducing the Treasury to extend those facilities of transmission through the post-office which have been conferred on printed papers, legal documents, and books, to samples of manufacture and other descriptions of matter.

In the last annual report of the Council, notice was taken of the labours of the Gutta Percha Committee in conducting the investigations undertaken by them. When that Committee was appointed, it was understood that early practical results could not be looked for from its labours; but the systematic character of its proceedings, and the zeal with which its inquiries are pursued, afford the best assurance that the nature of the defects to which that substance is incident, the causes of its decay, the aids to its preservation, and the qualities to which its special value is owing, as well as the conditions for the safe and convenient employment of an agent of great utility alike to Arts and Manufactures, will be elucidated by the labours of the Committee.

No consideration has yet been given by the Surgical Instruments Committee to the catalogue of instruments and apparatus employed in the investigation and treatment of disease, which has been prepared under the direction of its various Sub-Committees; but such catalogue will be early submitted to the consideration of the Committee, in order that when sanctioned by them it may be published.

The important meeting of scientific and musical authorities, which assembled in this room in the month of June last, on the invitation of my predecessor, under the presidency of Dr. Whewell, affirmed that it was desirable to establish a uniform musical pitch, and it remains for the Committee then appointed to consider and report what pitch shall be adopted in this country. There has been collected, during the vacation, a large mass of correspondence, to which it will be the duty of the Committee to give early consideration.

At the Conference on the 28th June last, between representatives from the Institutions in Union and the Council of the Society, a resolution was carried affirming the desire of the Institutions to receive, at their own cost, for local exhibition, collections of some of the more portable and useful of the articles which are annually exhibited by the Society; and the Council will gladly promote the wishes in this respect of the Institutions in Union, whenever the consent of the owners may be given for such an exhibition of their works.

The insufficient accommodation afforded in the present building for the various operations of the Society, has been noticed in addresses from this chair on former occasions; and the want of additional space seriously diminishes the interest and value of those exhibitions in which are annually collected the most approved specimens of recent improvements in the various departments of manufacturing industry.

It has been suggested that the Annual Exhibition of Patented Mechanical Inventions should be extended so as to comprise manufactures and raw produce in general. The present Annual Exhibitions, however interesting may be the patented inventions of which they are composed, are scarcely worthy of the Society of Arts; but they cannot be enlarged until more extensive accommodation can be provided.

The Council must early determine whether, by an addition to the area of the present site, the existing building can, with a due regard to economy, be so altered as to become adequate to the wants of the Society, or whether we shall

abandon the home in which its meetings have been held fo nearly a century, and seek in another dwelling that accommodation which is required for the efficient conduct of the business of the Society.

The Council desire me to make known to you that several gentlemen who are eminently qualified to render our Wednesday evening meetings pleasant and profitable, have undertaken to read papers before the Society during the present session.

Sir John Bowring, whose return to his own country we have hailed with much pleasure, will discourse on the Arts and Manufactures of China.

Dr. MacGowan will make us better acquainted with Japan.

Mr. W. Hawes, a member of Council will describe the *Great Eastern* steam-ship, and explain the objects, commercial and political, for which that vessel was designed.

Professor Crace Calvert will discourse on Starches.

Mr. J. Chalmers Morton will describe and illustrate the Mechanical Forces employed in Agriculture.

Dr. Forbes Watson will bring before us the important subject of Indian fibres, a subject on which he has already excited a warm interest in former years.

Dr. Angus Smith has promised to read a paper on the method of taking scientific evidence in Courts of Law, with a special reference to the injurious effects of the present system on the interests of art and industry.

Public attention is now much directed to the construction of electric cables, and the Council will gladly facilitate the consideration of that subject, if any gentleman competent to the task will undertake to read a paper on a matter of such great and growing importance; interesting alike to the scientific inquirer, the manufacturer, the merchant, and the statesman.

Impressed with the importance of collecting and diffusing accurate information with respect to the resources and products of our Colonial Empire, the Council (having sought and obtained the good offices of the late Secretary of State for the Colonial Department) have made known to the Governors of our several colonies the desire of the Society to give publicity to their resources, and thus increase the demand for their productions, and they have suggested, as the best means for effecting those objects, that some person or society in each Colony, qualified for the task, should frame a statement of the matters on which information would be valuable, in the form of a paper, to be read before the Society, and should suggest such further proceedings as may be most suitable to the peculiar circumstances of the Colony, and best adapted to further those interests of Arts, Manufactures, and Commerce which are so largely interwoven with the prosperity of our Colonial Empire.

Institutions in Union with the Society exist in the following Colonies, and by the extension of such Union to Institutions of a kindred character in other Colonies, an organisation may be provided beneficial alike to the Colonies and the mother country:—

Antigua, Polytechnic Association.

British Guiana, Royal Agricultural and Commercial Society.

Calcutta, Agricultural and Horticultural Society of India.

Graham's Town (Cape of Good Hope), Literary, Scientific, and Medical Society.

Grenada, Agricultural and Horticultural Society.

Hobart Town, Mechanics' Institute.

Jamaica, Royal Society of Arts.

Kandy (Ceylon), Agricultural and Horticultural Society.

Natal, Agricultural and Horticultural Society.

Swan River, Mechanics' Institution, Perth, Western Australia.

Sydney, Horticultural and Agricultural Society of New South Wales.

Sydney, Mechanics' School of Arts.

The Australian Library and Literary Institution.

Toronto (Canada West), Mechanics' Institution.

The rapid growth in population and commerce, the great extent, the varied character, the diversified climates, the dissimilar products, and the resources, well nigh boundless, of the colonies and dependencies of the United Kingdom, render the relations of those States to the mother country an object of deep and increasing importance, and in many respects of the most anxious solicitude. In our colonies and dependencies may be found all the raw products which the most varied and extensive manufacturing skill can require, as well as markets for the productions of our looms, and our mines, and whatever else may be contributed by the arts and industry of the home country.

When George III. ascended the throne, in 1760, the population of the British empire, including the colonies, did not number 12 millions, and the populations in the Old and New World who now speak the English language may be estimated at 60 millions.

In 1756 the foreign possessions of England were limited to Gibraltar, some of the West India Islands, and the Colonies of North America. Our colonies and dependencies now include many millions of square miles of territory, and extend into every quarter of the habitable globe.

In that year twenty-three Englishmen included all the subjects of the Crown of England in the province of Bengal—the sad remnant of the prisoners (146 in number) immured in the Black-

hole of Calcutta. Our Canadian provinces, and several of our West India Islands, were in the possession of France; the Cape of Good Hope belonged to the Dutch; Australasia and the Islands of the Pacific were only known to us by the narratives of enterprising voyagers. And now, in this, her day of wide-spread empire, the British possessions in Hindostan, including the dominions of the native princes, comprise a territory of 1,400,000 square miles, and a population of 180 millions; in Ceylon, 24,700 square miles, and a population of nearly 2 millions; in Australasia, three millions of square miles, and a population exceeding one million; in the West Indies, 85,000 square miles, and a population of one million; in North America, two millions and-a-half of square miles, and a population of 3 millions and-a-half; in South Africa, 130,000 square miles, with a population of 400,000; and on the Cape Coast several thousand miles of country, and a population of 200,000 persons; and in the Mediterranean we hold Gibraltar, Malta, and the Ionian Islands.

Year by year a larger proportion of the capital of our country is devoted to Arts, Manufactures, and Commerce, whilst schools, institutions for adult instruction, and other agencies, increase the supply of skilled labour, and improved machinery multiplies indefinitely the means of production.

In Continental Europe, as well as in the States of the New World, we may be obstructed by protective duties, or rivalled by the skill and artistic feeling of foreign manufacturers; but we shall, nevertheless, possess in our wide-spread Colonial Empire extensive and increasing markets for our surplus production, to be exchanged for those raw materials on a cheap supply of which our manufacturing prosperity so largely depends.

The computed real value of imports from, and the declared real value of exports to, British possessions, in the year 1858, were but little less than 80 millions of pounds sterling, and the exports, which exceeded 40 millions, doubled in seven years. It may be noticed, as specially interesting to many members of this Society, that in the year 1857 more than one-fourth of the raw cotton imported into the United Kingdom was grown in British India, and that more than two-thirds of the wool imported into Great Britain is the growth of our own possessions in South Africa, the East Indies, and Australia.

The increase in the textile fabrics of this country; the gigantic establishments erected for the manufacture of cotton, wool, and silk; the capital employed in their production; and, above all, the increasing number and growing intelligence of the artisans who labour in those branches of industry, render a cheap and certain supply of the raw materials required for the production of those fabrics an object of ever increasing solicitude.

A century ago the value of all cotton goods manufactured in this country was estimated at £200,000, and when the spinning jenny was invented in 1767, by Hargreaves, a carpenter, the yearly exports of cotton fabrics did not exceed that sum. In 1858 the total value of our cotton manufactures exported, including twist and yarn, amounted to 43 millions of pounds sterling.

A century back the total value of the textile fabrics exported from the United Kingdom did not amount to five millions, whilst the value of such fabrics exported in 1858 exceeded 69 millions.

At the beginning of the present century, the quantity of raw cotton imported into this country was 50 million pounds weight. The quantity imported had increased in 1850 to 663 millions, and in 1858 to a thousand millions of pounds weight, of which the value exceded 30 millions of pounds sterling.

It is with no slight gratification that I notice the increased proportion of the supply of raw cotton which is now sent to us from British India, and which has grown from eighty-four millions of pounds weight in 1848, or one-ninth, to 250 millions, in 1857, or one-fourth of the entire imports of those years respectively. When increased intelligence and capital shall be devoted to the cultivation of the cotton plant in our Indian Empire, and the improved communications now in progress throughout that country are completed, may we not reasonably anticipate that our dependencies will provide us in far larger measure than at present with a raw material of such vast importance to our manufacturing ascendancy; thus cheapening a product heretofore almost exclusively supplied to Europe by the United States, and which in that country is the product of slave labour.

If we look to India for additional supplies of raw cotton, we may look to South Africa and Australia for increased supplies of wool; of which the quantity sent us in 1844 from South Africa was 2 millions, and from Australia 17 millions of pounds weight, and in 1858, was from South Africa 16 millions, and from Australia 51 millions of pounds weight.

In alluding to South Africa, our attention is directed to the labours of our distinguished countryman Dr. Livingstone, who, uniting the enterprise and fearlessness of the companions and followers of Columbus, to the self-denying spirit and missionary zeal of Apostolic Christianity, seems destined to carry the seeds of civilisation and the doctrines of the Cross into the benighted regions of Central Africa. No one who was present in this room in the winter of 1856, when a most able and interesting paper was read by Professor Owen, on the ivory and teeth of commerce, but will remember the discussion which followed the reading of that paper, in which Dr. Livingstone took a prominent part.

Amongst the modern agencies of civilisation, commerce seems destined to exercise the widest and deepest influence; and if it be the privilege of England to carry the blessings of civilisation and Christianity into the countries of Central Africa, the spirit of commercial enterprise must be the chief human instrument for raising to the dignity of true manhood the tribes of that vast continent.

You will, I feel assured, be desirous of joining in that tribute of admiration for, and grateful acknowledgment to, Dr. Livingstone, which his countrymen are so eager to offer. Such men communicate somewhat of their own spirit to the age in which they live, and, by giving a practical utility to the higher motives of our nature, insensibly elevate the standard of our common humanity.

In recounting the marvellous progress of this country in population, which has doubled in half a century; in foreign commerce, which has trebled in a quarter of a century; and in manufactures, which have grown during the present generation with a celerity unknown in any other age or country, we must not lose sight of the important truth that our unexampled progress is chiefly the result of the application of science to the arts of production and the operations of industry; and in few if any of the great staple trades of the country has that influence been more remarkable than in the metallic and ceramic manufactures, of which the present importance will be apprehended when it is understood that the value of the metals (including manufactured goods), minerals, earthenware, and porcelain, exported in the year 1858, exceeded 26 millions sterling.

If the extent to which invention is directed to new processes and improved methods of operation, in the great departments of productive industry, be estimated by the number of patents which are registered year by year, it would seem that in no department is the application of science to art more active and continuous than in the manufacture of iron; and in none would the benefits derived from scientific improvement seem to be more certain, whether we regard the manifold purposes to which iron, in some or other of its stages, is now applied, or the constantly increasing demand for that metal at home and abroad.

I have endeavoured to make you acquainted with the measures which it will be the especial object of the Council to further in the session on which we have now entered, but my colleagues are fully sensible that it is to the members of the Society we must look for strength and support to bring to a successful issue the labours we may undertake.

We desire to withdraw your thoughts for a brief space from the individual cares and personal occupations of your daily life, in order that each of you may the better realize the frequent opportunities afforded him to extend the influence of a Society, which embraces within its appropriate sphere of action very varied means of usefulness; and I would indicate the important service you may render by increasing the number of our members, and especially by introducing amongst us in larger measure, active, ardent, and good men, who desire to labour for their country's welfare. If, as the older members are withdrawn from our Society, their places are supplied by younger and more ardent spirits, who, whilst they respect the prudence and deliberative caution of their predecessors, manifest the increased activity and energy of a more adventurous generation; if by contributing to the weekly *Journal* and to the lectures and discussions of this place, the knowledge acquired by familiarity with Arts, Manufactures, and Commerce, you add to the interest of our meetings, and increase the circulation of our Journal, we shall rejoice together at the prosperity of a Society that includes so many agencies which contribute to the well-being of the community.

We especially appeal to those men eminent in the various professions and walks of life who serve upon our Board of Examiners, or take an active part in the proceedings of our Committees, and who, although habitually engaged in the discharge of weighty professional or other duties, are nevertheless willing to employ their leisure hours in voluntary investigations, often difficult, and always laborious, undertaken on behalf of the Society. By thus submitting particular subjects to practised observers, facts are accurately collected, conclusions carefully drawn, and valuable results obtained, and by degrees prejudices are overthrown, improvements secured, physical science advanced, and social ameliorations promoted. Lord Bacon says "that in government change is suspected, though for the better, but it is natural to arts to be in perpetual agitation and growth." He adds there is a great difference between arts and civil affairs, for the danger is not the same from new light as from new commotions. In civil affairs a change for the better even is suspected, through fear of disturbance, because these affairs depend upon authority, consent, reputation, and opinion, and not upon demonstration, but arts and sciences should be like mines, resounding on all sides with new works and further progress.

Let then the operations of the Society resound on all sides with new works and further progress; but in the midst of our labours let it not be forgotten that truth and not triumph is the object of all scientific investigation:—

"It is a pleasure to stand upon the shore and see ships tossed upon the sea; a pleasure to stand in the window of a castle and to see a battle and the adventures thereof below; but no pleasure is com-

parable to the standing upon the vantage ground of truth (a hill not to be commanded, and where the air is always clear and serene), and to see the errors and wanderings and mists and tempests in the vale below; so always that this prospect be with pity, and not with swelling or pride."

At the conclusion of the address.

Mr. Thomas Webster, F.R.S., said, although it was not the practice upon these occasions to move any resolution with reference to the address from the Chairman of Council, he nevertheless believed it was admissible that members present, who took an interest in the proceedings of the Society, should call attention to the more prominent features of that address. It would be impossible to express the gratification which every one present must have felt at the admirable address which they had heard, and at the prospects for the Society which had been shadowed forth. There was one paragraph at the close of the address in the sentiment of which perhaps the Chairman might personally be allowed to indulge, but in which he (Mr. Webster) did not sympathise—that was in the pleasure of standing "in the window of a castle and seeing a battle and the adventures thereof below." He remembered the time when the name of their Chairman was highly distinguished in a distant part of the kingdom. They might not all be aware that it was Sir Thomas Phillips who distinguished himself in suppressing the Frost rioters at Newport some twenty years ago, and who, when standing at a window, in the discharge of his duty, was severely wounded. Having said so much, he would say one word upon that which he regarded as the great and leading topic of that address—viz., the announcement of the Council that they intended to originate measures for carrying out an International Exhibition in 1862. He believed that decision would be sympathised with throughout the whole country. He could not but think that the Council would have done well if they had even declared their determination to hold quinquennial Exhibitions, which should take place regardless of the state of things either at home or abroad; for we must remember that we were now in a far different state to that which existed when this Society projected the Great Exhibision of 1851. That was a great and a mighty experiment, which could never be repeated. But it had established the precedent; and when they saw the benefits which resulted to this country, and also to foreign countries, from such gatherings, as well as those of the Royal Agricultural Society, the British Association and the Social Science Congress, they could not but feel how much good was effected by the co-operation of men having a common cause at heart. He therefore believed that the Council of the Society would have done well if they had considered the question of quinquennial exhibitions, as a most important matter for the progress of the objects of the Society. At all events, he was not going to accept the decision in favour of decennial exhibitions as final. Let the Society have one in 1862, and no doubt the success of that would be such, that before five years had elapsed, they would determine upon having another. Another important subject alluded to in the address, was the building in which the operations of the Society would hereafter be carried on, in which they must all feel a deep interest. He thought the members ought to use every effort to establish the Society in a building worthy of its objects. He confessed, for his own part, he should be sorry to leave the Adelphi. He should not object to see the whole site into the Strand cleared away for the purposes of their building; but there was another site between the present one and Westminster-bridge, which might be equally desirable; and amongst the many plans that had been propounded for the improvement of the river by the embankment of the Thames, it might be urged that nothing would be more becoming than the erection of a Palace of Industry and Art on that portion of the river's bank, which was now but a muddy swamp. The chairman had referred to other matters, to which he (Mr. Webster) would only make a passing allusion. There was the question of copyright in Works of Art. The question of protection to intellectual labour was of the first importance, and any one who knew what now took place with regard to pictures must feel convinced that something ought to be done in the direction to which the chairman had pointed. There was also another subject—viz., that of trade marks, which was of the highest importance in connection with the manufactures of this country. It was discussed in one of the sections of the Social Science Congress, over which the learned Vice-Chancellor Wood had presided. It appeared to him (Mr. Webster) that the question of trade-marks was a question of copyright in the mark itself. Cases of actual fraud the law could now deal with, but if it were enacted that persons who adopted a particular design, which they chose as their trade-mark, should have a copyright in it, there would be a simple remedy against infringement, which the courts of law and equity would be able to put in force. The able review which the Chairman had given of the progress of the nation as regarded manufacturing industry, and his remarks on the importance of the education of the working man would be appreciated by all present. He trusted that their Chairman might be spared to co-operate with the Council in carrying out the great scheme for an Exhibition which had been shadowed forth. It was an aspiration worthy of the head of this republic of Arts, Manufactures, and Commerce. Although as he had stated at the outset, it was not competent for them to pass any resolution upon the address which they had just heard, he was, nevertheless, not precluded from moving a vote of thanks to Sir Thomas Phillips for his admirable address.

Vice-Chancellor Sir William Page Wood begged to second the resolution. He had listened, as all present must have done, with the deepest interest to the address which the chairman had been good enough to deliver, and which had so completely embodied the object, design, and future prospects which the Society ought to have in view. He was the more called upon to return thanks on this occasion from its having been noticed in the address that the Council had done him the honour of electing him a Vice-President in the room of a name so distinguished as that which had been referred to; he might say, without invidious remark, one of the most, if not *the* most distinguished of those to whom the chairman had referred in the sad obituary of the past year. He really felt unworthy to occupy the place of such a man. He wished to take the present opportunity of recording his testimony of that great man in a sphere in which he was generally less known than in that of the great department over which he had exercised so wide an influence,—he meant his (the Vice-Chancellor's) own sphere. He first formed his acquaintance from having examined and cross-examined him as a witness, about thirty years ago; and he was proud to say that he had since been allowed to call him his friend, from the acquaintance which was then formed. Of all men who presented themselves in a witness-box, there never was one equal to Robert Stephenson, not only on this account—that he did, what all should do who desired to promote the interests of justice and truth—preserved his temper—but he was always an honest witness—pre-eminently so in cases where he (the Vice-Chancellor) had found the character of a man severely tested—where he gave evidence of opinion and not of fact. There was little credit due to a witness who was truthful in matters of fact; but much credit was due, he would say, from the long experience he had had, to the man who was always honest when called upon to give testimony upon matters of opinion. He felt how unequal he had been at all times to take part in the Society's deliberations, and it was princi-

pally owing to one circumstance that he had been induced to become a member of the Society, namely, that when last he had the honour of being present, he heard a narrative of all that had been done by this Society in respect of education. That was a subject in which he felt a deep interest; and feeling that they were doing much for that cause, it appeared to him that he was bound to assist, as far as he was able, the effort they were making to diffuse education by applying the best of all tests—judicious examination. He had the honour, a few weeks ago, of being present at a meeting of an educational institution at Bradford, in a great measure promoted by one of those munificent manufacturing princes of the north—Mr. Akroyd—on which occasion the Chairman was present, in his official capacity, as chairman of the Council of this Society. On that occasion were distributed the certificates obtained at the Society's Examinations. Some results of this he might mention. In consequence of one of the pupils having gained a first-class certificate in chemistry from this Society, he had obtained employment in a large dyeing and bleaching establishment in Scotland. In consequence of a similar certificate awarded in respect of book-keeping, another had obtained a very important and beneficial position in another large establishment. These two facts were satisfactory evidence of the value that was attached to the certificates issued by this Society, and they showed also the great stimulus which these certificates gave to the education of a large and important branch of the community. It was principally in that branch that he felt that he could take any useful part in their deliberations; and, perhaps, in one other way also—viz., in the legal questions which might arise as connected with science. With regard to this he had felt deeply that the state of the Patent Law was in an unsatisfactory position. At the time when he had the honour of holding the office of Solicitor-General he concurred in that alteration of the patent law which he hoped ameliorated the evil of the great expense of taking out patents; but he felt that much had still to be done before those who took out patents obtained full justce at the hands of the tribunals of the country; and no less distinguished a man than the late Mr. Brunel was so strongly impressed with the difficulties thus imposed on patentees that he thought—in which opinion, however, he (the Vice-Chancellor) did not concur—that it would be better for inventors and the community at large, if the whole patent law were swept away altogether, looking upon it, as he (Mr. Brunel) expressed himself, as a delusion and a snare. With respect to trade-marks, he thought a good deal might be done by useful legislation, and he should be happy to assist in any of their deliberations. The abuse of trade-marks did most deeply concern the honour of the manufacturers of this country, and many painful cases of the kind had come before him. There was one case in particular to which he might allude. A certain company in America invented valuable steel instruments of different descriptions for various operations in husbandry. Those instruments were fraudulently imitated by a number of firms in this country, who in other respects, he believed, would not have thought of doing a disreputable thing; but they engaged in making those instruments, which they stamped with an imitation of the inventor's mark. The argument on their part was that in such a case, the plaintiffs, being foreigners, could not have redress in this country. He (the Vice-Chancellor) however was bold enough to hold to the contrary, and the judgment was affirmed upon appeal. It was a sad thing that such a plea should have been put on record, that because parties were foreigners, therefore they were to be denied justice in this country. They ought to feel that a fraud was a fraud, upon whomsoever it was committed. He could not but feel that it was most important for the objects the Society had in view, that the honour of commerce should be supported in this country, where it flourished in its highest and fullest development.

Mr. John Dillon wished to say a few words in support of the motion which had just been made. He had listened with delight, and he hoped with instruction, to the address presented to them, and there was one point of view in which he never heard the facts of the progress of the country in arts, manufactures and commerce, without being struck with the peculiar and he thought new position in which this country was placed. The nations of antiquity had their colonies as well as those of later ages, but he regarded England as the mother and founder not of colonies merely, but of nations which would rise to succeed them when we were gone. This country did not so much regard them as dependants, but as young nations destined to carry our language and civilisation, our arts and manufactures, down to distant prosperity. One word on the subject of the proposed International Exhibition for 1862. He was not himself sufficiently acquainted with the facts of the case to say whether it was judicious or not to choose 1862 for that Exhibition, but he had the fullest confidence in the gentlemen in whose hands the matter had been placed; and if they determined that that was the proper period, and if they armed themselves with such a Guarantee Fund as had been proposed, it would show that confidence on the part of the public which would ensure success. He should only be too happy to contribute his share towards the support of that object. The only motive that could deter them from the task they had undertaken was the fear of war and such political circumstances as had in the past year impeded their plans. But it might be well that the friends of peace should arm themselves in a peaceful cause, and he had no doubt, even if our relations with foreign countries should be such as to preclude their participation, the inhabitants of the United Kingdom and their colonies would supply contributions amply sufficient for a successful Exhibition in 1862. Upon the subject of Education, the Chairman had alluded to the fact that working-men were the persons they were more particularly endeavouring to instruct; and he (Mr. Dillon) fully agreed in the sentiment that such education should not be confined to each man's special occupation, but should be of a general character. No man, he believed, whatever might be his sphere—whether master or workman, manufacturer or artist, would succeed in his calling or his art unless his mind was imbued with general knowledge. He believed it was a mistake to suppose that for a man to succeed in any particular art it was necessary to concentrate his whole powers upon the prosecution of that art, and neglect the general instruction of his mind upon other subjects. The man who painted the pictures around that room knew something of Pericles and something of William Penn; he must have had a general knowledge of history, science, and art before he could excel as a painter. No man could really succeed, even in the lowest walks of life, unless his mind was strengthened by the acquisition of general knowledge.

The vote of thanks to Sir Thomas Phillips, for his able Address, was then put by Mr. Webster, and carried by acclamation.

Mr. C. Wentworth Dilke wished to say a word or two with respect to their present position in that building. The Council had not lost sight of the wish which they believed to be generally felt, that the Society should remain in its present abode; but there were difficulties in the way of doing so. The necessary alterations would require a large expenditure, and there was some doubt as to whether a term could be obtained sufficiently long to warrant such an outlay.

Mr. Thomas Webster had never contemplated the idea of a short term of lease. When they took up their position again, he hoped it would be for a permanency.

Mr. Harry Chester said the Council was always happy to receive suggestions on this or on any other subject, but if the Society would repose confidence in the Council on this point, they might rely upon its being

fully and deliberately dealt with. He agreed that it would be desirable to stay where they were, if they could do so on advantageous terms. The subject, however, was a large one, and it would be most carefully considered by the Council.

The Chairman then presented the medals awarded by the Council at the close of the last Session, as follows:—

To Messrs. Hamilton and Nash, for an "Improved Lock." *The Society's Silver Medal.*

To Messrs. Peter and Charles Garnett, for their "Toothed-Roller Cotton Gin." *The Society's Silver Medal.*

To Mr. F. Joubert for his invention of "A Method of rendering Engraved Copper Plates capable of producing a greatly increased number of impressions," and for his paper explanatory of it, read before the Society. *The Society's Silver Medal.*

To Mr. E. J. Reed, for his paper read before the Society—"On the Modifications which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence." *The Society's Silver Medal.*

To Monsieur Théophile Silvestre, for his paper read before the Society—"Les Arts, les Artistes, et L'Industrie en Angleterre, depuis la Dernière Moitié du Dix-huitième Siècle Jusqu'à ce Jour." *The Society's Silver Medal.*

To Dr. J. Forbes Watson, F.R.S., for his paper read before the Society—"On the Growth of Cotton in India, its Present State and Future Prospects, with Special Reference to Supplies to Britain." *The Society's Silver Medal.*

To Mr. Leonard Wray, for his paper read before the Society—"The Culture and Preparation of Cotton in the United States of America, &c." *The Society's Silver Medal.*

To Mr. John Bell, for his paper read before the Society—"Some remarks on the application of Definite Proportions and the Conic Sections to Architecture, illustrated chiefly by the Obelisk, with some History of that feature of Art." *The Society's Silver Medal.*

To Messrs. Parkins and Gotto, for "A Cheap and Portable Writing Case." *The Society's Silver Medal and* £20.

The Secretary announced that on Wednesday evening next, a paper by Sir John Bowring, F.R.S., "On China, and its Relations to British Commerce," would be read.

UNSINKABLE SHIPS.

The following letter has been addressed by Mr. Atherton to the editors of the *Mechanics' Magazine*, in reply to the article on this subject which appeared in the *Journal* for the 4th inst., p. 761:

Gentlemen,—My letter on Unsinkable Ships, in the *Society of Arts Journal* of the 28th ult., and your editorial article thereon, in your last week's number (No. 45), have already attracted the attention of inventors with a view to the production of materials suitable for the purpose to which I have alluded, namely, the construction of unsinkable ships; and from the nature of the communications which I have received, you will do me a favour, and some of your inventive readers a service, by inserting in your *Magazine* my letter of the 11th ult. in full, as it appeared in the *Society of Arts Journal*, excepting that I will thank you to place the two extracts from the *Times* in juxtaposition. There is no part of your editorial critique to which I object, although evidently intended to overrule my suggestion. The great use of publicity is to draw the attention of thinking men to the subject that may be referred to, and as all your readers are of a class who think for themselves, I am satisfied that only good can result from any latitude of expression or forced construction of my views, on which, as in some respects in this case, you may be inclined to advance some sound and useful views of your own. The practicability of the principle of my suggestion, namely, that ships may be made unsinkable, however perforated by shot, will, I have no doubt, be conceded; but the extent to which the adoption of this principle can be advantageously carried will greatly depend on the properties of the material that may be brought forward, including the few properties that I have enumerated to exemplify my views, and many others, such, for example, as being fire-proof, which, it is hoped, may be effected, now that many preparations have been devised for rendering even wood uninflammable. The comparative expense of such unsinkable ships, with reference to any other known mode of preventing accidental foundering, and setting Armstrong's ordnance, and, I may add, the contemplated Nasmyth steam ram at defiance, so far as the absolute sinking of ships is concerned, is essentially dependent on the success that may attend the inquiries now proposed to be set on foot, combined with the plans that may be devised for the application of such material to the construction of floating bodies, whether intended for the purposes of commerce or war; and here, again, as you truly, though rather sarcastically observe, is a subject for the exercise of invention "worth a very handsome premium, and the Society of Arts would do well to offer one for it before they offer the other." I concur in this your recommendation to the Council of the Society of Arts, only I would prefer that the required material, possessing in the highest degree the properties of specific lightness, toughness, non-absorption of water, cheapness, uninflammability, &c., be determined upon before the premium for its application to the purposes of naval architecture be offered; also, as another preparatory step, I would suggest for consideration this question—Where is this premium to come from? On which point I may observe that if improvement in modern ordnance necessitated the introduction of iron-cased ships of war, such as the *Trusty;* and if further improvements—such as the Armstrong gun, firing elongated bolts of malleable iron or steel, has already rendered iron-cased ships of the *Trusty* class no longer trustworthy, but necessitated further improvement, in the hope of defying even the Armstrong system of ordnance; as, moreover, the steam-ram is looming in the distance, and as it is difficult to see any end to this rivalry of gunnery and rams *versus* iron-cased ships, or of the cost that it will involve, I would merely suggest that if for every one million of money thus devoted by Parliament to the construction of iron-cased shipping, with a view to invulnerability, £100 only were awarded as a premium to naval architecture, with a view to promoting the efficiency of unsinkable ships of all classes respectively, it is probable that such rivalry between modern intellect and modern ordnance would be conducive to public good and to the peace of the world. For my part, I should have little doubt of Britain being at peace with all the world, if all ships were effective for their respective uses and unsinkable. Pertinent to this subject, it may not be out of place that I here refer to a noble sentiment of Admiral the Earl of Dundonald. It was my official duty, in January, 1848, to test the performance of the *Banshee*, a vessel built by Government, expressly for the Irish Mail Service. On my return from the trial, I found Admiral the Earl of Dundonald at Woolwich dockyard. I told him of the unprecedented steaming speed we had attained, namely, 16 knots per hour. The noble admiral replied: "Had I the command of such a ship in war, I would not encumber myself with guns,—I would run up to and board everything I could catch." Various essentials to the realisation of this noble sentiment (so characteristic of the man) are obvious. An unsinkable ship, with machinery invulnerably cased in, the crew protected from the Minié, and

commanded by a Dundonald (and a thousand such men will be forthcoming when required), would be an ugly customer, I guess; but it is not my purpose at present to go into any details of naval architectural construction in connection with unsinkable ships; I will merely observe that the property of being unsinkable does not necessarily imply that such vessels shall have no stowage below the level of the load water-line which may be appropriated to machinery; and I may further remark that by the present construction of line-of-battle ships such as the *Royal Albert*, only about one-third of the internal cubical capacity of the ship is below the level of the load water-line.

In the conclusion of your critique, you respectfully invite me to tell you what I am thinking of, and I as respectfully reply that since the introduction of iron-cased ships, and especially since the reported practice on the *Trusty*, I have been occasionally thinking how ships of all classes respectively may be rendered unsinkable, compatible with the respective uses for which they may be designed; and this is the subject on which I now hope to interest the Council of the Society of Arts, and through them, and by the aid of the Society of Arts *Journal*, and with the co-operation of the *Mechanics' Magazine* and other publications usefully devoted to such inquiries, I hope to interest the public.

I am, Gentlemen,
Yours very obediently,
CHARLES ATHERTON.

The following are the remarks of the *Mechanics' Magazine* on this communication:—

We have received from Mr. Atherton a lengthy communication respecting our last week's article on the above subject, in which we are requested to insert Mr. Atherton's "letter of the 11th ult. in full as it appeared in the Society of Arts *Journal*." Why the request is made we cannot divine; nor can we comply with it, for we have no space to devote to matter which would convey nothing novel or interesting to our readers. Mr. Atherton, in the letter on another page, implies, it is true, that we have put a forced construction upon his statements, but as he makes no attempt to prove the implication he can have no claim upon us in the matter. We might also, we think fairly, decline to insert the communication now sent to us, for it throws but little light upon the questions which we submitted to Mr. Atherton's consideration; but, on the whole, we think it better to give it a place in our columns.

It will be seen that Mr. Atherton entirely admits the truthfulness of our suggestions on the necessity of making the light material of which he speaks fireproof. He is, however, less explicit on the other and more important question, viz., what the design of the unsinkable war ship is to be. We are really afraid he has taken no pains whatever to give a practicable form to his propositions even in his own mind. At the first glimpse of the difficulties which we pointed out he abandons, in point of fact, an important part of his proposals, for he now tells us that "the property of being unsinkable does not necessarily imply that such vessels shall have no stowage below the level of the load water line which may be appropriated to machinery." But the truth is, Mr. Atherton's first suggestion (made in January last) was that the ship should be "up to the line of its load displacement, a *solid* mass of material," and he has nowhere until now repudiated this part of his plan.

But we need not pursue these considerations at present, Mr. Atherton's fundamental idea may be a good one; indeed we have ourselves a presentiment that unsinkable war ships, at least for purposes of home defence, will one day be devised. But the difficulty of producing them will lie as much in giving form to a light material as in procuring such a material, and we are sorry to find that Mr. Atherton is unable to add anything to our knowledge on either point. Nevertheless, good may arise from the introduction of the subject to public attention, and on this ground Mr. Atherton deserves praise. If the Council of the Society of Arts can adopt any means of hastening the realisation of Mr. Atherton's ideas, they too will earn the approbation of the public.

The following is Mr. Atherton's rejoinder:—

Woolwich Dockyard, 14th Nov., 1859.

Gentlemen,—The adverse tone of the commencement of your editorial critique in the *Mechanics' Magazine* of the 4th inst., on my suggestion of unsinkable ships, enhances the importance of the conclusion at which you have arrived in your editorial remarks on this subject of the 11th inst., namely:

"Mr. Atherton's fundamental idea may be a good one, indeed, we have a presentiment that unsinkable war ships, at least for purposes of home defence, will, one day, be devised. Good may arise from the introduction of the subject to public attention. If the Council of the Society of Arts can adopt any means of hastening the realisation of Mr. Atherton's ideas, they too will earn the approbation of the public."

The subject being thus recommended for the consideration of the Society of Arts, it may be premature to anticipate their decision. I would merely observe how effectively the invitations of the Society of Arts have, on many occasions, been responded to whenever, through the action of that Society, the public mind has been directed to any public requirement. For example, within a week of the publication, in the Society of Arts *Journal* of the 28th ult., of my suggestion on "Unsinkable Ships," I received communications from parties already prepared to take up the subject of the required material therein referred to, and it was a singular coincidence that in the very same journal an article appeared describing (with reference to a totally different subject) a new process for converting a certain solid substance into a cellular mass; and in the *Mechanics' Magazine* of the present week, we have the subject of rendering even textile materials uninflammable practically treated of. Both these points are analogous to what is required in the present case.

I cannot doubt that if the Council of the Society of Arts should take up this subject, and be liberally supplied with the means of offering the premiums referred to, namely, first, for the material best adapted for the construction of unsinkable ships, or rendering ships unsinkable; and second, plans for the most effective application of such material for all cases of naval construction, I have no doubt that such action of the Society of Arts would call forth a display of chemical, mercantile, and constructive knowledge of no ordinary character, and, may be, of the greatest public utility.

I am, Gentlemen,
Your very obedient servant,
CHARLES ATHERTON.

BRITISH ASSOCIATION, ABERDEEN, 1859.

The following paper was read before the Mechanical Section:—

On Experiments to Determine the Efficiency of Continuous and Self-Acting Breaks for Railway Trains.—By William Fairbairn, F.R.S.

Of late years various improvements have been introduced upon railways, to diminish the danger of travelling, and attention is specially directed to the increase of the retarding power for trains by various kinds of breaks. From an early period in the history of

railways it was seen that few objects were more important for ensuring the security of passengers, and reducing the loss of time occasioned by stoppages, than the attainment of some means of destroying the momentum of trains with ease and rapidity; that is, in the least time and in the shortest distance. The less the time requisite to break a train, the longer the steam may be kept on in approaching a station, and the less is the loss of time in stopping; and the shorter the distance in which a train can be brought to a stand, the less danger is there of collision with the obstructions on the line perceived not far off a-head.

It is already allowed by many of those connected with railways, and has been expressly stated by the Lords of the Committee of Privy Council for Trade, that the amount of break-power habitually supplied to trains is in most cases insufficient, and their lordships enumerate thirteen accidents from collision occurring in 1858, the character of which they consider would have been materially modified, if not altogether prevented, by an increased retarding power under the command of the guards of the trains.

Upon this subject the most important communication hitherto made has been the report prepared by Colonel Yolland, for the Railway Department of the Board of Trade, and containing a large number of experiments with heavy trains at high velocities. The breaks with which Colonel Yolland experimented were those which as improvements on the common hand-break, have hitherto commanded most success. These were the steam-breaks of Mr. M'Connel, the continuous break of Mr. Fay, the continuous and self-acting break of Mr. Newall, and the self-acting buffer-break of M. Guérin. The general conclusions to which Colonel Yolland was led by his experiments resulted in the recommendation of the break of Mr. Newall; and for heavy traffic, a provisional recommendation of the break of M. Guérin.

From a misunderstanding caused by this report of Colonel Yolland, arose the necessity for some further experiments on the similar breaks of Mr. Fay and Mr. Newall; and these I was called upon to arrange and carry out, by the Directors of the Lancashire and Yorkshire Railway. I propose to lay before the Association a brief abstract of these experiments, with some remarks upon the conclusions to which they gave rise.

It will not be necessary here to describe minutely the details of the construction of these breaks. They consist essentially of a series of break blocks, acting upon every wheel of the carriages of the whole train, or some part of the train, the break blocks being suspended as flaps, or placed on slide-bars beneath each carriage, as in the ordinary arrangement of the guard-vans. But, whereas, it would be both expensive and inefficient to work these breaks with a guard or breaksman to each carriage, both Mr. Fay's and Mr. Newall's patents provide for a continuous shaft, carried the whole length of the train, beneath the framing, and with suitable jointed couplings between each pair of carriages, so that they may be undisturbed by the rocking motion of the train, or the action of the buffers. In this way the whole of the breaks may be worked by a single person at either end of the train, communicating his power through the agency of the continuous shaft.

Again, there have been applied, in the first instance, by Mr. Newall, and subsequently by Mr. Fay, powerful springs beneath each carriage, connected with the arms of the rocking shaft, by means of which the breaks are made to act instantaneously throughout the train, on the release of a catch, or disengaging coupling in the guard's-van. The value of this provision for the immediate and simultaneous action of the whole of the breaks, in cases where an obstruction is perceived upon the line, will be at once evident. It is one of the most important features of these breaks.

In carrying out the views of the directors of the Lancashire and Yorkshire Railway Company, it was arranged, in order to test the relative efficiency of these breaks, to have a series of experiments upon the Oldham incline of 1 in 27. On this gradient, a train of carriages, fitted with Mr. Newall's self-acting slide-breaks, and a similar train fitted with Mr. Fay's continuous flap-breaks, were started in turn, and after having passed over a measured distance by the action of their own gravity, the breaks were applied, and the distance along the incline, in which the trains were respectively brought up, was carefully ascertained as a measure of the retarding force of each. The trains employed consisted of three weighted carriages each, and having been placed upon the incline, they were started by removing a stop. Having then descended a previously measured distance with a uniformly accelerating velocity, they passed over a detonating signal, which conveyed notice to the guard to put on the breaks. Then, the train having been brought to a stand, the distance from the fog signal to the point at which the train stopped was measured, and the train brought back for another experiment. In this way it was easy to obtain an initial velocity of 50 feet a second, or 35 miles an hour before applying the breaks.

Unfortunately, the day upon which these experiments were made proved misty and foggy, with rain at intervals, so that the rails were in the very worst condition for facilitating the stoppage of the train. The significance of this fact will be seen, on comparing the retarding power of the breaks in these experiments with those made in fine weather.

Reducing the results, we find that the retarding force exerted by each break in terms of a unit of mass, was equivalent to the numbers in the following table:—

Experiments on the Oldham Incline.

	MR. NEWALL.			MR. FAY.		
No. of Experiments.	Velocity of Train in ft. per second.	Time in stopping in seconds.	Retarding Force of Break.	Velocity of Train in ft. per second.	Time in stopping in seconds.	Retarding Force of Break.
1	25·71	14	1·32	25·71	13	1·91
2	30·00	16	1·63	30·00	13	1·79
3	37·50	17	1·70	37·50	14	1·84
4	42·85	25	1·69	41·37	15	1·76
5	42·85	14	2·01	40·66	12	2·02
6	48 38	19	1·78	48·38	25	1·72
7	52·94	17	2·04	50·00	17	1·91
Mean..	...	21·6	1·74	...	19·2	1·85

The general result of these experiments give a retarding force of 1·74 lbs. per unit of mass for Mr. Newall's break, and 1·85 for Mr. Fay's. Or, in other words, Mr. Newall's break exerted a retarding force of 121·3 lbs. per ton weight of the train, and Mr. Fay's a retarding force of 129 lbs. per ton.

I afterwards arranged for some further experiments at Southport, upon a piece of level rail between that town and Liverpool. The speed requisite in this case had to be obtained by the aid of an engine which was detached by a slip coupling at the instant of applying the breaks. In other respects, these experiments were conducted like the preceding, with fog-signals, and the time noted by stop watches. The weather, however, was, in this case, fine and dry; and hence the following results were obtained in the most uniform circumstances.

The friction of the train itself, and the resistance of the air, were ascertained to amount with Mr. Newall's train to 6·4 lbs. per ton, and with Mr. Fay's train to 10·4 lbs. per ton.

Experiments at Southport:—
Slide Breaks.—Engine Detached.

MR. NEWALL.			MR. FAY.		
Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of break.	Speed in miles per hour.	Distance of pulling up in yards.	Retarding force of break.
32·72	56⅔	6·77	35·29	56	7·97
36·73	77	6·28	43·90	98	7·05
43·90	136	5·08	50·00	129	6·94
46·15	140⅔	5·42	54·54	144	7·40
52·94	205⅓	4·89	54·54	161⅔	6·59
54·54	192	4·66	37·89	97	5·30
47·37	260⅓	...	60·00	204⅔	6·30
53·73	222	5·23	60·00	214	6·03
63·16	273	5·55			
Mean		5·49	Mean		6·70

In this case we have a retarding force per unit of mass equivalent to 5·49 lbs. in Mr. Newall's break, and 6·7 lbs. in Mr. Fay's. Or, in other words, the retarding force of the slide breaks of Mr. Newall, from eight experiments, at velocities varying from 35 to 60 miles an hour, was equivalent to 382·6 lbs. per ton weight of the train.

The retarding force of Mr. Fay's slide break, from eight similar experiments, at velocities from 33 to 63 miles per hour, was equivalent to 466·4 lbs. per ton weight of the train.

Flap Breaks.—Engine Detached.

MR. NEWALL.			MR. FAY.		
Speed in miles per hour.	Distance of pulling up in yards.	Retarding Force of Break.	Speed in miles per hour.	Distance of pulling up in yards.	Retarding Force of Break.
50·00	132⅔	6·75	51·43	158⅓	5·98
50·00	123	7·28	51·43	162⅔	5·82
51·43	192	4·93	54·54	184	5·79
Mean		6·32	Mean		5·87

These experiments give for the retarding force of Mr. Newall's flap-break 6·32 lbs. per unit of mass, and for Mr. Fay's, 5·87 lbs. Or, in other words, the retarding force of Mr. Newall's flap-break, from three experiments, at velocities varying from 50 to 51½ miles per hour, was equivalent to 440·3 lbs. per ton weight of the train.

The retarding force of Mr. Fay's flap-breaks, from three similar experiments, was 408·6 lbs. per ton.

We may illustrate the general bearing of these experiments, by estimating, from an average of the whole experiments, the distance required to stop a train fitted with these breaks, and detached from the engine.

A train would be stopped:—

At a velocity of		20 miles an hour	in		23·4	yards.
,,	,,	30	,,	,,	52·9	,,
,,	,,	40	,,	,,	93·8	,,
,,	,,	50	,,	,,	146·8	,,
,,	,,	60	,,	,,	211·5	,,

This last table exhibits, in a very clear manner, the advantages of this class of breaks, in which the whole weight of the train aids in destroying the momentum of the mass, instead of the weight of one or two guard vans only. It may be impossible in long trains to apply these breaks to every carriage, but at all events in the ordinary traffic three times the present amount of break power may be employed with ease.

On the score of economy also the system appears to encourage its application. From experiments which have been made, it appears that the wear of the tyres is far more uniform and equal, because the springs may be so adjusted as not to cause the wheels to skid. The manager of the East Lancashire Railway states that with two trains running together between Salford and Colne, the carriages fitted with continuous breaks travelled 47,604 miles before the wheels required turning up; whilst an ordinary break van running the same distance had to have its wheels turned up three times in the same period, three-eighths of an inch being taken off each time.

Experiments at Southport.—Engine not Detached from the Trains.

MR. NEWALL.		MR. FAY.		Remarks.
Speed per Hour.	Distance of Pulling up.	Speed per Hour.	Distance of Pulling up.	
Miles.	Yards.	Miles.	Yards.	
33·96	124⅔	31·8	121⅔	Engine and tender. Tender break applied.
37·11	169⅓	33·96	137	
41·86	221	41·86	192⅓	
		51·43	274	Tank Engine.

It will be observed that on most through lines the trains travel on some portion of the distance at the rate of 60 miles an hour, and in the event of an obstruction half a mile in advance, a collision would be inevitable unless the driver had the power and the presence of mind to act with promptitude. Now, at 60 miles an hour there is only 30 seconds or half a minute to effect that object, and it is quite impossible to apply the breaks in their present state before the train—in such a precarious position—is in actual contact. Assuming, however, that breaks upon the principle of Newall and Fay were attached to the engine as well as the train, and that the driver had the power of instantaneous application by liberating a spring, it is evident that, instead of the train dashing forward to destruction, the momentum might be destroyed in a distance of less than 500 yards, and that without injury to life or property. Besides, the application of the electric telegraph, which prevents on most through lines more than one train being on the line between the stations, is a great additional security, and that, united to the continuous break, applied to the engine as well as the train, would, when united to a more perfect system of signals, render collision next to impossible.

STEAM-PLOUGHING.

The following is extracted from the *Chelmsford Chronicle*:—

"We are at all times desirous of calling the attention of our agricultural readers to any new feature professing to be an improvement in the application of steam-power to the cultivation of land, and on this account accepted an invitation to witness the practical operation of a patented invention of Mr. Eddington, of Chelmsford, in connexion with steam-ploughing, which being in a comparative state of infancy, is unquestionably susceptible of modifications to improve the efficiency of the system. On Tuesday last we visited the farm of Mr. William Impey, at Broomfield, for the purpose of seeing Mr. Eddington's plan at work. Many of our readers will remember that Mr. Eddington was the successful exhibitor of a draining plough at the Royal Agricultural Society's show at Warwick, in July last, for which a prize of £15 was awarded. That which we witnessed on Tuesday was an adaptation of the same principle to steam-

ploughing, involving, of course, many alterations in detail, to render it suitable to the altered nature of the work. By this plan Messrs. Eddington have, since harvest, ploughed upwards of 150 acres in the neighbourhood of Chelmsford. As the apparatus and mode of working are quite new to our readers, and as the plan professes to be an improvement on all others now in vogue, it will be necessary for us to point out wherein the difference consists. It should be stated that there is nothing new in the implement itself, as the engine will work Fowler's plough, Smith's cultivator, and Coleman's scarifier, equally well. As the wire-rope is used, and not direct traction, as in Boydell's plan, we have only to compare the operation of this with Fowler's and Smith's systems, the two latter, we believe, being the only competitors in the field. In Mr. Smith's plan, a common portable engine and his windlass are fixed in some part of the field to be ploughed, and the rope passes round the field, being kept in place by anchors, to which are fastened sheaves for the rope to run in. The length of rope used is necessarily three times that of the furrow ploughed. In Mr. Fowler's latest plans an ordinary thrashing engine is not applicable, as the grooved drum, &c., are fixed on the engine itself. At work the engine is placed on the headland of the field, and is shifted along as the work proceeds, at right angles with the work. On the headland opposite to the engine, on the other side of the field, a moveable anchor and sheaf are placed, and shifted in like manner to the engine. The wire rope goes round the drum attached to the engine, and then round the sheaf on the opposite side of the field and back to the drum again, the plough or other implement moving to and fro between the engine and anchor. By this mode a rope twice the length of the furrow is required. In Mr. Eddington's plan a windlass is made quite separate from the engine, and consists of a strong oak frame placed on wheels, wherein are fixed two drums, around which the rope is coiled. The frame is made so that a common thrashing machine can stand on the top of it, the power of the engine being applied by a strap passing around the fly-wheel. Mr. Eddington prefers using two engines and windlasses, and it was in such a manner we saw the plan in operation. An engine and windlass were placed on the headland on each side of the field, and followed the progress of the work. Two ploughs were at work between the engines, meeting midway, returning, and ploughing both ways. No anchors or sheaves are necessary, the ropes winding direct on to the drums. The length of rope required is only that of the furrow ploughed by each engine; of course the two engines execute double the quantity of work performed by one. But although Mr. Eddington prefers to work his plan with two engines, one can be used with an anchor in a similar manner to that of Mr. Fowler's. The advantage claimed by Mr. Eddington over the plan of Mr. Smith is, that one-third of the rope only is required, and the anchors and sheaves are dispensed with; and over that of Mr. Fowler, that one-half of the rope only is required, and in the fact that the common portable thrashing engine is applicable to his plan, whilst in Mr. Fowler's it is necessary to have an engine especially for the purpose of ploughing. It may be observed, however, that in case of one engine only being used, the length of the rope would be the same as in Fowler's plan, the advantage over which would then be reduced to the convenience of adapting the common thrashing engine to Mr. Eddington's windlass, instead of purchasing an engine for the sole purpose of cultivating operations. Whether the saving of half the rope would induce farmers to use two engines, as recommended by Mr. Eddington, is doubtful; but the adoption of his system would certainly appear to enable the farmer to adapt the common engine to all the operations of his farm to which steam has been applied. The work done on Tuesday was in crossing a stiff piece of land after wheat for mangold. Two of Mr. Fowler's ploughs were used, each turning three furrows at once, the field being ploughed level, without leaving furrows, obviating the necessity of a second ploughing which is required when horse power is used. The cost of working two engines is estimated by Mr. Eddington as follows:—Two engine-drivers at 3s. 6d. per day each, two ploughmen at 2s. 6d., four labourers at 2s., two boys at 1s., one horse and man carting water 6s., and 18 cwt. of coals 20s., making in all 48s. per day. The quantity of land ploughed in a day would be fully ten acres; the working expenses would therefore be about 5s. per acre, and allowing 2s. per acre for wear and tear, the total cost would be 7s. per acre. The cost of the same work by horse-power is estimated at 15s. per acre, thus showing a great saving. We understand Mr. Eddington's windlass, as applied to the steam plough, is attracting considerable attention; many visitors of authority are expected to witness it in operation, and it will be seen by an advertisement in our present issue, the plan will be at work on and after this day, at Mr. Perry's, the Warren farm, Writtle.

Home Correspondence.

EXAMINATIONS AND THE YORKSHIRE INSTITUTIONS.

Sir,—The letter of Mr. Harry Chester, in the *Journal* for the 4th inst., is but a just tribute to the several Institutions in Yorkshire whose members have been striving to take advantage of the Examinations of the Society of Arts, although the numbers who obtained certificates may not be a fair test of the preparations made for the future. The great want in a wide district of country is publicity, so as to bring the advantages and the means of obtaining them to the knowledge of those for whom they are intended. This the Yorkshire Union has endeavoured to provide, by the distribution of a large number of boldly printed placards, setting forth the days appointed for the next Examinations, the subjects in which candidates will be examined, and the means by which they may become entitled to the privilege. Displayed in the reading rooms, class-rooms, libraries, &c., of the several Institutions, it is hoped that many more will be stimulated to exertion, and that Yorkshire will maintain that prominent position in educational efforts which is characteristic of the intelligence and energy of her people.

I am happy to be able to state that the spirit of improvement is now perhaps greater than at any previous time. At Bradford, Halifax, Middlesbrough, and Huddersfield, very large additions are being made to the number of members, and increased accommodation is in many places urgently called for. New buildings are being erected for several Institutions; Bradford, though possessing a large Institution, is contemplating a movement for one still larger; at Huddersfield the foundation-stone has just been laid for a building to comprise very ample class accommodation; Middlesbrough has just opened a new building with 900 members, although a year ago the number was only 200; the little village of Marsden is spending £2,000 in a new building, and above three-fourths of the money has been raised. Mossley has a commodious building, which cost £1,800; Holbeck has spent above £1,500 for the same purpose, and the lectures are attended by hundreds of hearers; in Hunslet an Institution has just been formed, and already numbers about 250 members; and Selby is finding a home for her members in a commodious structure. All these are evidences of the manner in which mental improvement is appreciated in Yorkshire, and of the exertions which are made by all classes to promote its extension.

As a proof of the extent to which class instruction is carried on in the Institutions comprised in the Yorkshire Union, I may state that in 90 institutions there are 5,224 pupils receiving elementary instruction, whilst of definite

objects of study the following are the number of pupils from recent returns:—Grammar, 895; Geography, 726; History, 388; Drawing (in addition to the pupils of Local Schools of Art), 442; Music, 455; English Literature and Composition, 242; Book-keeping, 58; Mathematics, Algebra, Mensuration, &c., 319; Chemistry, 50; Physiology and Physics, 40; Natural Philosophy, 15; Phonography, 22; French, 149; German, 34; Latin, 6; The Bible and Theology, 44; Elocution, 42; Sewing, 78; being a total of 9,229.

Much of this success in the spread of intelligence is, no doubt, owing to the organisation of the Yorkshire Union of Mechanics' Institutions, which has been established twenty-two years, and has been unceasing in its exertions to make the Institutions within its influence practically beneficial for adult education. Though some have entertained the opinion that elementary classes are but substitutes for ordinary night schools, there is a limit to the age of the members, and the youngest of them are earning wages for their subsistence, and pay for their own education. The majority of the Institutions in Yorkshire are what they are professed to be, Mechanics' Institutions, and many of them are composed exclusively of working men, and are successfully conducted.

At the same time it must be admitted that a very valuable impetus has been given to class instruction by the Examinations of the Society of Arts, for whatever difference of opinion may exist as to the mode which has been adopted, the extended knowledge of their advantages which the Yorkshire Union has endeavoured to promote, will, it is hoped, tend still further to make them available. The young men will discover that their labours for their own improvement will not go unappreciated or unrewarded, and if the attempts to give a more permanent character to the Local Boards be successful, we may confidently look forward to a much greater increase in the number of candidates for Examination than has yet taken place.—I am, &c., BARNETT BLAKE.

Leeds, November 7, 1859.

Proceedings of Institutions.

Accrington (East Lancashire Union of Mechanics' Institutions).—The prizes awarded by the Council of of this Union were distributed on Saturday, the 5th of Nov., in the Peel Institute at Accrington, under the presidency of Lord Brougham. There were also present—Lord Stanley, M.P., Vice Pres. of the Society of Arts, Sir J. P. Kay Shuttleworth, Bart., Mr. Harry Chester, Vice-President of the Society of Arts, Mr. W. Fairbairn, Vice-President of the Society of Arts, the Rev. Canon Richson, &c. — The Rev. Mr. Kennedy (Inspector of Schools) introduced the candidates. Amongst those who received the prizes were a number of young women and girls.—Lord Brougham expressed his gratification at the assistance given to the cause of education by the East Lancashire Union. Although it had only been in existence three years, it had been going on constantly increasing year after year. The first year it increased from upwards of 400 to 800, the next year from 800 and odd to upwards of 1,200. The number of persons attending and the number of candidates for examination had increased in a much greater proportion, the number in the first year being 20, in the next year 95, and in the third year 168. With reference to one feature of its operations, nothing could possibly be more highly interesting, more deeply important to the best interests of society, than the education and general training of women. Upon that depended whether the working man had a good housewife for his wife, whether his children had a good mother to attend them, whether his home was made comfortable and happy to himself. His lordship drew attention to the remarkable changes which had taken place in the opinions of men of eminence, with reference to the importance of the spread of education, remarking that even in the works of so enlighted a writer as Edmund Burke, there was not to be found a single allusion to the evils of popular ignorance, or to the necessity of better teaching for the people.—Mr. Harry Chester explained the system of examinations introduced by the Society of Arts, and moved the following resolution:—"That the system of annual public examinations of candidates for prizes, whether conducted in provincial unions of institutions, or as offered to the whole country by the Society of Arts, affords a means of testing the efficiency and stimulating the efforts of the evening classes, and of enabling employers of labour to select from the best conducted youths attending them such as show by talent, industry, perseverance, and good conduct that they deserve confidence."—Mr. H. Moore seconded the motion, which was carried unanimously.—Lord Stanley congratulated those present upon the unexampled spectacle which that hall afforded. They had at present one who for 60 years has been the foremost champion of the educational cause. They had there men who, like Sir James Shuttleworth, Mr. Kennedy, and Mr. Chester, had given years of energy and labour to that movement. There were present, in numbers unusual, the operatives of this and the surrounding towns. They had also on the platform, for the purpose of paying due honours to prizemen of the working class, and of promoting and extending the education of that class, those who represented the science and mechanical skill, enterprise, and capital of the East Lancashire districts. That was a sight which, anywhere, and at any time, would be very satisfactory. Lord Stanley took occasion in the course of his address to point out the great advantages that accrued from the union of Institutions, giving greater importance and dignity to the work in which they were engaged. The Rev. Canon Richson, Mr. Edmund Potter, Sir J. Kay Shuttleworth, and Mr. William Fairbairn, afterwards addressed the meeting.

Newcastle-on-Tyne (Northern Union of Institutions).—On Monday, the 28th October, a large meeting was held under the auspices of this Union, in the new Town-hall, which was quite crowded, not only with the leading inhabitants of Newcastle, but by persons interested in the progress of education from Durham, Sunderland, Hexham, North and South Shields, Blyth, Hartley, and other places. Lord Brougham presided, and there were also on the platform the Right Hon. T. E. Headlam, M.P., Mr. Ridley, M.P., Mr. Hutt, M.P., Mr. Ingham, M.P., the Mayor and Sheriff of Newcastle, the Mayor of South Shields, the Mayor of Sunderland, Dr. Headlam, of Newcastle, Mr. Joseph Cowen, the chairman of the River Tyne Commissioners, and a number of other leading friends of education. Upon his lordship taking the chair, he was received with the utmost enthusiasm.—From a report read by Mr. Joseph Cowen, jun., the hon. secretary of the association, it appears that the northern Association of Mechanics' Institutions has now been in existence 11 years, having been established at Hexham in 1848. The association at first extended to the four counties of Northumberland, Durham, Cumberland, and Westmoreland; but during the last few years its operations have been confined to the former counties. Annual conferences have been held at Hexham, Carlisle, Sunderland, Alnwick, Winlaton, Walker, Gateshead, Workington, South Shields, and Newcastle. The number of institutions in the district over which the association extends is 103; the number of members in these institutions is nearly 8,000; the number of volumes in the libraries is nearly 85,000. All these societies, except 24, are connected with the Northern Association. In addition to their libraries, three-fourths of these institutions have reading and news-rooms, which are by far the most popular and attractive departments. Eleven years ago there were only in this same district 32 institutions, with an aggregate of 2,500 members; while few news-rooms existed, and the united libraries did not contain more than 38,000 volumes.—The Right

Hon. T. E. Headlam moved, and Mr. George Ridley seconded, the following resolution:—"That in the opinion of this meeting, the Northern Association of Mechanics' Institutions is calculated to extend the usefulness of the educational institutions of the North of England, and is therefore deserving of the warmest support of the friends of popular education," which was unanimously adopted.—Dr. Headlam having presented an address to his lordship,—Lord Brougham rose to reply, and was received with great cheering. After expressing the gratification afforded him by the address, and by his kind reception at Newcastle, he alluded to the great benefits conferred on society by Dr. Birkbeck, the founder of Mechanics' Institutions. The advance which had been made by them of late years was most remarkable, particularly in the North, as was shown by the report just read. Speaking of the very large number of volumes (85,000) in the libraries of the Institutions connected with this Union, he said that he entirely agreed with his hon. friend who had lately spoken, in his remarks upon what those libraries ought to be; and he used a most happy expression, which he (Lord Brougham) heard then for the first time, that books ought to be a man's companions as well as his teachers. And in their society he ought sometimes to obtain information, sometimes to be set a thinking and pondering, and therefore increase his wisdom; but sometimes, also, to obtain relaxation, for these were the various qualities which society possessed, and these were the various goods which social intercourse bestowed, partly to instruct, by the communication, the mutual communication, of intelligence; but also partly to relax, after the severity of the labours of the day, in harmless and even wholesome amusement. He therefore entirely agreed with his hon. friend in condemning that error—he would not call it rigorous or puritanical—of those who maintained that no work of fiction was fit to find a place in those libraries. His hon. friend instanced various books, works of fiction, but he might have instanced the greater part of poetry. Should poetry be excluded from all access to these libraries? Should working men, and others of the class above the working class, not relax their minds by reading the works of Dryden, and Pope, and Milton? Why, these were relaxations of the most refined order, and also wholesome to the mind, in producing right trains of thought and promoting right moral principles. He would except all works of a pernicious tendency; this spoke for itself; but the innocent amusement, the more than innocent, the wholesome and useful relaxation—to be obtained from the best works of fiction, the reading community of all orders, from the humblest to the highest, ought to enjoy. Much had been said by both his hon. friends, their members, Mr. Headlam as well as Mr. Ridley, of Mechanics' Institutions being supposed not to embrace those classes for whom they were primarily and chiefly intended; and it was quite true, as Mr. Headlam had observed, that if they did not reach those classes, the fault was in the construction of their rules, and in the management and administration of their affairs. A plan had been adopted at Carlisle, when it had been found that there was a difficulty in obtaining the concurrence and active practical support of the working classes, which had answered well. The council and committee of management of the Institution had been entirely confined to the working classes. A rule was laid down that no person should be a member of the council who did not live by weekly wages. The consequence of this was immense. At once the rooms were filled. The reading-rooms, which before had been deserted, were immediately filled, and ever since that they had been the favourite resort of the working classes. So it had been at Kendal and at Manchester, and at other places, some of them in the county of Northumberland, where the Carlisle rule was adopted. It was chiefly applicable to reading-rooms and libraries. There were some difficulties in applying it to Mechanics' Institutions which were supported by lectures; but to libraries and reading-rooms of all descriptions the rule had been most successfully applied. He should say applied with unvarying success. His lordship then spoke of the importance to all classes, and particularly to the working classes, of the economy of time, and of punctuality, and concluded by thanking them for the hearty reception which had been given him.

CONTRIBUTIONS TO THE READING ROOM.

The Council beg to acknowledge, with thanks to the proprietors, the regular receipt of the following journals and periodicals:—

WEEKLY.
Agricultural Review.
Athenæum.
Atlas.
Builder.
Building News.
Cosmos.
Critic.
Engineer.
Gardeners' Chronicle.
Mechanics' Magazine.
Mining Journal.
Monetary Times.
North British Agriculturist.

FORTNIGHTLY.
Canadian News.
Photographic Journal.

MONTHLY.
Agricultural Review.
Artizan.
Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
Civil Engineer and Architects' Journal.
Journal of the Franklin Institute.
Newton's London Journal of the Arts and Sciences.
Pract. Mechanics' Journal.
Repertory of Patent Inventions.

QUARTERLY.
Atlantis.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....British Architects, 8.
Medical, 8½. Clinical Discussion.

Tues. .....Civil Engineers, 8. Continued Discussion "On the Government Water-works, Trafalgar-square," and, if time permits, Mr. R. B. Grantham, "On Arterial Drainage and Outfalls."
Medical and Chirurg., 8½.
Zoological, 9.

Wed. .....Society of Arts, 8. Sir John Bowring, "On China, and its Relations to British Commerce."
Archæological Assoc., 8½. 1. Rev. Henry Jenkins, "On Cæsar's Passage of the Thames and his Route afterwards." 2. Mr. Bateman, "On Anglo-Saxon Antiquities discovered at Caistor."
Medical, 8½. Lettsomian Lectures, by Dr. F. W. Pavy, Professor of Physiology, Guy's Hospital, "On certain points connected with Diabetes," with experimental illustrations.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 11th*, 1859.]

Dated 17th August, 1859.

1894. A. V. Newton, 66, Chancery-lane—Imp. in the construction of carriages, and in apparatus for guiding or reining in carriage horses. (A com.)

Dated 24th August, 1859.

1932. G. Riley, Elm Tree Lodge, South Lambeth, Surrey—Imp. on helical refrigerators for cooling brewers and distillers' worts.

Dated 13th September, 1859.

2083. A. B. Seithen, 6, Alpha-terrace, Caledonian-road—Imp. in apparatus for shaping cork stoppers, and in the manufacture of life buoys and buffers of cork.

Dated 20th September, 1859.

2144. L. Matthews, 28, Fletcher-gate, Nottingham—Imp. in machinery to be employed in introducing plain or coloured wire upon lace or other fabrics, for the purpose of ornamenting the same, or for running on and stiffening caps, cap borders, or for other similar purposes.

Dated 4th October, 1859.

2250. T. Cook, Coburg-road, Old Kent-road, Surrey—Improved tools for making screws.

Dated 5th October, 1859.

2258. R. Fisher, Westbourne-grove, and C. Aspray, Newton-road, Westbourne grove—Imp. in photographic stereoscope slides, and in the stereoscopes employed in viewing the same.

Dated 10th October, 1859.

2298. J. Bentley and H. J. Sillem, Liverpool—Imp. in breech loading fire-arms, and the machinery for manufacturing projectiles for small arms.

Dated 14th October, 1859.

2340. J. F. Conscience, 8, St. John-street-road, Clerkenwell—A new and improved process of making bread, and certain machinery connected with it.

Dated 15th October, 1859.

2356. M. Henry, 84, Fleet-street—An apparatus for washing hanks, skeins, threads, and yarns of silk and other fibrous materials. (A com.)

Dated 19th October, 1859.

2398. R. Hobson, Leeds—Imp. in producing ornamental devices in glass or other transparent substances for decorative and other purposes.

Dated 25th October, 1859.

2436. W. C. Day, Strand—Imp. in stockings and drawers, and other articles of under clothing.
2438. J. M. Napier, York-road, Lambeth—Imp. in printing machines.
2440. H. C. Hurry, Worcester—Improved apparatus for applying or using magnetism or electro-magnetism as a motive power.

Dated 26th October, 1859.

2442. A. McGlasham, Coal-yard, Drury-lane, Middlesex—Imp. in refrigerators for cooling worts and other liquors.
2444. J. J. Bourcart, Manchester—Imp. in mules for spinning.
2446. W. W. Kennedy, Glasgow—Imp. in shirts.
2448. J. W. Hackworth, Priestgate Engine Works, Darlington—Imp. in dynamic valve gear, applicable to locomotive marine and other engines.
2450. J. Armour, Perceton Fire Clay Works, Kilmarnock, N.B.—Imp. in apparatus for measuring and for regulating supplies of solid and fluid substances in the preparation of mixtures or compounds.
2452. R. Christy, jun., Weston, Hertfordshire—Imp. in means or apparatus for the closing of doors.

Dated 27th October, 1859.

2454. I. Zacheroni, Liverpool—Imp. in electric telegraphic cables for submarine and subterranean uses, and in submerging the same
2456. P. D. Mickles, Syracuse, U. S.—An automatic railroad switch. (A com.)
2460. H. Phillips, Penhoe, and J. Bannehr, Exeter, Devonshire—Imp. in the manufacture of manure.
2462. R. A. Brooman, 166, Fleet-street—Improved threads for weaving, and a machine for making the same, which is aiso applicable to the winding or coating of one thread with another. (A com.)

Dated 28th October, 1859.

2464. A. B. Mitchell, Birmingham—A new or improved penholder.
2465. J. Plantier, Paris—Imp. in brushes and brooms.
2467. D. Dillies, Roubaix, France—Innovations in weaving looms.
2469. J. F. Cole, Devonshire-street, Middlesex—Imp. in time-keepers.
2470. J. J. Baranowski, Paris—Imp. in railway signal apparatuses.

Dated 29th October, 1859.

2471. G. Ghesquière, 11, Quai Conti, Paris—A process to render gold and silver malleable and ductile.
2473. S. C. Lister, Manningham, and J. Warburton, Addingham—Imp. in dyeing silk, cotton, and china grass, and similar vegetable fibre, and in preparing and spinning coloured and mixed coloured yarns from such fibres.
2474. C. Stannet, New-street, Covent-garden—Imp. in apparatus used in the manufacture of boots and shoes or other coverings for the feet.
2475. J. S. Margetson, Cheapside—Imp. in collars for gentlemen's, ladies', or children's wear.

Dated 31st October, 1859.

2477. J. A. Turner, Manchester—Imp. in rendering paper waterproof.
2479. T. C. Newby, Welbeck-street, and J. A. Raine, Wells street, Gray's-inn-road, Middlesex—Imp. in portable bedsteads and spring mattresses.
2480. J. Ingham, Halifax, York, and G. Collier—Imp. in the manufacture of fabric, of the character of that technically called "camlet," also in the winding of yarn employed in the production of such fabric, part of which improvements is applicable to other weavings.
2481. J. Bolton, Halifax—Imp. in means or apparatus for winding thread or yarn on to shuttle bobbins, or pirns, which improvements are also applicable in winding on to other bobbins, or spools, or tubes.
2483. R. A. Brooman, 166, Fleet-street—Certain plastic compositions to be employed for building and decorative purposes, and in lieu of marble, stone, brick, and cement. (A com.)
2484. R. Cichowski, Linow, Poland—Imp. in ploughs.
2485. J. Holmes, Pleystowe Capel, Surrey—An improved halter-block for stable purposes.
2487. L. Pohl, Offenbach, Germany—Imp. in fastenings for bags, purses, and similar purposes.

Dated 1st November, 1859.

2488. C. Read, Birmingham, and I. A. Read, Smethwick, near Birmingham—A new or improved tap or stop cock.
2489. W. Spence, 50, Chancery-lane—An instrument for taking and registering deep sea soundings. (A com.)
2490. A. V. Newton, 66, Chancery-lane—An improved mode of and apparatus for condensing and cooling vapour and fluids. (A com.)
2491. J. Jones, jun., Liverpool—Imp. in ship-building.
2492. W. H. Perkin, King David Fort, St. George's-in-the-East—Imp. in the manufacture of colouring matters.
2493. R. De Bary, Finsbury-square, Middlesex—Imp. in machinery for the manufacture of cigars. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, November 11th*, 1859.]

November 11th.

1192. A. P. Rochette.
1214. S. C. Sheard.
1216. W. Midworth.
1224. A. R. Landre, P. Gras, and A. L. A. Boucherie.
1294. J. Mallett.
1870. W. Green, W. Fawcett, and F. B. Fawcett.
1998. P. Wright
2004. A. V. Newton.

[*From Gazette, November 15th*, 1859.]

November 15th.

1219. G. Allcraft.
1226. A. E. C. J. Reynaud de Trets.
1227. J. Nasmyth.
1231. E. Charlesworth.
1232. S. N. Evans.
1238. R. A. Brooman
1240. J. Valda.
1241. G. Walker.
1244. G. J. Parfitt.
1282. G. Hadfield.
1334. J. L. Norton.
1354. S. Wood, J. Wood, and P. Billington.
1360. J. B. Pascal.
1365. R. Mushet.
1384. W. Green.
1385. C. Pooley.
1404. J. H. Tuck.
1405. E. Welsford.
1438. E. Humphrys.
1445. W. Birkmyre.
1474. W. Clark.
1483. A. V. Newton.
1491. W. E. Newton.
1551. J. J. Griffin.
1847. W. MacLellan.
2193. T. Sutton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, November 11th*, 1859.]

November 7th.

2629. W. Porter.

November 8th.

2639. H. Bessemer.
2645. J. Somerville.

[*From Gazette, November 15th*, 1859.]

November 10th.

2461. A. Barlow.
2462. F. J. Manceux, and E. N. Vieillard.
2468. W. Smith.
2657. J. Bernard.
2671. W. Green.
2700. N. P. J. Leseure.

November 11th.

2668. R. A. Brooman.
2681. Hon. W. E. Cochrane.
2768. A. Clark.
2777. W. E. Laycock.

November 12th.

2674. C. W. Dixey.
2680. J. Kinniburgh.
2706. J. Billing.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, November 11th*, 1859.]

November 7th.

709. G. Lucas.
721. C. Bloomer.
832. J. Beale.

November 8th.

685. R. Knowles

[*From Gazette, November 15th*, 1859.]

November 11th.

808. G. Wilson.

November 12th.

755. J. Robertson.

Erratum in Gazette of 7th October.

In the list of "Patents on which the Stamp Duty of £50 has been paid," the following must be cancelled, it having been omitted in error from the previous Quarterly List of Patents become Void by reason of non-payment of said Stamp Duty of £50:—

26th September.

2266. W. Smith, Skisner-street, Snow-hill, London, and N. F. Taylor, Stratford, Essex.—Dated 27th September, 1856.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,209	Nov. 3rd.	Wristband	John Stewart Margetson	Cheapside, E.C.
4,210	,, 5th.	A Rifle Club Boot	James Medwin	86, Regent-street, W.
4,211	,, 7th.	Sword and Pouch Belt	George Palmer Evelyn	8, Onslow-crescent, Brompton, S.W.
4,212	,, 14th.	Reversible Cartridge Carrier or Box	Edwin and Alfred Ludlow	Birmingham.
4,213	,, 16th.	A disc and rim for supporting the "tip," and in lieu of the ordinary crown lining of hats	S. and T. Carrington	Stockport, Cheshire.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 25, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows:—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded as soon as possible to the Secretary of the Society of Arts.

SECOND ORDINARY MEETING.

WEDNESDAY, NOVEMBER 23, 1859.

The second Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 23rd inst., W. H. Bodkin, Esq., Assistant-Judge for Middlesex, Vice-President of the Society, in the chair.

The following Institution has been taken into Union since the last announcement:—

Lichfield Working Men's Association.

The Paper read was—

ON CHINA, AND ITS RELATIONS TO BRITISH COMMERCE.

BY SIR JOHN BOWRING, F.R.S.

Although I have often been called upon to speak on matters connected with China, I confess I never approach the subject without an increasing sense of its grandeur and its importance; for when we look at the extent of that immense empire, occupying so large a portion of the habitable world—extending from the tropics to the icy regions—and inhabited by probably more than one-third part of the whole human family; when we consider the great and general interests involved and the special interests of our native country, we cannot but acknowledge that the topic is one of the greatest possible gravity; and it is a subject of congratulation that those remote regions, which seemed to have been forgotten, will, by the course of late events, be again forced upon the public attention. I hope the issue of what is taking place and about to take place in China, will tend to the promotion of the happiness of the Chinese, and to the prosperity of Great Britain and the world at large. I do not mean to refer on this occasion to political questions, further than to express the hope that those peaceful and commercial interests whose prosperity I desire, and whose security and extension I have always endeavoured to promote, will not be complicated by any of those desires for territorial aggrandisement which must inevitably lead to future embarrassment. And I may say at once, our territorial position is all that we can wish. Experience has shown that the island of Hong Kong, so prosperous and progressive now, was exceedingly well chosen, and the condition of that colony is in every respect satisfactory. The increase of its population is most remarkable. During the five years in which I had the honour of governing it, the number of the native Chinese inhabitants was trebled. I found when I arrived there about 30,000 Chinamen. I left more than 90,000. So rapid had been the increase of trade, that it was seldom there were less than 100 or 120 square-rigged vessels in the harbour, one of the most magnificent in the world, and affording nearly five miles of safe anchorage; and the average entries of square-rigged vessels, independently of native junks, amounted daily to more than 2,000 tons. The colony, which had been very onerous to the government, is now in a most comfortable condition, for it has a considerable surplus revenue, and I believe the improvements which have been introduced—the draining of the city, the extension of public roads, the planting of trees, the settlement there of a number of opulent Chinese—all have placed, or have tended to place, its future on a most desirable basis, and it is now certainly one of the healthiest of the tropical colonies. Hong Kong cannot, indeed, have a great trade in any of its own products. It is an island principally distinguished for its granite boulders; and it is rather a singular fact that at this moment the most beautiful public buildings in San Francisco have been erected of the stone furnished from Hong Kong; and that small colony has been sending to many of the islands of the Pacific and the Eastern Archipelago the labours of its granite quarriers. And now I may mention that in comparing the mode of cutting and working granite at the present moment at Hong Kong, with that employed in the quarries of Assouan, on the skirts of Nubia, out of which were extracted the monoliths erected in the time of the Pharaohs in Egypt, I was much struck in observing precisely the same mode of manipulation and labour which were probably in use from thirty-five to forty centuries ago, both in China and Egypt, and still in China the method has undergone no improvement.

The population of China, as I said, may be deemed to amount to one-third of the race of man. The facts connected with the extent of population have been the subject, as you are aware, of much curious investigation and speculation; but I believe no country in the world possesses so many elements for obtaining accurate returns of vital statistics as the Chinese people. Even in the remotest times there are references to the ancient mode of numbering the people; and it is mentioned in one of the early histories of Confucius, the great philosopher, that when he saw the population returns on their way to the authorities he was accustomed to bow his head in reverence. Such was the respect paid to that important document. Some years ago I was requested by the Registrar-General to furnish such data as I could collect to give some approximate notion of the real amount of the population of the Chinese empire, and I then came to the conclusion that there were good reasons for estimating their numbers at from 360,000,000 to 370,000,000. The measures I took were, that where I had the opportunity of consulting the mandarins who had local knowledge, I compared the returns that I received from them with the official returns for 30 or 35 years back, as the ancient laws of China require "that the elders shall make returns to the district magistrates of the whole number of inhabitants in their particular locality." No doubt that law, like a great many other laws in China, has fallen into disuetude; but the machinery is still there, and the last accounts I received induce me to believe that the population of China at present exceeds 412,000,000 of human beings. Evidence enough there is of the existence of an extraordinarily redundant population. The pressure upon subsistence, to use a Malthu-

sian term, is such that the exodus of the Chinese from only two provinces of Southern China is represented by many millions of men. Wherever an opening is found in Oriental regions the Chinese make their way; and, illustrative of this, I may mention that on examining a port, whose very name is probably known to few of you—Zamboanga—the most southern port of the Island of Mindanao, in the Phillippines, which I lately visited, although that port was only opened three years ago to foreign commerce, I found whole streets occupied by Chinese settlers, who had opened channels of trade with the various races of the interior, among tribes which the Spaniards had not been able to reach; and I was assured by them that the sale of manufactured goods, principally British, amounted in the last year to 400,000 dollars; in fact, the Chinese prosecute their commercial enterprise in every region to which they find access. So great is the amount of population, and so difficult is it to find subsistence, that life itself is of little value; and as there are many crimes in China in which substitution is allowed, there is no difficulty whatever in finding competitors for execution at the price of about a hundred ounces of silver per head.

I may here mention, as a remarkable feature in the Chinese character, that reverence for the past which is universal in China, and is exhibited in their civil or religious ceremonies, called the "Worship of Ancestors," which is adopted by every variety of creed, whether "Confucian, Buddhist, or Taouist. The Jesuits found the "Ancestral rites" so universally reverenced, that they caused their exercise to be respected, and recommended to the Pope that these observances should be considered civil, and not religious ceremonials, and so long as they left these observances untouched they continued unmolested at the Court of Pekin, but as soon as the Dominicans and the Franciscans induced the Pope to decree that these rites were idolatrous, all the missionaries were packed out of China together, and have not till a late period been allowed to return. Their return was accompanied by exposure to very great personal danger, and in some provinces to martyrdom, but they are now tolerated, and are diligently occupied with the business of their missions.

I shall now, in referring to the trade of China, which was the special subject to which I promised to direct your attention, have to refer to some dry and dull statistics, but they are absolutely necessary for the understanding of this important question, and I have obtained divers official returns, which will satisfy you of the growing importance of this great interest. The imports from, and exports to, China are thus represented. Including Hong Kong, the imports to the United Kingdom, from the year 1854 to the year 1858, average £9,163,063 sterling annually. In the year 1857, when there was an enormous demand for the raw silks of China, the imports were increased to £11,448,639. In the following year they were reduced to £7,073, 509, so that the result is that considerably more than a value of £9,000,000 is annually imported from China into Great Britain. But neither the imports nor the exports give any adequate idea of the amount of British capital employed, for there is a vast deal of trade that is not represented in the official returns.

With reference to the coasting trade of China, the trade of China with foreign countries, such as Siam, Cochin China, and other places, I am disposed to believe (and I think I could furnish evidence of the fact) that there is at this moment engaged in the trade with China an amount of British capital more nearly approaching fifty than forty millions sterling, while the revenues derived from this trade exceed ten millions. Between three and four millions of this are received into the Treasury of the Indian Empire, and the balance into Her Majesty's exchequer in this country. The export trade to China has progressed wonderfully; and I will endeavour hereafter to explain why that increase has not been even greater. In 1854 the exports of British and Irish produce were £1,000,716; the average for five years is £1,964,848, and for the last year, 1858, they amounted to £2,876,447. Independent of this there has been a considerable export of foreign and colonial merchandise.

These statistics do not represent the most important articles of British commerce, and those articles are opium and silver. Upon the subject of opium, I seize with great satisfaction this opportunity of correcting some misinterpretations or misrepresentations of what I have said elsewhere with reference to the opium trade. I never smoked opium in my life, I am no advocate for its use, and I doubt not that its excessive use is most injurious, but the extraordinary mis-statements which have been made upon the subject of opium, I have felt it my bounden duty, in more than one instance, to correct. It has been averred, for example, that the opium trade is carried on in violation of our treaties with China. Now there is not one word in our treaties with China which has reference to the opium question. Opium is among the unenumerated articles, of which there are many, such as salt, saltpetre, gunpowder, and others, and on these a duty of 5 per cent. is levied. Now I am quite willing to acknowledge that this 5 per cent. ought to have been paid by our merchants, but the opium question was found a question of such delicacy, and Sir H. Pottinger on the one hand, and the Mandarins on the other, were so unwilling to deal with it, that they made no special reference to it in the tariff. It has been said that this trade is carried on in perfect scorn and contempt of Chinese opinion, and against the remonstrances of the authorities. After ten years' residence in China, and probably having had more personal intercourse with the mandarins than any former representative of Great Britain, I declare that I never in my long experience heard a mandarin speak on the subject of the opium trade, and the subject has never been introduced but where I have taken the initiative.

For the last twenty years a great controversy as to the desirableness of formally legalising the opium trade has been carried on in the *Pekin Gazette*. The *pros* and *cons* of the question have been there presented and argued. There has been, no doubt, a party, and a strong party, hostile to its introduction and to its use. There has also been a party earnestly advocating its recognised introduction, and advising the Emperor that considerable revenues might be derived from this source, declaring, at the same time, that to prevent the importation of an article so largely consumed, and so easily conveyed, was utterly impracticable. No doubt, if the Chinese were strongly opposed to the introduction of opium, the poppy would not be allowed to be cultivated in China itself, but opium is produced in no less than eight Chinese provinces, and whenever the price of opium is elevated beyond a certain height in India, there is a great increase in its production there. The advice I would respectfully offer to the East India Company, is to put an end to their opium monopoly, and to allow of the free cultivation of the poppy; and my language to the mandarins has always been, legalise its introduction, for, under the present circumstances, the abuses are monstrous. Statements have been widely circulated, as I said just now, of the most incredible—I may say, of the most audacious kind. It has been averred that by the use of opium, millions of lives in China are annually destroyed, and that the crimes and miseries connected with the opium trade (and this most unwarrantable assertion has been printed again and again) exceed the horrors of the slave trade. I was instructed by the British Government to make inquiries and to report. That report has been printed, I believe, among Parliamentary papers, and certainly one of the results of that report has been this, that many of those who were most eager to get rid of what was called a national sin, have hesitated in re-agitating the question, when the facts were before

them to refute their assertions. I had nothing to do but to call upon the officials dependent upon me to make returns, and they were obtained from British medical authorities and Tipos or Chinese local officers. I am not responsible for the statistics, but they show that among 600 European residents in Hong Kong, more individuals die of *delirium tremens* from intoxication and from excess in drinking, than among the 90,000 Chinese from the use of opium.

It has been stated in divers quarters that these statistics are untrustworthy—made to accommodate my own opinions (and I need hardly state that I am wholly disinterested in the question), and that the real fact is that the consumers of opium leave the colony and perish elsewhere, and that, therefore, the bills of mortality are not to be relied on. You may judge of the value of such a statement, and in the meantime the documents speak for themselves. Now, it appears by the ancient records of China, that drunkenness was formerly one of the common national vices. There are many decrees in which the severest punishments are threatened to the manufacturers and consumers of alcoholic drinks, and there is a reference to the prevalence of the vice of inordinate drinking even in the writings of Confucius. At this moment, whatever may have produced the change, there is not a more sober nation than the Chinese. I have scarcely ever seen, in my experience of China, a drunken man. No doubt the use of this narcotic stimulant has, to a great extent, superseded the use of spirituous liquors. I have stated (and I am here to repeat it) that the drinking of spirituous liquors in excess is constantly associated with the most daring and detestable crimes, with assaults, and other acts of violence, with robbery, and with murder itself; and that at all events the use of opium does not produce these fearful and fatal results. It leads no doubt to a dreamy, and, when taken in excess, to a useless existence; but as far as regards its action upon the human frame, this is scarcely perceptible when employed in moderation; and I have often seen opium smokers who have lived to eighty and ninety, and, in one instance, a man was introduced to me who lived in a Buddhist convent to the age of 104 years. It has been said, too, that the use of opium has been a great impediment to missionary labour. I do not know why, but this I know, that among the Siamese, who use no opium, no converts whatever have been made; but that in the kingdom of Siam, among the Chinese, among whom opium-smoking is almost universal, many have been converted to Christianity; and in China itself the missionaries have had the most success, and have rendered the most essential benefits to opium smokers in particular. It has been said that our insisting upon this opium trade is one of the reasons that our manufactures are not more generally consumed. I do not myself believe that the prohibition of opium would augment the sale of British goods to the extent of a single bale more. Opium is produced in China, and introduced into China because it has become a necessary of life. It is an unhappy necessity, if you please, but it is a necessity; and those who study the laws of political economy know full well that legislative enactment is helpless against the influence of demand upon supply.

Lord Elgin accomplished an object which I had much at heart, in obtaining, by his late treaty, the legalisation of the introduction of opium. The rate of duty is, however, far too high, and will not put an end to smuggling, which is a great social evil, as it is frequently associated with piracy and other crimes. The duty should not have been more than five per cent, which is as much as can well be collected. The question, however, is for the present disposed of. Two or three years ago the import of opium was legalised in several of the ports of China. Under the old state of things, the merchants and the mandarins understood one another very well, and opium was as openly sold in the markets as it was publicly used in the streets, and the government was either unwilling or unable to interfere with the traffic.

I have only one additional observation to make on this part of the subject, namely, that inasmuch as our purchases in China are very large, and destined probably to be increased, and as at present there is not the prospect of any considerable augmentation of the demand for our manufactures, so as to provide payment of the large balance due to the Chinese, if opium is not sent, silver bullion must be provided. I believe at the present moment the amount of bullion which goes into China may be estimated at from £5,000,000 to £7,000,000 a year, which is about the amount represented by the present trade in opium. China, which was formerly a great producer, is now the greatest absorber of silver.

Again, reverting to the trade of Hong Kong, the average exports for the last five years have been £704 350, and in the last year (1858) they were £1,145,669, while the foreign and colonial exports amounted to £10.216 in 1854, and in 1858 to £58,581. It is a remarkable fact, that not only is the British trade conducted with British capital, but almost all the American and foreign trade also passes through English houses. There are only two places in the world on which bills can be drawn in China, namely, Calcutta and London; and if an American house wants to purchase Chinese produce, they must place the funds either in the capital of British India, or in the capital of Great Britain, so that Great Britain and her possessions indirectly participate in the advantages of a trade not immediately their own.

You are most of you aware that, by the treaty of Sir Henry Pottinger, several new ports were opened to British commerce, and you will see that in each of these there has been a gradual progression. Perhaps some other ports might have been chosen in preference, but upon the whole I think we were fortunate in the selection, considering the imperfect knowledge we then possessed. I take as an instance the port of Ningpo. I know nothing more beautiful or attractive than the adjacent scenery—mountains covered with the most luxuriant vegetation—possessing every charm that nature can offer. Placed on a navigable river, and with a large population, Ningpo was naturally fixed upon, though its adjacency to Shanghae, which has so many greater recommendations, was certainly an objection to the choice.

It is to be observed, in connection with the commercial interests of China, that there is not, in the whole extent of that country, a single city on the sea-board. There is not one important place of commerce which is not situated either at the head of a bay or on the estuary of a river; for it seems to be a normal condition of the Chinese that they should be involved in intestine quarrels, and that their coasts should be troubled with pirates and freebooters. Hence, from the remotest times, people engaged in commerce have sought protection by locating themselves at some distance from the sea-shore, along which I have often remarked watch-towers erected, whence to announce the arrival of sea robbers; while in many of the mountains cities or enclosures of refuge have been constructed, to which the people resorted for protection in cases of invasion, while the principal commercial establishments are at some distance inland, though generally accessible by water communication.

With reference to our general relations with China, and the vastness of those enormous regions, it may be remarked that we have only just touched the distant fringes of the empire; that there are but five places in which we have hitherto been legally located, and in which we have to look upon the great results at which we have arrived. Trade has, indeed, found its way to many an unlicensed port, but our merchants have not as yet been able to proceed up the rivers, whose banks are so thickly peopled; at all events the communications with the interior have been hitherto very limited and imperfect, and in most cases we have been represented by natives, who, with

an imperfect knowledge of our language, have often exclusive interests of their own. The number of our merchants who speak the Chinese language does not, perhaps, exceed a dozen. The consequences of the monopoly of the East India Company are still felt. They employed agents trained to discourse in a barbarous dialect, called Canton English, and it was part of the policy of these agents to keep the company far away from the producers and the consumers of the interior, so as to confine the trade to a monopoly of Hong merchants, who admitted none to participate in the profits of the trade. We still inherit many of the injurious consequences of these ancient abuses, and the Canton linguists and rude interpreters have been too frequently the only means of communication with the interior. They have, moreover, accompanied our merchants to many of the new ports, where they have been a great nuisance, from which our traders have only to a small extent emancipated themselves.

The import trade of Ningpo, in the two years of which I have the returns, is represented by the entry of 45,885 tons of shipping, of which 24,928 were British; and in 1856 the amount was 45,718 tons, of which 25,506 tons were British. In 1858 the British shipping was 17,540 tons; I have not the foreign return. The average import for five years amounted to 328,546 dollars; but in 1858 they had reached 722,557 dollars. The export trade showed an average of 293,816 dollars, and in 1858 it was 495,647 dollars, indicating a rapid progress, considering the originally small amount.

We next come to the port of Amoy. I do not, myself, think that was well chosen for the seat of British authority. It is situate at somewhat more than twenty miles from Changchow-foo, which is a large city, containing between 200,000 and 300,000 inhabitants. There is always the greatest possible advantage in having our functionaries located in adjacency to the great mandarins. I believe that questions can seldom be comfortably or satisfactorily settled without personal intercourse with them; and I mention that, because I am persuaded that if the policy of our government, in 1849, had been to enforce our entrance, according to treaty rights, into the city of Canton, so that we could have obtained access to the supreme authorities there, the grievances of which we had so much cause to complain would have been redressed, and the public peace have been unbroken. No recourse to arms would have been needful to enforce a right or redress a wrong. I have myself tried the experiment in the only locality where I had the opportunity of doing so. In every provincial city which is the residence of a viceroy, there are six or seven mandarins, who hold direct intercourse with the Emperor and his minister at Pekin. At Ningpo, Amoy, and Shanghae, the highest authority is called a Taou-tai, who is a district intendant, but he does not correspond with the capital except through the viceroys and governors of the larger cities. Foochow, however, is one of the places where a supreme authority exists. I was enabled to carry my point there and to establish personal relations with the viceroy, by whom I was received with becoming honours; and there was no one pending question which I was not able satisfactorily and promptly to settle; every complaint was attended to—a sad contrast to my position at Canton, where the great mandarins are unapproachable. I am certain that if the obstinate and intractable ex-Commissioner Yeh had followed the judicious example of the viceroy of Foo-Kien we should have had no controversy with the Chinese of a character to impair our friendly relations.

There entered into Amoy, in the years from 1855 to 1858, an average of 138,771 tons annually, and in 1858, 180,558 tons. I may mention, in reference to this part of the subject, that the nation which occupies the third rank in the extent of the shipping at that port is the Siamese. I had, myself, the privilege of opening the trade with Siam, which has extended itself into large proportions. Last year no less than 196 square-rigged vessels found cargo in Bangkok, and there is not one of the legal ports in China which is not visited by many vessels from that very interesting and promising kingdom. Of the Amoy shipping, the British represented 99,331 tons; the Dutch 22,936 tons; and the Siamese 12,320 tons; while that of the Americans was 9,975 tons. The importations in British vessels were—average from 1853 to 1858, 1,380,817 dollars. In 1858 they reached the value of 4,040,484 dollars. The average exports in the same period were 1,106,352 dollars; in 1858 they amounted to 3,051,741 dollars, so that Amoy has already become a port of great interest and importance, and it was the first port in which the trade in opium was legalised by the local authorities, the amount of opium imported into that locality being, in 1851, 1,680,144 dollars in value.

The port of Foochow has great political importance. In it the viceroy, the governor, the Tartar general, the collector of salt revenue, the provincial treasurer, and the judge of appeal are in constant correspondence with the court, and receive many times a year a direct communication in the handwriting of the Emperor, which is generally to the effect that he is serene and well. But the importance of intercourse with these provincial cities is that through them, and through them alone, is access obtainable to the Emperor or his cabinet. Our great embarrassment in all our relations with China has been our entire inability to establish diplomatic relations with Pekin. If communications were made to the court they never reached their destination, or were treated with utter disregard. The treaties of France, America, and Great Britain, which we supposed to have been safely lodged in the great archives of the capital, were all found in the hands of Commissioner Yeh when we took the city of Canton; and the probability is, that the Emperor was very imperfectly informed of the engagements which had been entered into when these treaties were made. In fact the correspondence discovered in the yamun (or offices) of that eminent man showed that from beginning to end every deception was practised in order to delude and pacify the "barbarians." They were reported as very troublesome, and that it had been necessary to enter into engagements with them in order to get rid of their molestations. Every document showed the insincerity of the proceedings of the mandarins, who were waiting only for an opportunity to get rid of what they felt to be onerous.

The trade of Foochow, however, for a long time remained almost without commercial advantage, and the question was very seriously entertained of abandoning the place in order to avoid the expenses of the consular establishment; and yet it was a notorious fact, not only that it was a capital of great importance of itself, but that it was nearer the tea district than either Shanghae or Canton, which might in time give Foochow great advantage over rival places.

These are the remarkable results of our intercourse with Foochow. From 1853 to 1858 the average quantity of British shipping was represented by 44,409 tons. In 1858 it had risen to 69,784 tons. The accounts of imports are kept not in dollars, but in pounds sterling; and the average from 1854 to 1858 was only £152,846, but this had risen in 1858 to £379,846. The exports, of which the average was £960,559, amounted, in 1858, to £1,189,111. The tea trade had a great development a few years ago, and the average from 1854 was 18,564,164 lbs. In 1858 the export of tea from that port was 23,855,522 lbs. The rapidity of the river Min at Foochow, denies to the importation of foods the same facilities which it gives to export.

Now comes Canton. The trade there is associated with this remarkable fact, that it continues about the same as it was before the opening of the other ports, that is to say, the opening of the other ports has led to an extension of our relations equal to the whole of their

trade. From 1852 to 1855, the Canton tonnage averaged 182,935 tons; in 1856 it was 209,673 tons. There, as elsewhere, the general proportion of shipping engaged is about one-half British, one-quarter American, and the other quarter the rest of the world. In Canton about two-thirds of the shipping is employed in the direct trade, and about one-fourth in the indirect trade. The annual exports average for the years 1852–56 (including ten months of 1858) 5,654,684 dollars; for the ten months of last year, 6,799,752 dollars. The average imports are 6,992,919 dollars; for the ten months of 1858, 10,656,589 dollars.

Shanghae is the port which represents the maximum of trade with China, and the returns from thence are of a much more satisfactory and authentic character than from any other port. The Custom house there is administered by foreigners. I thought it a very great advantage, with the co-operation of my colleagues, to establish a system by which security should be given to the Chinese revenues, and the honest British merchant should be protected from unscrupulous rivals. It was throughout anticipated by the opponents of the inspectorship system, that the greatest possible injury would be done to the trade of that port, and that the trade of Shanghae would suffer in consequence of the laxity that prevailed in other places. The result, however, has been altogether satisfactory, and Lord Elgin has been so convinced of the value of this system, that he has made it a condition in the new treaties that assistance should be given to the Chinese authorities for the due protection and security of their revenues.

The average shipping from 1855 to 1858 was (tonnage entered) 193,102 tons. In 1858, it was 242,624 tons.

The average value of exports and imports in British and American vessels was :—

	In 1856.	In 1857.	In 1858.
Exports	8,601,462 dol.	14,549,226 dol.	19,017,049 dol.
Imports	28,637,981	33,334,435	30,623,759

It is not many years since the silk trade was in a state almost of dissolution, from the apprehension of a failure in the supply of the raw material, and when the harvests of Italy and France were so unproductive as to fill our silk manufacturers with alarm. It was found, however, that in a very short period China was able to fill up that enormous deficiency left by the absence of supply from Europe. The annual average from 1852 to 1858 of raw silk imported from Shanghae, was 59,183 bales, but in 1856, which was the great year of demand, the import was 91,924 bales. Now you will see that this one port was enabled to send out a value of nearly ten millions sterling in this important article.

I was asked lately, when on a visit to Coventry, what are the means of supply which China possesses? My answer was that her productive powers are almost unlimited. It is merely a question of price; and if the English merchant will pay to the Chinese a greater sum than their own manufacturers, they will be able to secure as greater an amount of the raw material as they can require. The Chinaman is a man of common sense, and you have only to offer him a higher price for what he desires to sell than is offered by another, and you will be sure to get it; and if your quality is better and your price lower than your competitors for the article he wants to buy you may calculate on the Chinaman's custom.

Now take the power of production with reference to tea. The annual average export of tea from Shanghae from 1852 to 1858, was 49,032,661 lbs.; but that port alone, in the year 1855, shipped no less than 76,711,659 lbs. Now this is considerably more than double the imports of tea in the period of the East India Company's monopoly; and I am sure it will be in the recollection of many who hear me, that the East India Company, by means of its agents and representatives, averred to the House of Commons that it was impossible that China could produce more than thirty-five-million pounds of tea: that the removal of the monopoly would diminish the quantity, augment the price, and deteriorate the quality. China at this moment is able to send from a port, then unvisited by us, between 70,000,000 and 80,000,000 lbs. of tea, and the whole exportation of China amounts to more than 120,000,000 lbs.; and as to the productive powers of China, I will repeat here what I have stated elsewhere, that he would be a very ingenious person who could estimate what the consumption of tea in China must be, where its use is universal, where the tea pot is found in every cottage, however humble, where it is drunk about five times a day, and where the consumption is to be considered as that of 400,000,000 of people. Of the largest exportation which took place, 47,000,000 lbs. came to Great Britain, 25,000,000 went to the United States, and 3,500,000 went to Australia. A remarkable fact is, that while Great Britain took 37,000,000 lbs. of black, and only 10,000 000 lbs. of green, the United States took 1,250,000 lbs. of black, and 23,750,000 lbs. of green. The green colour is an artificial colour. I myself have often seen, when there has been a demand for green tea, that the black tea has been made green, and when there has been a demand for black, the green tea has been made black.

In this most interesting locality we have seen the greatest progress in the demand for our manufactured goods. In the average of 10 years the British cotton goods imported amounted to 2,927,236 dollars; in 1857 they had reached 5,886,000. There is no reason why the demand for British manufactures should not greatly increase in China, and I have no doubt that that will be the case. I am of opinion that, in the same way that China has solved the silk difficulty, you must look to China for the solution of the cotton difficulty. There is no doubt an importation of raw cotton into China, but it is only in the southern provinces. I consider however, that several hundred millions of Chinese are clad in garments made of the cotton of the country, and I cannot but see that a vast field is open to the enterprise of our manufacturers. No doubt the raw material is cheaper in China, in the cotton-producing districts than in India. No doubt the industry of the people has associated the manufacture of cloths with the domestic habits of the women, and there is scarcely a house to be found without its loom. No doubt Nature has given them certain rich dyes, particularly indigo, which is universally used in its liquid state; still the power of machinery is so great that I believe the time will come in which the same process will be gone through in China which has been gone through in many of our Indian regions, particularly at Dacca, which was formerly a great producer and exporter of muslin. I am of opinion that when we shall be able to introduce cotton seed which will give a longer and a better fibre—when we shall teach the Chinese the improved arts of cleaning, packing, and transporting the cotton—that it will be the interest of the Chinese rather to produce the raw material than the manufactured article, and that that result will be advanced by the opening of the new ports under the Elgin treaty.

Now the commerce of China may be considered under various aspects. The internal trade is incredibly great; the rivers are covered with boats. One of the results of that excessive population to which I have referred is the necessity imposed upon an immense number of the Chinese to live in boats upon the rivers, many of their occupants being engaged in petty traffic. On the river at Canton the river magistrates reported the existence of 80,000 boats, and you can scarcely estimate less than four individuals on board each boat, so that there are more than 300,000 people there living on the water. There they are born, there they are married, there they live, and there they die; the whole coast is crowded with fishermen and sailors, who find employment, not only in petty intercourse, but many engage in shipping

transactions of great extent, and with many oriental regions. You find shipping of almost every size and character employed. There are boats throughout the oriental world called sampans, meaning, "three planks;" other boats named tankas, or egg-houses, from their shape, many of them not more than 5 or 6 feet long, in which families live; you find vessels called centipedes, with 60 or 100 rowers; some boats are full of luxuries, adorned in the most splendid style, lighted with magnificent lamps, painted with the most ornate colours, employed for dramatic representations, and for a variety of public amusements. There are also boats that convey whole families into the interior, divided into many apartments — locomotive warehouses; in fact, every imaginable form of boat is to be found on the Chinese waters. There is the lorcha, a name of some notoriety, at one time, in England. Some gentlemen have ventured to call a lorcha a Chinese vessel, its resemblance to the junks of China being like that of a stage-coach to a hay-cart. I venture to say that no Chinese ever dreamed of calling a lorcha anything but a foreign ship; and it was because I contended that the British flag was bound to protect those who sailed beneath it, that I was called to rather severe account.

The Chinese have a character of industry, to be found not only in no part of the oriental, but, I believe, in no part of the western world. I came back to this country and found a great struggle going on between the masters and the workmen upon the question of reducing ten hours a day of labour to nine, for which the same liberal wages were to be paid. There are hundreds of thousands of Chinese who would be glad to toil 16 hours a day if they could only get paid for it. The Chinese are essentially a people of an industrious, persevering, sober, and economical character. I have said that millions of that people leave their own country for other lands, but in every instance it is with the hope of returning to it again. No women are allowed to accompany them out of the country; such is their unfortunate condition; for so stringent is the law in China as to the exit of women, that it would not protect the clan from the vengeance of its neighbours if they consented that any of its females should abandon the land of their fathers. I was myself applied to by one of the most opulent Chinamen of Java, who would have been willing to have paid £30,000 or £40,000 to have obtained permission for his young wife to join him there. I did my best to augment the domestic felicity of the parties, but I failed. That is only one of many similar instances in which I have been applied to, but it is impossible, by any pecuniary inducement, to obtain the consent of the clan to the departure of a single Chinese woman out of the country.

That reverence for ancestors—that desire of being interred amongst the shades of their progenitors, is so universal that we have sometimes had in Hong-Kong an arrival of vessels—not charged with human bones, but laden with coffins of Chinese, sent from California and Australia, to be buried in the locality where reposed the remains of their progenitors. I took some pains to ascertain how long the Chinese ordinarily lived in foreign countries, and I found that, upon an average, in five years they were enabled to return with savings amounting to about 200 dollars. I visited the Island of Banca, where the whole working of the mines is in the hands of the Chinese; and the governor of the place informed me that every year 5,000 of the Chinese arrived to replace the same number who left, and who, in the space of time I have mentioned, had acquired a little independence, returned to their country, and purchased land with the money. I do not know whether I have mentioned the fact that in this vast population of China there are not more than 500 or 600 different clans; and that although it may be that very few labouring men in England can tell the names of their grandfathers, there is scarcely a man in China, however low his position, who cannot trace back his pedigree for many generations. This leads me to mention a singular usage which prevails in the nobility of China,—they reckon upwards, that is to say, if a man distinguishes himself in his youth, and is made a duke, his father would be a marquis, his grandfather an earl, and his great-grandfather a baron, and so on as far as they could follow his history. The theory of that is, that they do not know what a man's children may be, but they know what his forefathers have been, and the state is quite safe in conferring honours upon the deserving and those who trained them.

With reference to education in China, the competitive system universally exists. It is intended that no man shall hold office who has not undergone a previous examination, and who has not worked his way through the different halls to a certain literary position. There is no distinction in this respect between rich and poor, and some of the most eminent men in that country have risen from very low origins. Commissioner Lin, whose name is so familiar to you all, was a maker of artificial flowers in his boyhood, as his father was before him. The present head of the Han Lin College, which is the highest of university establishments, was the son of a humble shopkeeper in Ningpo. He was brought up and educated in a mean street, where his father kept a small stationer's shop. He was very successful in the different grades of examination; he obtained the various degrees which are accessible to the Chinese; he reached the Han Lin College, and afterwards became its president. I happen to know something of the honours done to his family. His father, mother, and grandmother received the felicitations of the whole nobility, dignitaries, and great functionaries of the district, at the honour attained by their son. You must suppose the small number who attain to that degree of eminence, when I mention the fact that in the province of Kwangtung there are 20,000,000 of inhabitants, and that there, after the various examinations are gone through, the number who go to Canton, when the literary examiner comes there once in three years, to be competitors in the triennial examinations, varies from 7,000 to 9,000. Amongst these are young children and old men. There are cases of men 70 or 80 years of age, who have been struggling all through their life to obtain some public appointment, who go into the examinations, and perish under the effort; for there is scarcely an examination at Canton in which several of the students do not die from the extreme excitement and exertion. Of these thousands of competitors only 72 can be selected for the honours awarded.

The misfortune of China is that she is so stationary. If her educational machinery were fed with proper knowledge, it would make China not only one of the most progressive, but one of the most influential countries in the world. But unfortunately, in China, every man looks to the past: he finds no wisdom but in the days gone by. He swears by his ancestors. You may discuss with a Chinese the absurdity of his astronomical system, and he will argue by saying:—"You people of the west are a very absurd people. You talk about the earth moving round the sun when your common sense should convince you, when you walk out in the morning, that the sun rises in the east and goes down in the west; and yet you are perverse enough to say that the sun stands still and the earth moves round it." You employ a series of reasonings against his theory; you prove that the same results must happen if the earth moves round the sun as are produced, in his idea, by the sun's moving round the earth; and you urge that there are many things which are not explicable under his theory, and the answer you get is, "But the sages say that the sun moves round the earth;" and in that way you are dumb-foundered.

Looking into the early history of China, I find that 4,000 years ago the art of draining was thoroughly un-

derstood, that mountains were levelled, that valleys were raised, and that agriculture was carried on in a state of perfection, beyond which it has not progressed a step. I find that 2,200 years before Christ the Chinese people were clad in silk; and there is a very ancient proverb which says it is an opprobrium to a man who, having reached the age of 50, does not possess a silk garment. I lately stumbled upon a passage in a history of the second century, in which I found a description of the manufacture of paper in all its detail, from rags reduced to pulp, and which, by pressure, were made to give a paper upon which the Chinese were in the habit of writing, while it is notorious that in Europe the manufacture of paper was contemporaneous with the invention of printing, and, perhaps, more important than the invention of printing itself in the advancement of civilisation. Many of the discoveries which are modern in Europe are ancient in China. It is impossible to say when the Chinese had *not* the printing art. The mariner's compass, it is notorious, was possessed by them hundreds and hundreds of years before we had any knowledge of it. There is a description even of iron boats and rotatory paddles at a remote period. Everyone knows of what antiquity is their beautiful porcelain. So far from progression, I am sorry to say that these arts are in a state of decadence in China, and the value of porcelain is now estimated by its age. In consequence of some porcelain having been found, either in the Pyramids or in the ruins adjacent to them, it was maintained that there must have been intercourse between China and Egypt, and that these, bearing as they do undoubtedly Chinese inscriptions, and being filled with cosmetics or perfumes, or with the valuable produce of the East, contained evidence of the existence, not only of the Chinese language three or four thousand years ago, but of intimate relations between India and China. The fact led to investigation, and we were enabled to trace in the poets of China every inscription that was found upon these curious porcelain jars; and this showed that they could not have had an earlier existence than the period at which these poets lived, which was between the eighth and the tenth centuries, certainly a very curious and not uninteresting fact.

While I feel how much backwardness there is in China, and that in many matters there is a great deal to learn, I know that we might communicate to them much very valuable knowledge. The only instance in which, so far as I know, they have generally adopted the improvements of the West, is in the general use of fire-engines, which are found in many of the principal cities in China, and which are worked with very great activity and dexterity. China, I think, might teach us something in other matters. In a collection that I made for the town of Sheffield, it was discovered that they had the art, I believe wholly unknown in Europe, of hardening brass to the consistency of steel; and there are brass instruments made in China at this moment of exceeding delicacy, that have all the power which we give to steel. I think also that something is to be learnt in the chemical field of inquiry. Many of the colours of China are very superior to those of Europe. There is one colour which has led to some curious investigations, namely, a perfect vegetable green. They have a green indigo, which is a permanent colour. Now I believe up to the present time we have never been able to make a green which will resist all the changes of temperature and climate. I have suggested, on two or three occasions, when I have had the opportunity of giving advice, that it is exceedingly important now that China is likely to be opened to European inquiries, that intelligent persons should be sent there, in order to see whether, from the experience of these forty centuries, something might not be gathered up that is of practical value. Intercourse may lead to the removal of many of their prejudices, but without that intercourse it is impossible to alter the stereotyped character of the Chinese. They treat us with disdain, and often with perfidy; but they are all educated under the idea that we are no better than "barbarians," and that we ought to be dealt with as if we were wild beasts. Such are the teachings of their philosophers, who represent that the world is divided into two great portions, that its centre is under the canopy of Heaven—the ordinary name which they give to their country—all civilization being under this canopy, and that besides this there is the barbarism which is beyond. We represent that barbarism; and in discussing the matter with the Chinese, they say "You are great fighters; you have attended to the art of war, and we have not, but you have no civilisation; you have no language that is intelligible. It is true, you are taught to write, but then we see a man who comes from a nation of three or four millions of people, and on the other side of the water there is another nation of three or four millions, and the writing of the man on one side of the river is given to a man on the other side of the river, and he cannot make out a word of it." They say, "We are three or four hundred millions of people who cannot, indeed, understand one another's talk, but everybody understands what everybody writes." I never found a Chinaman embarrassed when he met a man from a distant province, for though their spoken idioms are different, their written signs are identical. Failing to be understood in speech, the Chinaman makes a mark on his hand, and he is understood immediately. The Chinese often taunt us with the imperfection of our education and the narrow scope of our language, and in this respect deem us inferior to the natives of Japan, Corea, or Siam, who can read the Chinese character.

At the conclusion of the Paper.

Sir Thomas Phillips rose for the purpose of proposing a vote of thanks to Sir John Bowring for the instructive and interesting description he had given them of a very remarkable people. When they took into account what had already been done in reference to the present extent of our relations with China, and the importance of those relations to this country—and when they considered the progress of that commerce, which had grown with such surprising rapidity during the last few years, they must all feel how deeply interesting to them all was the topic had been selected for the consideration of the Society this evening. He felt sure that this evening's proceedings would awaken additional curiosity on the subject, and he could not but hope that a better understanding on our part of the characteristics of the Chinese people, and a better understanding on their part of the desire of the British people to enter into relations with them of amity and mutual interest and mutual good-will, would tend, if not to remove the hostilities which he felt were impending, at all events to shorten their duration. Unless he much misinterpreted the feelings of those around him, he was sure they would all be anxious to express to Sir J. Bowring their warmest thanks for the able address with which he had favoured them.

Mr. John Dillon seconded the resolution.

The Chairman, in putting the motion, said they must all, as natives of this great commercial country, feel greatly indebted to Sir John Bowring for the vast fund of information he had laid before them, relating to a part of the world which might ultimately become one of the greatest fields of Britain's commerce.

The resolution was passed by acclamation.

Sir John Bowring said, I thank you for the kind way in which these remarks have been received. Certainly the field is very ample, and I have found the necessity of compressing my observations. But looking to regions so vast, and, taking in the dependencies and tributary powers—the extent of territory exceeds 4,000 miles from east to west, and 2,300 from north to south—taking into account the fact that the Chinese language and the Chinese education influence, besides the 400,000,000 to whom we have referred, probably 100,000,000 ad-

ditional, who have received impulses and instruction from Chinese sources—I think the importance of the subject has not been exaggerated, and I cannot but feel great gratification, on my return to England, in finding that English inquiry and English curiosity are now directed towards regions which have been too long in a state of—I will not say alienation, but certainly have been delivered over to oblivion. China is now beginning to occupy public attention. It is distressing to me that this attention should be associated with menaces of war. I hope and trust that the claims of humanity, and the consideration that our interests with China are essentially and permanently pacific and commercial, will not be disregarded; and I believe that if not lost sight of, the unfortunate events that have occurred in Northern China will be turned to account. It is satisfactory to find that all our quarrels with the Chinese are local; that the responsibility of a misdeed is not assumed by the Government; indeed, in the case in which I was concerned, and which led to consequences so grave and serious, I cannot, in any manner, reproach myself. The honour of the British flag was confided to me, and I certainly had a strong opinion that, where such vast interests were concerned, where such multitudes of human beings looked to that flag as their protection, it did not become me to deliver up a single individual who believed himself to be protected by that flag to that Commissioner who at that period was decapitating 600 or 700 human beings a day. I do say, that if I had done what I was told I ought to have done, I should have allowed these men to be victimised by the tender mercies of that cruel tyrant who has poured out more human blood on the scaffold than any man that ever existed in human history. I do repeat, that if I had delivered up these Chinese, who, under the British flag, believed they were entitled to my protection, and had waited for instructions from home before I menaced Commissioner Yeh for a violation of the treaty, I should have had no bed of repose, and I do not believe that any Englishman in my position would have acted differently.

The Secretary announced that on Wednesday evening next, the 30th inst., a Paper by Mr. P. H. Holland, "On the Prevention of Accidents in Coal Mines," would be read.

ON THE QUALITIES OF BELLS.

By E. T. Loseby.

The following remarks were read by Mr. Loseby, at the Institution of Civil Engineers on Tuesday, the 8th inst.:—

The subject treated in the present paper may be considered under the following heads:—

1st. The qualities which a good bell should possess.

2nd. How to obtain a good bell.

3rd. The causes which occasioned the fracture of the present Westminster bell.

4th. General remarks.

To begin with the first question: The best clock-bell, according to my views, may be defined as that which shall weigh the least and yet produce the greatest volume of sound with the lightest blow of the hammer, and that in which the tone produced shall be of the most musical quality and capable of being clearly heard to the greatest distance. These qualities are requisite, in order that the most useful effect may be obtained with the smallest and least expensive clock and bell not only in the first cost, but in the constantly recurring expense of winding the clock up and repair of the parts.

These views appear so conclusive that it would have been difficult to imagine how two opinions could exist about them, had not the Westminster bells furnished evidence of views being entertained which are in direct opposition. In those bells the aim appears to have been to increase the thickness to an extent which required an enormously heavy blow to elicit the full tone. In fact, the great weight required for the hammer in proportion to the size of the bell, has been published as one of the best features which those bells contained. It is, therefore, quite time this part of the question was definitely settled.

2nd.—How to obtain a good bell:—The surest way of effecting this object would be to enter into a contract with one of the first bell-founders of this country, binding him to produce a bell entirely on his own responsibility, which shall be first placed in the tower and then be subjected by competent referees to certain specified tests relative to the weight of the hammer required to elicit the full tone, the musical excellence of the tone produced, and the distance to which it is heard &c.; the bell not to be purchased unless the referees are of opinion that all the conditions have been fulfilled, nor until the bell has been in constant use a full year. An outline of the kind of trial referred to was published and submitted by me to the Board of Works, about three years ago, as the test to which the first Westminster bell should be subjected before being purchased, but the suggestion was not acted on by the Board. The outline of the trial then proposed is equally applicable to any future bells that may be required; but as it may be found in the *Journal of the Society of Arts*, No. 214, and in the *Mechanics' Magazine*, No. 1737, I need not enter into further details here, and will only mention that the Government did not purchase the bells without going through the form of appointing referees to decide on their merits, but the object was entirely defeated by the designer of the bells being allowed to occupy the position of principal referee, and thus constitute himself the judge who was to pronounce an opinion on the merit of his own work. It is really amusing now to read the caution which I then submitted to the Government, and notice how completely the anticipations have been fulfilled.

3rd.—The causes which occasioned the fracture of the present Westminster bell:—The chief cause of fracture was undoubtedly the great weight and fall given to the hammer, which descended with considerably more force, in proportion to the weight of the bell, than the highest proportion which occurs in the instances that have come under my own observation; and before proceeding further I may as well caution persons against reposing confidence in the reputed weights and measures of bells, clappers, and clock-hammers, unless they have either taken the measures themselves or gleaned the information from a reliable source. Let us take St. Paul's, for instance. Here is a bell situated in the heart of London, and about which one would therefore suppose that every detail would be accurately known and published; but what is the fact? Why, if we consult Parliamentary return, No. 724, session 1847, we find that the fall of St. Paul's hammer is stated to be 10 inches, whereas the actual fall, measured by myself in 1857, proved to be only 3½, or little more than one-third of the reported quantity.

As St. Paul's is a well-known bell, I may as well employ it to show the comparative force with which the Westminster bell was struck. Taking the fall of St. Paul's hammer, therefore, at the reduced quantity which I found it to have, the force of the blow, compared with the weight of the bell, is still above the average proportion in my list, but it is, nevertheless, nearly seven times smaller than the proportion of force employed on the Westminster bell, and there is consequently no doubt in my mind about the force given to the hammer being the principal direct cause of fracture in the Westminster bell.

The great thickness of the proportions, which the designer perhaps introduced to carry out his published idea

of the best bells being those which require the hardest thumps to make them sound, was no doubt the cause which necessitated the heavy hammer, and therefore the chief indirect cause of fracture, although the designer seems to have considered he was guarding against accident by adding to the thickness; whilst, in reality, the thickness had a directly opposite tendency, as I will endeavour to illustrate. If, for instance, we take two equal lengths of the same metal, one thick and the other thin, and bend them to an equal distance, we know that the thick length will be more likely to break than the thin one. Well, the circumference of a bell is the given length of metal, and it must be bent to nearly the same degree, whether it be thick or thin, before the full sound can be produced; and, as the hammer which would bend the thin bell will not sufficiently bend the thick one, its weight must be increased until it does so; and, therefore, instead of extra thickness adding to the security of the bell, as it is supposed to do, it, in reality, increases the risk of fracture.

Another likely cause may be traced to the extra dose of tin employed in the composition, which exceeded the usual proportion by about one-fourth of the entire quantity. This would have been found to increase the brittleness considerably in frosty weather, and it may safely be classed amongst the causes of fracture, notwithstanding the mild temperature which prevailed at the time.

If I were to define the proportionate amount of effect due to each cause of fracture in something of an analytical form, it would be as follows:—

Force of hammer.....	8.
Extra dose of tin.....	3.
Uncertain.....	1.

4th.—General remarks:—It has been assigned, as a probable cause of the fracture, that the hammer occasionally rested upon the bell after the blow, and interfered with its free vibration. It is correct that the India-rubber recoil-springs proved so inefficient as to allow the hammer to "chatter" on the bell, and that the tone was therefore impaired, but I cannot regard this circumstance as instrumental in cracking the bell, because in all bells which are swung, the clapper invariably rests entirely on the bell after the blow, until the return oscillation.

Supposing large and small bells to be equal in quality, and otherwise uniform in their proportions, the larger they are the smaller is the proportion of hammer required to elicit the sound; and if the same proportion of force were employed on large bells which can safely be used on small ones, the result would be certain to end in fracture. Not only must the proportionate force be smaller for large bells, but it must also be applied in a more gradual manner, because it is impossible to set large masses in motion so suddenly as small ones; in fact, the velocity of the blow might be so great as to carry away the portion struck, without moving the distant parts of the bell at all. To prove this, I need only recall a few well-known instances, such as that of a bullet, fired from a musket, having sufficient velocity to make a round hole through a pane of glass suspended by a thread, without either cracking the pane or causing it to oscillate; the cannon-ball having so great a velocity as to be turned aside by water as completely as though the sea were a solid; and the piercing of a deal board by a tallow-candle fired from a gun. In these instances the velocity of the blow is too great to allow the surrounding parts sufficient time to partake of the motion, whereas with a lower velocity the whole pane would have been shattered, the cannon ball would have entered the water, and the candle would have been flattened out on the board like a pancake; and with a still lower velocity the pane of glass would simply have been set swinging, without fracture, and the candle would have gently rebounded from the board without its symmetry being obliterated. One of the chief things to aim at in large bells is therefore to impart the force slowly, and they should consequently be allowed to swing freely, so as to recede with the hammer and prolong the duration of impact. This may be done and some other practical objects secured at the same time, by suspending the bell so that it can oscillate freely in the plane of the blow, but in no other, and so converting it into a pendulum swinging in tolerably equal intervals; the time of its oscillation having been ascertained, the interval between the blows is so regulated that the bell is always making one of its return oscillations as the hammer descends to meet it, and thus the swing given to the bell by one blow is set against that caused by the next, and the two made to neutralise each other, so that the motion does not accumulate at all, and therefore the recoil-spring is only required to keep the hammer at little more than the distance that would suffice for a stationary bell, whilst the forces are so balanced against each other that all strain is nearly removed from the bell-frame.

It is hopeless to expect that as great a volume of sound can ever be obtained from a clock-bell—which must of necessity be comparatively stationary—as from bells that are rung, and therefore swinging through many feet of space. The view is quite erroneous which supposes the difference to arise simply from the hammer striking the outside of the bell instead of the inside, as a clapper does; and its unsoundness was proved by a bell which we fixed up at Leicester, with two hammers, one striking the outside, and the other the inside, when the outside hammer really produced the most sound, and its fall had to be a little diminished, in order to make the two sounds equal. The true cause is no doubt identical with that which produces the extra volume of sound when an accordion or concertina is swung about instead of being held stationary.

In bells, as in musical strings, there are certain points called nodes of vibration, which remain stationary whilst all the other parts are in motion. In strings the ends are fixed asunder, and the nodes of vibration therefore remain constantly at the same points on the string; but in a bell the two ends of the string may be said to be united, and the nodes of vibration to be at liberty to travel round the bell, and to occur occasionally at every point on its circumference. This will perhaps help us to explain the cause of one blow occasionally producing less sound than another, by supposing a node of vibration to be passing at the instant the hammer descends on the same point, which would consequently have to generate another set of vibrations exactly antagonistic to those already existing.

The tone of the Westminster quarter-bells is of a decidedly musical character, and if the same musical type could be retained and combined with clear articulation, and the bells sound freely with only an average blow, a considerable advance would be made in the art of bell-founding. The fourth quarter-bell is a bad one, with a dull, leaden sound, and the tone is accompanied with a large number of "beats," arising from the different parts being out of tune with each other, and vibrating in unequal times, which is owing either to imperfect proportions, unequal thickness all round, or unequal density of metal.

The Rev. William Taylor, who is nominally one of the referees for the Westminster bells, with limited powers of action, has informed me that he was at the pains of collecting and translating a large quantity of the most valuable information he could obtain from the Continent relative to the measurements and composition of foreign bells, but that very little advantage was taken by the designer of the Westminster bells, either of this information or of that collected by Professor Wheatstone. In addition to collecting information, Mr. Taylor has gone to the expense of making a number of experiments on bells, and it is therefore hoped that he will enrich this sterile field

of inquiry by their general publication, when they may, perhaps, produce fruit under happier circumstances.

It is some satisfaction to turn from the Westminster bells to the structure which contains them, and witness the efficiency of the internal arrangements. The staircase, from bottom to top, is very wide for a bell-tower, and has landings conveniently arranged as resting-places. The bell-chamber is, perhaps, the most spacious in Europe, compared with the number and size of the bells it contains. The bell-frame combines strength with economy of material to a degree that enabled it to receive the disproportionately heavy hammer upon the bell without perceptible motion in itself; and the whole of this part, both in design and efficient execution, is really something pleasing to contemplate, and the pleasure will be shared by thousands of the public who will, in time to come, look down upon the bells from the iron gallery which has been so conveniently arranged for their use.

BRITISH ASSOCIATION, ABERDEEN, 1859.

The following paper was read before the section of Mathematical and Physical Science :—

On the Angle of Dock Gates and the Roof of the Bee's Cell. By Charles M. Willich, Actuary University Life Assurance Society.

The proper angle at which dock-gates should be placed, so that the timber employed should yield the most favourable result, has often been discussed by mathematicians and determined as a problem of *maxima* and *minima*. The angle has been found to be 109 deg. 28 min. 16 sec.

A patient investigation of the properties of the cube has enabled me to succeed in dividing it into several geometrical solids, with which many definite and regular geometrical bodies may be constructed. The *dodecahedron* with twelve rhomboidal faces is composed of two cubes, six octohedrons, or four oblique rhomboidal cubes. The obtuse angle on its face measures 109 deg. 28 min. and 16 sec., being the same as that adopted by mathematicians for the angle of dock gates, and by Maclauren, in the beginning of the last century, as the best for the angle of the roof of the bee's cell. It will be readily seen, by the models submitted with this paper, that by elongating the *dodecahedron*, it becomes the precise form of the bee's cell, with the angles measuring 109 deg. 28 min. 16 sec.

I have succeeded in dividing or parting the cube in two different ways.

1st. By lines from the centre to the eight solid angles of the cube, which will give six four-sided pyramids.

2nd. By lines from one of the upper angles of the cube, drawn diagonally to the three opposite angles, dividing the cube into three equal and uniform solids. Each of these solids being halved, forms a left and a right-handed solid. These six solids, though equal in solidity, differ so far in shape, as three are left-handed and three right-handed, in the same way as the hands of the human body.

Each of the six bodies obtained by the second mode of partition may be divided into two of equal solidity and similar shape. Two of these bodies, each being one-twelfth of the cube, may be so united as to produce the pyramid obtained by the first mode of partition. Six of these bodies, each being one-twelfth part of a cube, may be so arranged as to form the oblique rhomboidal cube.

It may also be observed that the pyramid, or one-sixth of the cube obtained by the first mode of partition, may be divided into four bodies, each of which is one-third of a cube, containing one-eighth of the mass of the cube from which it was derived. So that, in fact, we may go on dividing and reproducing bodies of a similar shape, and still retaining the diagonal lines of the cube. How far this subdivision may be carried in nature, or how much farther than our powers of vision go, I will not at present venture an opinion. We can imagine the commencing atoms may be infinitely small, when we remember the wonders revealed by the microscope.

The paper was illustrated by numerous models.

DICA OR ODIKA BREAD.

By P. L. Simmonds.

Among the curious food substances of Western Africa, is the Dica bread of Gaboon, to which attention was first drawn by M. Aubry-Lecomte, attached to the Imperial Marine of France, as likely to become a considerable object of commercial industry. A specimen of it was deposited with the Minister of Marine, for the permanent exhibition of colonial products, and attracted attention in the Universal Exposition of Paris in 1855. In November 1859, among other native products and objects of natural history which I received from a correspondent in Gaboon, was a cake or loaf of this Dica bread. It was in the form of a truncated cone, of the weight of about 50lbs. The mass was very hard and compact, and could be only separated by sawing asunder, splitting off into fragments when attempted to be cut with a knife, a chisel and hammer making scarcely any impression. The interior presented the appearance of large almonds pounded and agglomerated by the action of heat, with a mixture of beeswax or some similar substance. It was of a grayish brown colour, unctuous to the touch, of an odour intermediate between roasted cocoa and scorched almonds. The flavour was agreeable but insipid, slightly bitter and astringent, resembling cocoa. In these particulars it corresponded with the account given by Dr. O'Rorke, in the *Journal de Pharmacie* of Paris (vol. 31), 1857. The tree which is the source of this product is called Oba in Gaboon. It is a species of mango (*Mangifera gabonensis*, Aubry-Lecomte), not before described.

Odika is scraped and put into some of their stews by the natives, and is very palatable, especially if it be with "bush deer," "bush pig," or smoked fish in a high or gamey state.

It is extremely common on the western coast of Africa, from Sierra Leone to Gaboon. It is found in the middle grounds where it forms forests. In appearance it differs from the *Mangifera indica*, and more resembles the oaks of Europe. Its height is from 45 to 60 feet, the diameter of the trunk about 27 inches. The whitish flowers resemble those of the India mango, but the leaves are shorter and less lanceolate. The fruit, called *iba*, is a yellow drupe, of the size of a swan's egg, and eaten by the natives. It contains a flattened stone, bivalve, enclosing a white oily kernel. It is from this kernel, mixed with other substances, that the Dica bread is made, and it used to form a considerable portion of the food of the natives, but at present less attention is given it. From the neglect of the negroes large quantities of these seeds are left to the sun and the rats, which are very common in the forests of Gaboon. They watch for these dainties, and in a few days all the stones of the fruit are devoured by these marauders. The fruit ripens in November and December and is easily collected.

By simple boiling in water, by heat, or by pressure, 70 or 80 per cent. of solid fat can be extracted from the Dica bread. This fat has a close resemblance to the butter of cocoa, in appearance, taste solidity, and odour, and is fusible at 30°. It burns with a white flame, without smell or smoke, and almost without residue. The resemblance of this substance to cocoa points it out as a much better ingredient for chocolate than many of the present adulterating substances used by dishonest makers. This would be the chocolate of the poor, since its cost price in Gaboon is only 6d. to 8d. the kilogramme.

The mixture of this substance with chocolate, as is

remarked by Dr. O'Rorke, would be far less prejudicial to the consumers than the marc of ground nuts, bean-meal, ochrous earth, stearine, and other substances, which unscrupulous manufacturers are in the habit of employing. The Dica bread, considered as an aliment very rich in nutritive principles, would acquire a considerable commercial importance. The solid fat contained in it can be employed in the manufacture of candles and soap, and would be an excellent substitute in pharmacy for the butter of cacao.

8, Winchester-street, S.W., Nov. 24.

GAS SUPPLY.

The following is Dr. Letheby's last report on the illuminating power and chemical quality of the gas supplied to the City by the Great Central Gas Company:—"The gas has been tested in the usual manner from an argand burner of fifteen holes, with a seven-inch chimney, and consuming five cubic feet of gas per hour. The testings were performed at the laboratory of the London Hospital and at Coleman-street in the City. In all, 295 experiments were made during the quarter, and the results are that the average illuminating power of the gas has been equal to that of 12·92 sperm candles or 14·77 wax of 120 grs. consumption per hour. The weekly averages for the quarter have ranged between 12.30 and 14·18 of the standard wax power. These results are satisfactory, for they show an average of 23 per cent. above the requirements of the Act of Parliament. The chemical quality of the gas has also been good, for there has been a complete absence of any trace of sulphuretted hydrogen, and the proportions of ammonia and sulphuret of carbon have been greatly below the average. These are advantages which cannot be overrated; for, at the present time, so much confidence is placed on the purity of the London gas by the public, that it is unhesitatingly employed in every kind of situation for illuminating purposes. It is, therefore, of the utmost importance that the proportions of sulphur and ammonia should be kept down to the lowest point. I regret that this is not generally the case, for within the last month I have found as much as 28 grains of sulphur per 100 cubic feet of gas supplied by one of the metropolitan companies beyond the walls of the City. The amount of impurity is capable of producing, by its combustion and subsequent oxydation, nearly 86 grains of the strongest oil of vitriol of English commerce, a proportion which is rather more than three times the average quantity found by the commissioners appointed by the Privy Council to inquire into the lighting of picture galleries by gas, and which they consider to be hurtful to pictures. It is, therefore, hardly necessary to say that the products of the combustion of such gas must be excessively injurious to all kinds of textile fabrics; and it is manifest that the interests of the public should be protected by some sort of supervision in respect of the chemical qualities of the gas supplied by the various companies."

NEW METHOD OF PRINTING.

A French lithographic printer, M. Désiré Chevalier, has invented a new method of printing, to which he has given the name of Neography. It consists chiefly in the substitution of blocks, composed of woven substances (vegetable or metallic), or in fact of any other sort of blocks possessing the quality of being permeable instead of those in ordinary use. As soon as the substance composing the block gives a free passage to the ink, colour, or dye material, it can be printed from, and this is effected either by means of a brush, as in the open blank letters, or by means of a press and inking pads.

The use of these pads, which act as real receptacles of ink, is said to have this advantage, that a considerable number of proofs (at least fifty) may be thrown off without inking, which is tedious, or setting the roller in motion, which is still more tedious, so that with endless paper the passage of the block under the press goes on rapidly, and almost without interruption. Inked cylinders may also be employed.

This new method of printing also renders possible the use of blocks in the decoration of substances where it was formerly impracticable, such as porcelain tea-trays, varnished sheet iron, marble, wood, stone, glass, &c. By means of it also an impression of different colours can be got by a single stroke of the press. In certain cases as many as twenty colours may be used at the same time.

Besides making use of woven substances as printing surfaces, and of ink-distributing pads in order to give a precise and definite form to the impression, every part of the surface which ought to be impenetrable to the ink is rendered so by gutta-percha or copper laid on by galvanism; any other impermeable substance will answer the purpose. Thus, a solution of gutta-percha laid on with a small brush, is sufficient for the preparation of a neographic block. By filling up the ground and leaving the outlines of the pattern, the impression will give black forms on a white ground; by covering the lines with gutta-percha, and leaving the ground permeable, the impression will give white forms on a black ground.

A neographic block may also be obtained by engraving in gutta-percha previously laid on the vegetable or metallic woven substance, or letters and patterns may be cut out, pasted on the woven substance, and then taken off after the latter has been rendered impermeable around the pattern or letters; indeed, a piece of calico, linen, or embroidered stuff may be used as a neographic plate or block of a certain kind. Another method is to employ a sort of ink, soluble on being simply washed in water. The proposed pattern is drawn with this ink on the woven substance prepared and made impermeable; this operation is stated to be as easy as if it were performed on paper. This done, the whole is rendered impermeable, and then the block is washed. This washing takes out the soluble ink, which carries away with it that part of the impermeable agent which has been disposed upon it, and thus leaves the woven substance uncovered. The part uncovered is then the only part permeable, but it is completely so, for this double-acting ink carries away at the same time the first and last layer of the impermeable agent deposited on the block.

Such are the different steps in the preparation of blocks producing flat effects in precise and definite forms.

Various irregular forms and effects, such as speckling, marbling, dotting, are very easily obtained by this process.

The system of blocks before-mentioned enables the inventor to bring nature directly to the aid of art in the production of new patterns. Thus, for example, an impression of a vine leaf may be taken, giving not only its exact form and the numerous ramifications of the stem, but also its fleshy and soft effect. In the same manner a fly's wing, the petal of a flower, a piece of embroidery, &c., may be reproduced.

Some of the principal applications of which the invention is in its present state capable, are as a substitute for the hand and for blank letters in the production of labels, bills, sign-boards, window-cards, &c.

The inventor believes that ornamental paperhangings may be produced by it, at prices much below those of papers produced by the ordinary processes, and that patterns may also be printed on silk, muslin, ribbons, canvas, and different stuffs, including cloth and velvet. It is also stated to be applicable to embroidery, laces, shawls, and that by it a pattern may be made to reproduce itself. Jacquard looms may be used in the preparation of the blocks.

It is also said to be adapted for ornamenting tea-trays, glass, porcelain, the colouring of plans and maps, and numerous other objects and forms an easy and cheap means of obtaining engraved typographic and lithographic plates or blocks.

The patent right in this invention has expired.

VINE CULTURE IN AUSTRALIA.

The following is the substance of a communication received from Mr. Henry Carmichael, M.A.:—

"It is most gratifying to the colonists of Australia to learn that the press of the mother country mentions, with apparent pleasure, the progress in vine culture and its products hitherto made in these colonies. For my own part, individually, at all events, I acknowledge most gratefully the good intentions exhibited in your article (in No. 303, Vol. VI., for Sept. 10, 1858) 'On the Manufacture of Australian Wines.'

"In animadverting on this article, I have to note the deceptive nature of general calculations regarding the outlay and returns from a given area of vineyard ground. The object of such calculations is, of course, to induce capitalists to invest in vineyard cultivation. I believe, from an experience in wine production of nearly 20 years, that vineyard cultivation in New South Wales is a legitimate beat of industry, calculated to promote extensively the growth and welfare of human beings; but that, as compared with wool growing in the colony, under present arrangements, vine culture is not lucrative. I would not therefore advise capitalists, whose sole object is to realise a large return in a short time, to invest in vines in preference to sheep. So long as New South Wales has waste lands to boast of, let the capitalist invest in sheep. It is otherwise, however, when philanthropy steps forward. New South Wales, as a territory, is far better fitted for the growth of vines than of sheep. In the competition of nations, therefore, I believe wine from New South Wales will take precedence of wool. I believe that the ultimate capabilities of New South Wales, in the market of the world, will be vastly in favour of the production of wine, as compared with the growth of wool. Meanwhile, wool is the more profitable product; and it may be remarked, moreover, that there are circumstances connected with the geological development and climatology of our interior, which would indicate wool growing as the distinctive and appropriate function of a wide range of our backwood country.

"In New South Wales the returns to capital invested in vine culture are slow and uncertain, but are nevertheless well worth the consideration of capitalists. From calculations based on the experience of the late Mr. King, of Irrawang, combined with my own, I feel confident in the substantial accuracy of the following statement:—That the result of expending judiciously in New South Wales a capital of £1,200 in vine cultivation, might ensure that, at the end of the seventh year, the entire capital and all current outlay necessary should be replaced, with interest on the whole at 8 per cent., and the capitalist should find himself in possession, in fee simple, of a vineyard, in thorough bearing, of at least 10 acres in extent, capable of yielding thereafter an income of £250 clear of all necessary outlay or expenses. Of course, were a large amount of capital embarked in the undertaking, the result would be increasingly favourable in proportion, inasmuch as the current expenditure necessary would bear a decreasing ratio to the extent of vineyard ground under cultivation.

"This statement will be found to modify considerably the 'estimate of the profits of wine making in New South Wales,' given in your article herein referred to. As the result of my own experience in a favourable locality, I may moreover state that, however extraordinary the annual yield of some of our vineyards has undoubtedly been, yet it would tend to mislead the capitalist were the average produce of good marketable wine to be stated at more than 300 gallons per acre. I should myself be inclined to rate it at less. Then, as to the money value of the wine. Although I have been charged at the inns of the colony 4s. a bottle for wines the produce of my own vineyard, I consider the practice of selling our wines at a high price most obstructive of the interest of the wine-grower, as well as most unfortunate in its bearing on the comfort of the general community. Wine, native wine, is the proper beverage of New South Wales, and were the legislature, instead of seeking a revenue by imposing bootless restrictions on the consumption of alcoholic drinks, to legalise the free sale of colonial wine, everywhere and in any quantity, any attempt at the adoption of a Maine liquor law would be rendered unnecessary. The general population, without crippling their labour-power by the intoxicating quality and the high-priced character of their drinks, would be enabled to quench their thirst under a sun, and in circumstances where to quench thirst is a necessity, by a beverage of their own, stimulating, healthful, and pleasant, and at a cost which would not add seriously to the cost of their labour.

"My experience on this head enables me to say that the wine-grower may sell profitably, and the merchant may purchase profitably from the vineyard cellar, sound colonial wine, six months old, at 2s. 6d. per gallon, and that the value thereafter becomes enhanced by the age of the wine, at the rate of one shilling per gallon per annum.

"The part of your article aforesaid, however, which requires most notice, occupies the three concluding columns. This is almost *in extenso* a 'Memorandum' by Thomas Collins Banfield, which was submitted to Earl Grey whilst principal Secretary of State for the Colonies, in October, 1848, and transmitted by the noble lord, in his official capacity, to our Governor at the time—Sir Charles Fitzroy—with his lordship's request that the Governor should take the necessary steps for communicating the information conveyed in Mr. Banfield's Memorandum to those persons under his government who might be interested in the subject.

"Accordingly this 'Memorandum' was laid formally on our Council table by our Colonial secretary, and ordered, by the Council, to be printed, 22nd May, 1849.

"This memorandum of Mr. Banfield was taken immediate notice of in a letter to Earl Grey, published in one of our Sydney newspapers, the original MS. of which is in my possession. It was the joint production of the late Mr. King, of Irrawang, and myself. The transcript of this paper of Mr. Banfield by Mr. P. L. Simmonds, given in your article now under consideration, omits some of the objectionable matter contained in the official copy as printed by order of our Council. As Mr. Simmonds has given it, however, it still exhibits matter erroneous enough to authorize the following remarks.

"In the paragraph succeeding the Vineyard table (in column 9 of Mr. Simmonds's article), Mr. Banfield affirms that success in making superior wines depends more upon the treatment of the juice after it is obtained, than upon the soil on which the grape is raised. This, taken in connection with his recommendation (in the last column) of the tin-tube apparatus during fermentation, and his talking (in the opening paragraph of his Memorandum as printed here on authority) of the satisfactory establishment in Europe of the true principle which insures a constant quality of wine from the same grapes, exhibits an ignorance of facts and an obliviousness of philosophy, in the matter of winology, thoroughly discreditable. Indeed, he seems to be ignorant of the fact that the same species of grape, grown in different localities, produces wine having a corresponding difference of character; and he is apparently unaware that to speak of a principle that will insure a constant quality of wine from the same grapes is absolute nonsense. Common sense, apart altogether from practical or scientific knowledge of the subject, might have suggested that, even in the case of the same grapes growing on the same spot, the infinite variations of temperature and of atmospherical condition alone are sufficient to vary essentially, from year to year, the produce of the same vineyard.

"Mr. Banfield's observations about manuring at a distance from the plant, and his recommendation about pruning the vine, demonstrate clearly enough that, at

the time of penning the 'Memorandum' to Earl Grey, he could have had no personal experience whatever in vine-culture."

Mr. Carmichael proceeds by animadverting in strong terms upon various other errors into which he conceives Mr. Banfield to have fallen in the communication referred to. He considers him to be wrong in his views with reference to fermentation, as well as with regard to the source of flavour in the grape. Mr. Carmichael also quotes from Liebeg's "Letters on Chemistry," an unfavourable opinion of the "tin tube apparatus" recommended by Mr. Banfield. Liebig's words are these:—"These tin tubes certainly exercise an injurious effect upon the quality of the wine; they are in every respect futile, the invention of some idle brain; they serve no object, and yet they are used by people who imitate others, without assigning any reason for doing so."

Home Correspondence.

THE LAW OF PATENTS.

Sir,—A long period has elapsed since, in your pages, I essayed to fight the battle of the originators, inventors, and patentees, against one who sought to be a legal authority on the subject, and who roundly declared that it was impossible to legislate so as to protect inventors; and, moreover, that it was not desirable, inasmuch as "inventors could no more help inventing than hens could help laying eggs," and the public were sure to obtain the advantage of their brains whether they were paid for it or not. And, strange to say, though a professed legist, he did not seem aware that his argument was one of moral idiotcy—that the process of confiscating the brains of the originating class in physics, to public use could not possibly be permanent—that, as has been experienced in India, protection to originating labour in the form of patents, is an essential of production; and, moreover, that if it were sought to make common stock of inventors' brains, it would not be long ere, deprived of their legitimate scope, they would seek to inquire why common stock should not be made also of the land and the water, the hills and valleys, and all that on and in them is. Not a desirable condition this, but far otherwise. It is in the fact of the scope for originality, however imperfectly developed as yet, that English progress consists; and in proportion as that development shall increase, the great mass of the community will attain a higher level.

The Society of Arts first commenced the inroad on the old Law of Patents, and called forth a host of opponents, many of whom assuredly did not desire that inventions should belong to inventors, but simply to capitalists and men of position. How much the advantages in the change of the law have been overrated I will endeavour to show, now that an equity judge in high position declares his conscientious conviction that originators have a claim to the law's protection in the use of their own brains; and moreover, that it is a practicable thing to make that protection efficient, and not a "mockery, delusion, and snare"

We may leave out of the question the origin of patents, and assume that henceforward they are to be granted on the score of utility to the public, and compensation to the inventor. We may cast aside, also, the question of originality, and cease to declare a patent invalid because some one recorded it in the days of the Second Charles. We may declare that originality should consist in a thing having been out of use for thirty years or more or less, and thus take off the *taboo* which has been placed on numerous useful arts, by the publication of Mr. Woodcroft's books, in which the indication of a valuable improvement acts as a warning to all improvers not to work in that direction. It is said that the possession of land for thirty years gives a valid title to its possessor; therefore the absence of a useful art for the period of thirty years ought to give an inventor the power of taking possession of it.

The amended patent law claims to have improved the condition of inventors by giving them for £25 what formerly cost them £350, *i.e.*, a patent for the "three kingdoms and our town of Berwick-upon-Tweed." But this is more apparent than real.

Inventions may be divided into two classes—inventions proper and contrivances. The first is a question of forethought; the latter of after-thought. The one may involve original speculation, as in the construction of a new machine; the latter merely finds a remedy for some defect forced on the attention. The first—the true inventor—really *finds* out by an *à priori* pursuit; the last stumbles accidentally on imperfect things put in his way by others.

The contrivance may be a single thing; the invention may be compounded of all the mechanical powers. It may contain wheels and levers, and inclined planes, and automatic springs, or gravitation movements. For the patent for the single contrivance, the inventor has to pay £25, but for the machine the inventor has to pay as many times twenty-five pounds as the Attorney-General or Solicitor-General, or their clerks, may decide on. The machine itself is called one patent, but every separate part of the machine may involve a separate improvement, and these separate improvements can only be protected by a separate patent for each, or all the world may use his improvements in other combinations of machinery. Thus he may have to take ten patents to protect his invention, which, under the old law, were contained in one. Many inventors were content with an English patent, not desiderating either Scottish or Irish, and in such case the patent for fourteen years cost them about £100. Under the new law a patent for a single contrivance costs for the first three years £25, the next four years £50, and the last seven years £100; total, £175. Supposing an inventor's machine to involve seven patents, it will cost him for the three kingdoms, under the new law, £1,215 for fourteen years, whereas under the old law it only cost him about £350. It is clear, therefore, that for practical purposes the simple contriver has now to pay £175, where before he only paid £100, and the inventor proper has to pay £1,215 in lieu of £100.

The apparent boon to poor contrivers is, that for an outlay of £25 down they can procure a three years' patent—the hardship is, that by the end of the three years, or 2½ years from the lodging of the specification, they must find another £50, or their patents are forfeited. On the whole, the inventor proper, *i.e.*, the man with philosophical acumen, added to instinctive perception, is worse off than before. The alteration in the law has been popular because it has added to the incomes of patent agents, solicitors, commissioners, and all those indirectly interested in patents who are paid by the fees of inventors, but the inventors themselves were better off under the old law.

I am not arguing for a return to indistinct titles covering a cyclopædia of inventions, such as "improvements in machinery generally," or for incongruous titles such as "certain improvements in tallow candles, and also in bricks." But it seems desirable that some known definition should exist as to titles, and what they should cover. It ought not to be left either to law offices or their clerks, to beat out inventions thin, in order to cover the greatest possible amount of fees at their own option. For example, an improved steam-engine as a whole should confer a claim to all improvements, both joint and several, regarding it as a power machine. Improvements in railways ought to cover both rails and machines running on them, just as much as an improvement in lathes should cover both the lathe beds and the tappet heads, or as a wheel and axle should go together.

The boundaries of titles need defining by statute, in order to prevent the inventor from being dependent on the varying views of succeeding functionaries.

One positive advantage has been gained by the system of preliminary specification. A speculative patentee can no longer possess an open mouthed specification in which to cram all the inventions of his neighbours, of which he acquires a knowledge in the six months previous to specifying.

With regard to the system of preliminary examination, on the supposition that the law officers are infallible, can know everything, and thereby grant an indisputable title, there is one strong objection. It would be a trial of what is supposed to be secret, and would lay open the examiners to all kinds of charges of nepotism and corruption. The only plan would be firstly to give notice to the applicant that in one or sundry modes pointed out the patent would be void, and then to leave it to his option to take it or not, providing in other modes, by open trial and examination, for striking off the record invalid patents, or invalid parts of patents as occasion might arise; and this brings us to the most important consideration of all—the mode of settling legal disputes between rival patentees, or between patentees and infringers. The present mode of procedure is indeed a mockery, a delusion, and a snare, in which the purse of the capitalist is pitted against the brains of the inventor; and but too often the capitalists make common cause to the ruin of the inventor. It is indeed a common remark amongst manufacturers that they only take up new inventions when the patent has run out; and to this mode of procedure the multiplication of payments, by instalments, £25, £50, and £100, is peculiarly favourable. I will endeavour to illustrate one of the processes.

Some years back an inventor obtained a patent for an important improvement, that could only be worked by public companies. A year afterwards an identical patent was obtained by another person. This second patent came into the hands of a private company, the members of which were officers of some of the public companies where only it could be used. They were the judges of what should be used, and, as a matter of course, wherever they could, decided in their own favour. The original inventor, of course, had his remedy—an application to the Chancellor, and a trial in a court of law. But his purse was not equal to it, and so he had to submit to his grievance, while the company were receiving the royalties in his despite. At length, by appealing to one company, he procured a stoppage of payments, and placed his piratical assailants in a difficulty. They then sought out one of the inventor's friends and proposed a compromise. This was to divide the outstanding royalties, which were only recoverable on the inventor's original patent, and after he had consented to pay so much black mail, he was to be admitted to a small share in the company. The latter he refused, not liking to "march through Coventry" with them, but he finally agreed to make over his patent to his friend, who was to enter into the company and have a vote in their proceedings. When this was arranged, and the patentee was disabled, the company broke the conditions, refusing to admit the friend to power. Twelve months thus passed over, and the inventor and his friend considered the agreement at an end, and took measures accordingly. The company then filed a bill, and the question was submitted to counsel, who decided that the agreement was at an end by lapse of time. Before going into court, the inventor and his friend, through their solicitor, tendered their readiness to fulfil the agreement, but the matter was carried into court, and judgment was given, by an unquestionably clear, learned, and upright judge, in favour of the company, to neither more nor less than the effect of what had been offered without the interference of the court, thus inflicting a substantial injustice on the inventor, who was plundered from first to last by the plots of unscrupulous pirates. The question of his legal right in the patent was not considered at all. The injustice done him by continued persecution was not considered at all, and the court gave him no relief from an agreement in which his friend was absolutely tricked. The receipt of royalty legally accruing from his own patent was considered as a payment by the company, instead of the opposite fact that the inventor was defrauded of his rights.

The absurdity in this case—the cruel absurdity—was that only half the case was tried. The law holds that in a bargain a consideration must be shown. Now the only consideration, on the part of the company, was their abstaining to a certain extent from injury. The inventor was plundered from first to last, and had he possessed the means of going to law, or had there been any simple and inexpensive mode of procuring justice, they would not only not have succeeded in their plots, but would have been obliged to disgorge their unfair gains.

A court of equity proceeds by written declaration and affidavit, which gives the moneyed men the advantage, when they would scarcely pass a *viva voce* examination. A court of law dealing with patents proceeds by *viva voce* interrogation of witnesses, not only on questions of fact but of opinion. It would be an advantage to change these systems, or, at least, to enlarge them, adding *viva voce* to written declarations in causes of equity, and adding written opinion to the *viva voce* examinations in legal cases. Many a man who will speak an opinion would hesitate to write it so that it could be criticised in the public press, and the falsifier of declarations would easily be caught, if tripping, *viva voce*.

The inventor I have referred to shrugged his shoulders under the decision so just to the ear, and so unjust to the moral sense. It was the second case where he had sown that others might reap, and he had to turn into "fresh fields and pastures new," again to try his fortune in the hope that the time would come when the law would protect him really as well as nominally.

At present it is an unquestioned fact that the purse is the conqueror in patent law courts. A company can get up a *scire facias* against an individual on account of a flaw in his patent, and destroy him. A pirate may infringe him, and overwhelm him. A patent action is an expensive luxury. In most patent disputes there are usually three parties—the inventor, his opponent, and the public. Now, inasmuch as the public grants the patent for its own supposed benefit, and the inventors contribute a large fund of surplus fees, it seems to me that the public ought, in conscience, to pay the judges, and furnish the courts to decide upon the validity or invalidity of patents disputed, without cost to the inventors, summoning their own witnesses if wanted, and supplying their own models and works of reference. If invalid, the patent, or so much of it as might be invalid, should be struck off the records, and the true inventor would then be armed with a proper document to go into a court of law to obtain damages against infringers. The system of hired witnesses giving opinions in favour of the highest bidder would be put an end to, and valuable patents would become a positive property instead of a gambling speculation. Of the various details in working out the principle of such a court I do not now speak, but I am quite sure that the highest physical prosperity, and to some extent the highest moral prosperity depends upon such a court, which would put an end for ever to the wholesale system of trade frauds whether falsifying trade marks or robbing inventors' brains.

The high legal position of Sir William Page Wood, and more than that, the fact of a highly conscientious man being also a man of high eminence, bids fair to open to inventors what Tennyson would call the "gateways of the day," and well will he serve this our common country by putting his intellect and energies to this use. Once more I quote from the published opinions of John Stuart Mill, our foremost logician and political economist.

"If the system of patents is abandoned for that of rewards by the State, the best shape that these could assume would be that of a small temporary tax, imposed

for the inventor's benefit, on inventions. No limit can be set to the importance in a purely productive and material point of view of mere thought. * * * Intellectual speculation must be looked upon as a most influential point of the productive labour of society."

It is an event pregnant with future hope when from out the very ranks of the lawyers steps forth a man to enunciate these lofty views, and, we trust, to act upon them.

I am, &c.,

COSMOS.

STEAM PLOUGHING.

Sir,—I see in the Society's *Journal* of Nov. 18th, an extract from the *Chelmsford Chronicle*, on Steam Ploughing, comparing several systems worked upon the rope traction; mine being one of them, I ask the indulgence of space to say a few words.

Lord Willoughby d'Eresby's plan, exhibited at the Exhibition in 1851, was represented by two engines, using chains instead of ropes, as used by Mr. Eddington, but in all other respects the same, except that it had the advantage of shifting itself from place to place. Mr. Eddington's is in fact his lordship's plan.

The extract is wrong when it says, that upon my plan it is necessary to use in rope three times the length of the field. Let the field to be ploughed be a parallelogram (say containing six acres, which is found in practice to be the most convenient size), having its sides six chains and ten chains long respectively. Place the engine and windlass at one corner, with the plot before the windlass, with a snatchblock placed on the headland, two chains from the opposite corner. It will then be seen that the length of rope at starting will be $10 + 6 + 2 + 11$ chains $= 29$ chains. When this part of the plot is done, bring the snatchblock two chains further along the headland; then work up to it; then bring it up to the other corner of the headland, and it will finish the plot, using at last only 20 chains of rope, so that the average quantity necessarily required to do such a plot is $24\frac{1}{2}$ chains, not three times its length.

As to using two engines, that is easy enough. I have repeatedly explained it. I did so to Mr. Amos, in the trial field at Warwick. This is my plan: Place one engine and tackle, either combined or not (I prefer them disconnected), upon one headland, and the other on the other headland, with Boydell's, Bray's, or such like means of shifting, to make certain of their being able to shift themselves. In this way two ropes the length of the field are all that is required to work two implements passing and repassing wherever they may meet. But can I ask my brother farmers to buy double sets of tackle, when I know that if steam cultivation is to become general, every two or three hundred acre ploughed-land farmer must have a set of tackle to himself, and to provide it he must put his hand into his pocket for £900? No, I will not,—not for the sake of saving a paltry bit of rope, when I know that the spending of £450 only will answer his purpose much better. Why the interest on the extra £450 would more than make good his annual wear of ropes. I will not, however, object to ask large occupiers and gentlemen who would like their engines to shift themselves, to pay the additional expense for Boydell's or Bray's means of shifting; but I have no faith in engines being able to shift without such means. I have no knowledge, of myself, as to what power they take in doing it, but I have of others that pretend to do it without those means, and I will give it here.

At Warwick I had a very good 8-horse power locomotive engine, without rails, made by Messrs. Clayton and Shuttleworth. It took 70lbs. of steam pressure, or 13-horse power out of itself, to take itself from the show-yard to the trial-field and back. This I had ample opportunities of observing. In the show-yard it could not be made to go over a spot where there had been some water spilt.

Now I know that it may be said that a company of farmers may join to buy double sets of tackle, or that the work may be done by hire. In this I do not believe, for I know that the first fortnight in September is worth double the last in smashing up bean stubbles on heavy land; that that month and October are the only two really valuable months in the year; and that work done in them by steam is invaluable compared with horse work. Then I ask who is it who will be content to stand last chance, either by company or hire? Why brothers would not stand it long, and I believe father and son would soon quarrel over it.

Again, it may be said that these double sets would do double quantities. In this I do not believe. For the time wasted in shifting from farm to farm (especially if farmers tried to accommodate each other in sharing the best and worst seasons) would be fully one-third.

I am, &c.,

WILLIAM SMITH.

Woolston, Bletchley, Nov. 21, 1859.

EXAMINATIONS AND THE YORKSHIRE INSTITUTIONS.

Sir,—In Mr. Chester's Review of the Institutions in the Yorkshire Union, in the *Journal* for the 4th inst., he speaks of Sheffield as follows:—"At Sheffield there have been financial drawbacks, and a change of premises, but 32 candidates were examined, and 26 received certificates from the Society of Arts." I wish merely to say that the Institutions which gained the certificates at Sheffield, viz., the People's College and the Church of England Educational Institute do not belong to the Yorkshire Union, and that the financial drawbacks and change of premises refer to the Working Men's College, the only Institution in the town connected with the Yorkshire Union. I am, &c.,

THOS. ROWBOTHAM.

People's College, Sheffield, Nov. 23, 1859.

Proceedings of Institutions.

Aberdeen Mechanics' Institution.—On Monday evening, the 10th Oct., a public meeting was held in the Hall of the Mechanics' Institution, when the certificates awarded at the last Examination of the Society of Arts were distributed. The winter session of the classes connected with the Institution was also opened, and an address by Mr. Farley Leith, on the subject—"India as a Field for the Investment of Capital, and the Application of the European Arts and Skilled Labour," was delivered. The attendance was numerous. Mr. J. D. Milne, advocate, Chairman of the Committee of the School of Science and Art, presided, and on the platform were Mr. Sheriff Watson; Rev. H. Angus, Rev. Dr. J. C. Brown; Baillie M'Hardy; Baillie Fraser; Baillie Forbes; Baillie Smith; Baillie Bothwell; Mr. Miller, President of the Mechanics' Institution, &c. The chairman opened the proceedings by giving an account of the state of the various classes connected with the Mechanics' Institution. The School of Science consisted of four classes—two for mathematics, a senior and a junior class; and there were classes for physics and for chemistry. 123 students had attended last session. With regard to the School of Art, he stated that 214 pupils had entered the different classes during the year; and that, besides, the school exerted an important influence in spreading a knowledge of elementary drawing in the public schools throughout the city, of which no fewer than ten, numbering 925 pupils, had been under the instruction of Mr. Cleland and his assistants during the

past year, making the total number who had shared in the advantages of the school 1,139. The numbers who had entered the classes for arithmetic, book-keeping, writing, and English, during last year, had been 204. At the Society of Arts' Examination four second and sixteen third-class certificates had been awarded to students of the classes, of whom 32 underwent examination by the Society. He concluded by announcing that the classes for arithmetic, book-keeping, and writing, were already open, as were also those of the School of Art—that classes for French and English would shortly be opened, and that the School of Science, embracing classes for mathematics, chemistry, and natural philosophy, would be opened the first week in November. The certificates were then distributed. Mr. Leith then gave the opening address of the session, at the conclusion of which Sheriff Watson moved a vote of thanks to Mr. Leith for his interesting lecture.—Mr. Miller, President of the Institution, seconded the motion. He took the opportunity of calling attention to the claims of the Mechanics' Institution, in particular those of the library. It contained 5,000 well-selected volumes, and the subscription was very moderate, viz., 5s. a-year.—The Chairman then conveyed the thanks of the meeting to Mr. Leith, and this terminated the proceedings.

Ashbourne Literary Institute.—On Thursday, September 29th, the annual general meeting of the members took place, the chair being taken by Joseph Wise, Esq. Several new members were admitted. The treasurer's accounts of the past year were adopted and duly passed, showing a balance of £6 upon the past year. A report from the secretary was also presented, showing a large addition of members during the past year, the present number being 150; also an addition of 60 volumes to the library, which now contains 2,389 volumes, the yearly issue having been 3,260. The thanks of the meeting were passed to W. Mundy, Esq., M.P., Jesse Watts Russell, Esq., P. B. Le Hunt, Esq., and T. W. Evans, Esq., M.P., for their continued support, &c.; also to the proprietors of the *Derby Reporter*, *Mercury*, and *Advertiser*, for their gift of papers, and that the best thanks of the members are due to Septimus Bradley, Esq., and Mr. Thomas Hall, honorary secretary; after which the officers and committee for the ensuing year were elected.

Chichester Literary Society.—A testimonial has recently been presented to Mr. J. L. Gauntlett, the honorary secretary, in acknowledgment of his valuable services to the Institution. Amongst those present on the occasion were Dr. Tyacke (in the chair), H. W. Freeland, Esq., M.P., the Revs. W. Watkins and T. S. Drake, Messrs. W. Gruggen, B. Adames, E. Fuller, E. W. Johnson, &c. The chairman having opened the proceedings in a complimentary speech, dwelling on the efficiency with which Mr. Gauntlett had discharged his duties as hon. sec. to the society, handed to him a list of the names of the 152 subscribers to the fund, and also a purse, containing the amount remaining in hand after the purchase had been made. The testimonial consisted of a handsome bronze ormolu clock, and tea and coffee service in silver, weighing about 72 ounces. Mr. Gauntlett responded. The remembrance of this interesting occasion would continue to his last moments; and to them all, for their valuable gift and kind expressions, he would tender his most heartfelt thanks. On the motion of Mr. E. Fuller, a vote of thanks was passed to the treasurer and honorary secretaries, who had so ably carried out the arrangements. Mr. B. Adames and Mr. Molesworth responded. Mr. Mitten proposed, and Mr. Bonny seconded, a vote of thanks to the committee, which was also carried unanimously, and to which Dr. Tyacke and Mr. E. W. Johnson appropriately responded. Mr. Bonny proposed a vote of thanks to the chairman, which the Rev. T. S. Drake seconded. This being carried by acclamation, the chairman briefly acknowledged the compliment.

Lincoln (Newland Young Men's Mutual Improvement Society).—The first anniversary of this Society was held on Thursday evening, the 10th instant. Its success has been great. On the 11th November, 1858, about a dozen gentlemen, interested in the welfare of young men, met and discussed the propriety of forming an Institution, having for its object the mental, moral, and spiritual advancement of young men. The result of such discussion was the formation of this Society. During the last winter the most that could be done was the delivery of lectures and the discussion of subjects—biblical, political, moral, and social. Several lectures were delivered to which the public were admitted free, and weekly meetings were held for discussion. In April last the number of members had increased to fifty, and the Society was taken into Union with the Society of Arts, and on the 13th of that month a *soirée* was held, in connection with which a series of photographs, lent by the Society of Arts, was exhibited. At a meeting held in the evening, under the presidency of the Rev. C. Scott, LL.B., addresses were delivered by different gentlemen:—On "Moral Power," by the Rev. S. M'All, of Nottingham; on "The Right of Private Judgment," by the Rev. Joseph Shaw, of Boston; and on "Mental Culture," by the Rev. Henry Ollerenshaw, of Hull. The Lord Mayor of London had expressed his approval of the objects of the Society, and his regret at not being able to preside on the occasion. John Crossley, Esq., of Halifax, was also prevented by a prior engagement from being present. The meeting, which was attended by upwards of 400 persons, was of the most enthusiastic character. Since that time the Society has continued to grow, and with such rapidity, that the building of class-rooms, &c., has been considered necessary. The number of members at present on the books is 178—an increase of 128 in six months. This number is also weekly increased. Classes have been established for instruction in arithmetic, algebra, book-keeping, drawing, elocution, English grammar, geology, and writing, and the Committee are in a position to form chemistry, German, logic, and musical classes. The students are young men, most of whom are working hard during the day—a class for whom these classes are especially intended. Very few of them have received instruction in these subjects before. A library and class-rooms are in course of erection, the cost of which will be £227. These are intended to be opened in January. £150 has been subscribed to the Building Fund, and a bazaar is to be held early in February to remove the deficiency, a number of ladies having cheerfully agreed to assist in the matter. A library is also in course of formation. A splendid copy of the "Encyclopædia Brittanica" has been presented by G. F. Heneage, Esq., M.P., and twenty volumes of "Alison's History of Europe," by Major Sibthorp, M.P. About £14 has been subscribed by others to the Library Fund. At the anniversary, on the 10th instant, Mr. Sheriff Roome occupied the chair. A spirited and excellent address was given to the members by that gentleman, in which some sound and good advice was embodied. He earnestly entreated them to value highly the privileges they were enjoying—to work hard in the different classes they were attending—and to gratify the wishes of the conductors and the Committee by being successful competitors in the Society of Arts' Examinations in 1860. He also warned them against making the outward adornment of their persons a matter of very deep study, as some foolish "fast" young men did, advising them rather to lay up a store of knowledge, which would be of incalculable benefit to them hereafter. Mr. Akrill, treasurer to the Society, addressed the members upon the importance of elocution. Some of them might—on a future day—occupy positions of power, as orators, ministers of the Gospel, patriots—and how necessary it was that they should be able to express their ideas correctly. He recommended them to attend carefully to the instruction given by the con-

ductor of the Elocution Class, who was a gentleman well qualified for the position. Mr. Akrill's remarks came with force and earnestness, and they were evidently appreciated. Recitations were given by some of the members. The lecture arrangements for the present session are good. Those which have already been delivered have been well attended; and, altogether, the efforts of the Committee are appreciated by the Lincoln public. For the comparatively short time the Society has been established, the amount of good it has done appears to be great, and the success it has met with most remarkable.

Manchester (Institutional Association of Lancashire and Cheshire).—A large meeting of this Association was held on Thursday evening, the 1st November, in the Free-Trade Hall, when the Right Hon. Benjamin Disraeli, M.P., distributed the prizes and certificates of honour to the students. On the platform were Lord Stanley, M.P., Vice-President of the Society of Arts; the Marquis of Chandos; the Hon. A. Egerton, M.P.; the Hon. W. Egerton, M.P.; Mr. Bazley, M.P.; Mr. J. A. Turner, M.P.; Mr. W. N. Massey, M.P.; Mr. W. Fairbairn, Vice-President of the Society of Arts; Mr. O. Heywood, Mr. E. Tootal, Sir J. Watts, and the Mayor of Manchester. The following is a summary of the annual report, read by Dr. J. W. Hudson to a conference of delegates from the various Institutions, held in the afternoon, under the presidency of Mr. Bazley, M.P.:—The Association now consists of 110 Literary and Mechanics' Institutes and Mutual Improvement Societies, with 22,000 members, including 2,000 females, and they possess in the aggregate 135,000 volumes in their libraries. Nearly all are increasing in prosperity. Sixty-five Institutions report an increase of members this year; only six a diminution. The relative proportion of the labouring classes has been greatly augmented. The number of male and female pupils attending the evening classes of seventy-two Institutions is 6,584, but the total number on the books of the several Institutes exceeds 8,500. Twenty-three Institutions have buildings of their own, acquired at a cost of £83,774. The Associated Institutes have been severally asked, "What is the most attractive feature in your Institution at present?" Forty-five replies say, "The evening classes;" twenty, "The news-room;" twelve, "The library;" seven, "Tea-parties and discussions;" and three, "The lectures." The itinerating library proves as attractive as ever, and the Committee only regret that the boxes of books are not far more numerous. During the last three years upwards of 3,500 male and female candidates have been subjected to a preliminary examination in spelling, grammar, writing, and arithmetic. Out of 1,200 pupils whose elementary knowledge was tested by the preliminary examinations held this year, 405 males and 45 females were deemed eligible for public examination. Out of this number prizes and certificates have been awarded to 123 males and ten females. During the past year one member of the Council has kindly visited many of the Institutes in the Union, and devoted two months to an inspection of the working of their classes. The Committee is of opinion that the Government is slowly and steadily rearing strong opposition to the educational department of Mechanics' Institutions by the establishment of subsidised night schools for the instruction of the labouring classes during the years of adolescence. The night schoolmaster, backed by the public purse, when in his own building, is in some cases enabled to offer lower terms to the working classes than the Mechanics' Institution, but without its collateral advantages. The financial position of the Association has improved, the income for the past year being £178 11s. 3d., and the balance in hand £22 11s.—Mr. Disraeli said he had acceded willingly to the invitation which he had received, because he sympathised with their feelings and honoured their efforts. He had felt much disappointment in the results of Mechanics' Institutions generally, and be could not but entertain the opinion that their partial failure had resulted from the isolated position in which such Institutions were often placed, an evil which such Unions as had then been formed tended to avert. The experience of each Institution became thus available to all. Mr. Disraeli went on to express his high opinion of the advantages of Examinations, and his gratification at the success which they had met with in that part of the country. He did not wish to express any dissent from the statement that learning was its own reward, but he thought that its influence in raising its possessor in the social scale ought not to be disregarded.—The prizes and certificates were then distributed. The meeting was afterwards addressed by Lord Stanley, M.P.; the Hon. Algernon Egerton, M.P.; Mr. W. N. Massey, M.P.; the Marquis of Chandos, and other gentlemen; and separated after passing a vote of thanks to the Chairman.

Watt Institute, Portsea.—On Thursday evening, Sept. 29th, a tea festival was held at this Institute, to celebrate the presentation of the certificates of merit to the successful candidates at the last Examination of the Society of Arts. The President, Mr. A. Murray, was unavoidably absent. Mr. T. Miller and Mr. James Spence were also prevented from attending. The duty of chairman fell on the Rev. W. Young, of Portsmouth, the President of the Literary and Philosophical Institution in that town, who very ably performed his part. The presentation of the certificates devolved upon Mr. R. Rawson (in the absence of Professor Main), who presented each certificate with a most gratifying and pleasing address. Major General Whylock, of the Royal Marines, who now fills the office of President of the Literary and Scientific Institution (the Athenæum), Portsea, was present, and delivered a short and appropriate address. The Rev. H. Hawkes (late President of the Athenæum) also addressed the meeting, giving most excellent advice to the young persons present. Mr. D. Maxwell also addressed the meeting on the subject of education. The evening was enlivened by a band; and after a vote of thanks to the chairman and others for their presence, the meeting separated at ten o'clock.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Prof. Tyndall, "On the Radiation and Absorption of Heat.
Actuaries, 7.
Geographical, 8½ (Burlington-house). 1. Mr. F. Galton, "On Sun Signals for the use of Travellers." 2. "Latest Accounts of the Central Africa Expedition, from Dr. Livingstone, with illustrations." 3. Mr. W. H. Purdon, "Notes on Capt. Montgomerie's Map of Kashmir."
Medical, 8½. Mr. Baker Brown, "On Vesico-Vaginal Fistula; a new operation for its cure."

Tues. .....Civil Engineers, 8. Mr. R. B. Grantham, "On Arterial Drainage and Outfalls."

Wed. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Society of Arts, 8. Mr. P. H. Holland, "On the Prevention of Accidents in Coal Mines."
Medical, 8½. Lettsomian Lectures, Dr. F. W. Pavy, Professor of Physiology, Guy's Hospital, "On certain points connected with Diabetes," with experimental illustrations.
Geological 8. 1. Mr. T. W. Atkinson, "On some Copper Relics found in a Goldbearing Sand in Siberia." 2. Mr. C. Heaphy, "On the Extinct Volcanoes of Auckland, New Zealand." 3. Rev. J. E. Woods, "On some Tertiary Beds in South Australia."

Thurs. .....Antiquaries, 8.
Chemical 8. 1. Mr. W. H. Perkin. 2. Dr. Hofmann, "On the Vapour Densities of Organic Bodies."
Linnæan, 8.

Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their application to the Arts and Purposes of Life."

Sat. .....Asiatic, 2.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 18th*, 1859.]

Dated 19th September, 1859.

2132. H. J. Warlomont, Liege, Belgium—Imp. in apparatus to be employed in the manufacture of zinc.

Dated 19th October, 1859.

2388. G. Gregg, Sheffield—An improved method of dyeing leather black.

Dated 27th October, 1859.

2458. P. R. Hodge, 16, Chalcot-crescent, near Primrose-hill, Middlesex—Imp. in the process of brewing fermented liquors, and in apparatus connected therewith, and in preparing and separating the materials, and the manner of using them in producing fermented liquors.

Dated 29th October, 1859.

2472. J. Mascord, J. Bonner, and F. Viner, Banbury, Oxfordshire—Improved machinery or apparatus for cutting up and pulping or reducing vegetable and animal substances.

Dated 2nd November, 1859.

2495. J. L. Budden, 48, Fenchurch-street—Imp. in forming and driving piles for the construction of piers, jetties, viaducts, bridges, or other works where piles are usually employed. (A com.)

Dated 3rd November, 1859.

2497. J. A. Turner, Manchester—Imp. in rendering paper waterproof.
2499. I. F. Delavier, Paris—Imp. in coffee pots, tea pots, and other culinary or pharmaceutical vessels of the same nature.
2501. C. Bacon, Edgware-road, Middlesex—Imp. in globes and shades for gaslights, and oil or other lamps.
2503. C. W. Siemens, Great George-street, Westminster—Imp. in insulating electric telegraph conductors and in battery arrangements connected therewith. (Partly a com.)
2505. G. Wemyss, Springwood-park, Roxburgh, N.B.—Imp. in ventilators.

Dated 4th November, 1859.

2507. E. Juzet, 29, Boulevart St. Martin, Paris—Imp. in lubricating apparatus.
2509. A. P. Boothby, Dean-street, Soho—Imp. in travelling and such like bags.
2511. L. Koch, New York, U.S.—A moving tread power.
2513. C. Brook, jun., Meltham Mill, Yorkshire—Improved arrangements and apparatus for folding, tieing, and labelling hanks of yarn or thread.
2515. W. Clarke, Nottingham, and J. Gee, Lenton, Nottinghamshire—Imp. in the manufacture of looped fabrics.
2517. R. A. Brooman, 166, Fleet-street—Imp. in breech-loading ordnance and other fire-arms, and in projectiles to be used therewith. (A com.)

Dated 5th November, 1859.

2521. D. Joy, Manchester—Imp. in machinery for the manufacture of telegraphic cables. (A com.)
2523. E. A. Cuche, 29, Boulevart St. Martin, Paris—Imp. in galvanizing metallic wires.
2525. T. W. McCallum, Belper, Derbyshire, and L. Woodward, Nottingham—Imp. in framework knitting machinery.

Dated 7th November, 1859.

2527. P. Dietens, Brussels—A system of letter-paper, letter-invoices, letter-circulars, prices-currents, memorandums, and other missives.
2529. J. A. Clarke, Long Sutton, Lincolnshire—Imp. in extracting seeds or stones from foot.
2531. H. Charlton, Blackfriars, Manchester—Certain imp. in the method of navigating steam ships or vessels, and in the apparatus connected therewith.
2533. G. Meline, Lay St. Christhope, France—Imp. in mills of whatever kind.
2535. W. E. Newton, 66, Chancery-lane—Imp. in promoting or accelerating combustion in furnaces or fireplaces. (A com.)

Dated 8th November, 1859.

2537. H. B. Powell, Foxleize park, Lyndhurst, Hants—The protection and prevention of fouling or injuring by foreign matters the screws, paddles, rudders, and stern posts of steam ships or other vessels.
2539. C. Greed, Birmingham—Imp. in the manufacture of tubes suitable for locomotives and other steam boilers.
2541. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in "passe-partouts," or mounts for pictures. (A com.)
2543. G. Hadfield, Carlisle—Improved machinery for cutting staves for casks and barrels.
2545. W. Clark, 53, Chancery-lane—A compound applicable for the manufacture of manure, the preservation and disinfection of organic matters, and for other purposes. (A com.)

Dated 9th November, 1859.

2547. G. White, 34, Dowgate-hill, Cannon-street—Imp. in the manufacture of endless leather bands, straps, or bells for driving machinery, and in apparatus for effecting the same. (A com.)
2549. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved means of destroying insects in grain and other organic matters. (A com.)
2551. J. Dales, 11 and 12, Gresham-house, Old Broad-street—Imp. in applying deodorizing fluids to sewers and other receptacles of sewage.

Dated 10th November, 1859.

2553. E. T. Hughes, 123, Chancery-lane—Imp. in railway breaks; also applicable for arresting the rotary motion of wheels and cylindrical bodies in general. (A com.)
2555. R. A. Brooman, 166, Fleet-street—Imp. in mills or apparatuses for extracting oil from seeds, and for other purposes. (A com.)
2557. A. J. Melhuish, Holborn-bars—Imp. in the construction of cameras for obtaining photographic pictures.
2559. G. Seymour, 116, Fenchurch-street—Imp. in insulating and protecting electric telegraph conductors.
3561. W. Day, Burton Latimer, near Wellingborough, Northamptonshire—Certain imp. in propelling vessels, which said invention is also applicable for converting the force of the wind into a motive power to be used in any convenient way either for stationary or moveable purposes.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2574. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Improved apparatuses for the concentration, distribution, and application of the heat evolved by gas, oil, and other lamps. (A com.)—14th November, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, November 18th*, 1859.]

November 18th.
1243. H. Newman.
1250. J. P. Budd.
1253. J. R. Scartliff.
1349. J. F. Miquel.
1402. W. Burness.
1511. E. T. Hughes.

[*From Gazette, November 22nd*, 1859.]

November 22nd.
1261. J. Knowles.
1262. R. V. Leach and T. W. Willett.
1264. G. Burnell.
1268. C. P. Moody.
1269. R. A. Brooman.
1277. G. Davies.
1279. G. D. Jones.
1280. J. Gibbs.
1284. A. J. Sax.
1292. A. Prince.
1300. H. W. Patrick.
1304. G. F. Chantrell.
1314. L. Farrenc and B. Subra.
1316. G. Hadfield.
1328. J. Bruce.
1332. W. Green.
1344. G. H. Smith.
1346. J. J. Lundy.
1368. J. H. Johnson.
1406. T. Greenshields.
1450. T. W. Jones.
1756. Patrick Robertson.
1842. F. L. Lawrence.
1958. E. Rettig.
1970. J. H. Johnson.
1978. J. Cowgill and J. Stocks.
2034. A. V. Newton.
2072. M. A. F. Mennons.
2104. J. P. Clarke.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, November 18th*, 1859.]

November 14th.
2705. G. Davies.
November 16th.
2797. J. Marshall, junr.
2818. J. M. Saunders.
2858. M. Townsend.

[*From Gazette, November 22nd*, 1859.]

November 17th.
2717. E. Blanchon.
2741. S. Fox.
2815. J. Higgin.
November 19th.
2743. J. M. Gilbert.
2757. J. W. Clare.
2758. C. Tooth.
2894. W. H. Bowers.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, November 18th*, 1859.]

November 15th.
767. J. Ramsbottom.

[*From Gazette, November 22nd*, 1859.]

November 17th.
771. J. T. Way and J. M. Paine.
785. P. Carmichael.
November 16th.
780. J. Potter.

Journal of the Society of Arts.

FRIDAY, DECEMBER 2, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded as soon as possible to the Secretary of the Society of Arts.

THIRD ORDINARY MEETING.

Wednesday, November 30, 1859.

The Third Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 30th inst., Edwin Chadwick, Esq., C.B., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Aley, Frederic William	Lee-Jortin, Henry
Bainbridge, Anthony	Lundy, John James
Bosanquet, George	Mann, James Alexander
Bowring, Sir John, F.R.S.	Mayall, George, jun.
Dexter, T. E.	Meredith, Samuel Bull
Dunn, James Benjamins	Miller, George Taverner
Elphinstone, Howard Warburton	Parson, George John
Fawell, Thomas	Peckover, Jonathan
Frodsham, George	Rowe, Thomas William
Harding, J. J.	Sinclair, Robert
Hennessy, John Pope, M.P.	Stanford, Edward
Imhof, Daniel	Stevens, Richard, jun.
Kennedy, Angus	Topham, John
Kerr, W. H.	Waller, Edmund
Kerr, Wm. Joseph	Withers, George
	Yeaman, Robert

The Paper read was—

ON THE PREVENTION OF ACCIDENTS IN COAL MINES.

By P. H. Holland.

Though I have had no immediate connection with the management of collieries, my attention has been very strongly called to this subject by having been instructed, in my capacity of Inspector of Burials, under the Home Office, to report upon the safest method of burying the numerous victims of the great explosion at Lundhill in 1857, by which 189 lives were lost. Two months elapsed before any of the bodies could be removed, and at the end of five months some still remained in the mine. Of course the removal and burial of so large a number of putrid corpses required the most careful precautions, but neither skill, care, nor expense was spared; and the free ventilation secured, the use of McDougall's disinfecting powder, Dr. Stenbruse's charcoal respirator, and other precautions, were effectual in preserving all the men employed in this difficult, dangerous, and disgusting work, from any serious injury.

It was of course impossible for me to have thus forced upon my attention a calamity so tremendous, by which 189 human beings were suddenly killed, 90 wives made widows, 220 children orphans, and a whole village deprived at once of so many on whom they were dependent for their daily bread, without strongly feeling the importance of adopting every practicable expedient for diminishing the recurrence of similar disasters, and inquiry soon convinced me, first, that the evil was of far greater magnitude than I was before aware of, and secondly, that precautions the efficacy of which is well known and fully proved, and which are ordered to be observed by proper legal authority, are, very generally, partially or wholly neglected, in defiance of humanity, of justice, and even of law.

To prevent any possible misunderstanding, I am anxious clearly to explain that though this subject was first strongly brought under my notice in the execution of my ordinary duty, I have not the slightest official connection with the administration of the inspection of Coal Mines Act, nor are any of those who are connected with its administration at all responsible for, or even aware of what I am about the state.

The magnitude of the evil is evident from the frequency with which the public are shocked by accounts of colliery accidents, particularly explosions, and the wide-spread and very correct opinion that employment in coal mines is very hazardous, but I own I was not prepared to find that out of a number of about 220,000 colliers, 1,000 are annually killed, and of course a very much larger number severely though not fatally injured.

During the last eight years there have been reported 8,015 deaths by colliery accidents, or 1,002 a year, showing a death-rate from violence exceeding four per thousand. I cannot calculate the exact proportion, because I do not know the increase of the number of colliers since the census, but the death-rate by accidents among colliers is at least from six to seven times as great as the death-rate from violence among the whole population, including suicides, homicides, and the dangerous occupations. If these were excluded it is probable that colliery work would be seen to be eight or ten times as dangerous as the average. In confirmation of this I may state that the charge of the insurance company against death by accident is for colliers eight times the ordinary rate.

If this destruction of human life were inevitable, it would be melancholy enough, but I shall convince you that a very large part of it is not inevitable, that it would be very much diminished if the inspectors of coal mines could succeed in enforcing obedience to their regulations; and that obedience to those excellent regulations would be far better enforced if it were made the direct and palpable interest of owners and managers of coal mines to observe and to enforce them.

The table (see next page) which is very nearly though perhaps not absolutely correct, shows the number of deaths occasioned by each great class of colliery accidents.

It will be noticed that with the exception of the year 1857, which included the extraordinary mortality at Lundhill, the number of deaths has scarcely increased, though the quantity of coal got, and therefore the number of men employed, must have increased considerably.

This result, gratifying so far as it goes, is no doubt the effect of such observance of precautions as the Inspectors have been able to induce, and there is great reason to hope for still greater success; but the causes of accidents are so numerous, and attention to such minute

SUMMARY OF DEATHS BY ACCIDENTS IN COAL MINES.

YEARS.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	Total in Eight years.	Average per annum.	Average in the northern district.	Proportion for the whole country.	Excess of deaths above the proportion of the north.
Explosions	321	264	214	210	148	235	377	215	1984	248	21	105	143
Falls of Roof	327	349	370	389	399	399	373	365	2971	371	49	245	126
Accidents in Shafts	219	209	236	290	235	210	166	169	1734	217	24	120	97
Miscellaneous under and above ground	117	164	137	156	181	183	206	182	1326	166	50	250	84*
Total	984	986	957	1045	963	1027	1122	931	8015	1002	154	720	

* Exclusive of the miscellaneous fatal accidents, the excess of deaths is 366 per annum, or more than one a day.

particulars so necessary to prevent them, that it is impossible to do more, by the operation of penal law alone, than check the most glaring kind of imprudences, unless the number of Inspectors were almost indefinitely increased, and their authority exercised to almost the superseding of all independence of management, which would be but little short of Government providing managers for mines at the public expense and assuming the responsibility of the result.

The next point to be noticed in the table is the proportion of different classes of accidents. It will be seen that deaths from explosions, which alone excite much popular attention, form only one quarter of the whole. These are all, or nearly all, preventible.

In the northern districts, in which one-fourth of the coal is raised, and nearly one-fifth of the total colliers employed, the deaths from explosions scarcely exceed one-twelfth, the average being only 21 out of 248 annual deaths from this cause, and these may be still further diminished by constant attention to ventilation, and especially by the use of such safety lamps as the men cannot open without extinguishing the light.

It is expressly enacted in the 4th section of the Colliery Inspection Act, that "an adequate amount of ventilation shall be constantly produced in all collieries, to dilute and render harmless gases to such an extent as that the working places of the pits and levels of such collieries shall, under ordinary circumstances be in a fit state for working." And by the special rules, colliers are forbidden to enter the mines until they have been examined by means of a lamp and found safe.

If the simple and common rule were universally followed, of not allowing any unprotected light in any mine, unless and until the part of the mine worked was found safe, there could be no explosions except in those very rare instances in which an explosive admixture of gases and air is rapidly formed. Mr. Mackworth reported that 72 out of 73 explosions, and 171 out of 172 deaths were atttributable to the use of naked lights, and that out of 1,154 deaths from explosions reported in five years, 12 only occurred where safety lamps had been used, all of which were in a defective state.

Mr. Kenyon Blackwell's evidence confirms this. He says that "out of 1,099 deaths, 7 only were with safety lamps, and adds that no instance has been properly authenticated of explosion from a proper safety lamp; and in the most dangerous mines of England, where the discharge of firedamp is greatest, but where locked safety lamps are exclusively used, explosions are almost unknown." (Colliery Report, 1857, p. 123.)

In the northern district, where nearly one-fifth of the total colliers are employed, the average number killed per annum by explosion is only 21, out of a total of 248. If the average loss of life were reduced, as with equal care it might be, to the average of the north, instead of 1,984 killed during the last eight years, there would have been only 845. That is to say, that 143 lives are annually thrown away, because the precautions proved to be effectual in Durham are not observed in Yorkshire, Lancashire, Staffordshire, Wales, &c.

Is it unreasonable to expect that the safety of all mines shall be raised to the standard of those of Durham, which are naturally among the most dangerous? Is it too much to require that the Act directing due ventilation shall be obeyed, and that the possibility of having an unguarded light in an explosive atmosphere shall be prevented?

Falls of coal and roof are the most frequent cause of injury. The deaths from these accidents alone have been 2,971 in 8 years, or 371 a year. Besides those killed by coal falling upon them, a very much larger number have been maimed and injured, often very seriously.

It is probable that no reasonable degree of care will completely guard against these accidents, but it is certain that they may be very much diminished, as is proved by the fact that in the northern district, which employs one-fifth of the men, there are only about one-eighth of the fatal accidents of this class.

This great difference appears to be chiefly owing to the plan adopted in the north, of employing men for the especial duty of looking after the safety of the colliers. It is a special rule, nearly always ordered, but very generally neglected, that "every collier shall securely sprag (*i.e.* prop) "coal while holing," (cutting away beneath to make it fall), "and shall also, when necessary, prop the roof." Any collier who neglects to do this is liable to fine or imprisonment, but it is neglected, and 126 men are annually sacrificed, and probably some thousand lamed in consequence. If a small part of the money lost by these accidents was expended in preventing them, the standard of danger might be reduced at least to that of the Durham mines, and 126 of the 370 annually killed saved.

Often props are not sufficiently supplied; more frequently, in his anxiety to get as much coal, and thereby as much money as possible, the collier neglects the not immediately profitable duty of propping.

In the northern district about one in six of the men employed are what may be termed the safety staff, for superintending ventilation, keeping up roads, setting timber, removing obstructions, and doing other things necessary for the safety of others. In most other parts of the country, colliers are expected to do most of these things themselves, and they are very much less properly done with the effect of an annual loss of 126 lives more than there would be if the danger were reduced to the Durham standard; and the northern mines are themselves susceptible of great improvement.

The most dangerous part of the collier's employment seems to be in the shaft, for though most of them pass but a small portion of their time in or near the shafts, more than one-fifth of the deaths occur there. That many of these accidents may be guarded against, is proved by the fact that many of them occur which the most simple precautions would certainly have prevented. For instance, men could not be killed by falling stones or coals, if the cages were properly covered. Few are thrown out of the baskets or skips, when cages with proper guide rods are used. Few are drawn over the pullies when there are proper indicators,

signals, and breaks, and when the engine driver's attention is not distracted by other duties. To neglect such means of safety is penal, but they are neglected, because their observance causes expense and trouble, and is not evidently and directly remunerative, though indirectly highly profitable.

About one-sixth of the deaths, or 166 a year, are caused by miscellaneous accidents, the chief of which are crushing by coal tubs, or by passing trains. Many of these are the consequence of bad discipline, the want of proper control to enforce obedience to rule. Some happen because the galleries through which coal trains pass are too low and too narrow. Some by the employment of machinery and horses, where hand putting, though dearer, would be less dangerous, and many, no doubt, from the reckless foolhardiness of the sufferers themselves. The young seem to be the peculiar victims of this class of accident, partly because they are chiefly employed in the galleries, partly from their want of experience and caution. About twice as many of the boys below 15 are killed, as is the proportion to the number of them employed.

Though the effect of the systematic inspection of collieries has induced the introduction of many precautionary arrangements, and, no doubt, has caused several hundred human lives to be saved, it has not produced all the improvement of which collieries are susceptible, and from the very nature of the case it never can. It was never intended that the Inspectors should be the substitutes for viewers, or mine engineers, who are so constantly employed by the owners of the northern mines, but not always elsewhere, to direct the general mining operations. If the Inspectors are to perform this duty, not only must their number be increased from 10 to at least a 100, but they must be invested with power enough to become in effect the real directors of the collieries in very important respects. Such an extension of the system of inspection, and of Government control, is not, indeed, impossible, but it would evidently be highly impolitic, and quite at variance with our national feelings and habits; it would be pre-eminently un-English, and would neither be sanctioned by Parliament nor endured by the people. All that can be wisely attempted by penal law is to enforce such general regulations, and to compel the adoption of such precautions, as will guard against evident and almost universal dangers, leaving the details of management and the discipline of mines to those who alone can effectually execute such duties, those who employ and pay the men. For Government to attempt to do more than this, would be to assume power which cannot be effectually exercised, and to incur responsibility which ought to rest as exclusively as possible on the colliery owners themselves. It is, indeed, a question whether the regulations, now ordered to be observed, but often neglected, do not err on the side of being too minute, though no one can reasonably blame the Inspectors for endeavouring to guard against every foreseen form of danger, whilst they know that, without their interference, precautions will be almost certainly neglected.

The reports of the Inspectors give ample proof, both that precautionary regulations directed to be observed are very generally neglected, and that a very large proportion of the thousand annually killed are destroyed in direct consequence of such neglect.

That such is the case in the great majority of instances is proved by the record of accidents and confirmed by the fact that in the northern districts, where precautions are best observed, the proportion of fatal accidents to the men employed is very much less than that of the country. It is the general belief of those conversant with the subject, that the numbers really killed by disregard of the precautions ordered, is greater than has been proved, which is very probable, as it must often be impossible to get evidence of neglect, which many have an interest in concealing, and under circumstances where the exact truth is apt to be obscured. Much good has been done, and much more no doubt will be done, by enforcing the penalties against those who disregard the regulations; but almost infinitely more might be accomplished if it were made the direct, palpable self-interest of all colliery owners, managers, and men, that whatever would diminish risk should be adopted. No doubt it is their interest, as the most intelligent of them are well convinced, but that is not always immediate and self-evident. The danger and loss are remote and contingent—the trouble, cost, and inconvenience of adopting precautions are certain and immediate. We are all more or less gamblers, and will incur a distant risk for a present gain, and most of us risk a distant loss which is out of proportion to the present gain.

This is especially the case with those to whom the risk is habitual and the precaution new; they underestimate the former and over-estimate the latter. For instance, it is abundantly proved, that the cost and inconvenience of using locked safety lamps is very small in proportion to the risk of not using them, yet their introduction has been pertinaciously resisted. Once introduced, their use has rarely been abandoned. The reason, doubtless, is that the inconvenience and cost of them are constantly apparent, but the diminished risk is evident to the thoughtful only. If the reality of the benefit were fairly estimated, all opposition to their use would vanish. All that is necessary to effect this change is, first, to prevent those whose neglect and mismanagement occasion the accidents, from pushing off the loss upon others, and secondly, to arrange that the loss instead of being left to be paid at rare and uncertain intervals, when accidents happen, should be paid for in anticipation, that is in the form of periodical premium of insurance against the risk. Colliery accidents are sometimes but not generally very destructive to property, but the heaviest part of even the pecuniary loss results from the loss of life. For instance, the Lundhill explosion, which was unusually destructive to property, is supposed to have cost the proprietors nearly £20,000. The same explosion destroyed also 189 persons, and deprived those who were dependent on them for support of their means of livelihood. If the families so impoverished had had annuities purchased for them, producing for ten years, 10s. a week for each bread winner killed, they would not have received full compensation for their mere money loss; but to purchase such annuities would have cost, at £200 each, £37,800, or nearly twice as much as the estimated injury to the colliery itself. A part, indeed, of this heavy loss was borne by the owners of the colliery, who subscribed largely to the fund raised to relieve the sudden and utter ruin in which the families of their workpeople were involved, and to prevent their all becoming a burden upon the rates. The ratepayers also had a heavy share, though very unjustly, but its weight fell chiefly upon the families of the colliers suddenly reduced from comfort to want, and partly on those benevolent persons who contributed to relieve an amount of distress overwhelming to the immediate district.

Upon whom ought such loss justly to fall? Clearly not upon the families of those killed, who must inevitably suffer so deeply in addition to pecuniary loss, and who have done nothing to cause, and could do little to prevent, their misfortune. Clearly not upon the charitable, who have difficulty in meeting other claims on their benevolence. Nor upon the ratepayers of the parish which is so unfortunate as to be the scene of such disasters. It is clear that those alone who profit by a dangerous employment should pay for its risks, and that any loss which might have been avoided by care, should fall as exclusively as possible upon those who could and who ought to observe and enforce precautions.

The cost of precautions, and of accidents which occur in spite of them, should be borne by the consumers of coal. The loss occasioned by accidents which might be avoided but are not, should be borne by those whose culpable negligence or cruel parsimony was the cause of them.

This just and beneficial result might be attained by one of two plans—by a system of insurance against death by accident, or by such an extension of Lord Campbell's Act as would secure compensation to the families of those killed apparently in consequence of the neglect of any of the precautionary regulations legally ordered to be observed, unless it can be proved that the death was caused by the deceased himself, instead of its being necessary for the claimant of compensation to prove that the death was caused by the direct act or default of the master, whereas it is generally the neglect of some servant or fellow workman, who alone is pecuniarily responsible, but from whom substantial damages can rarely if ever be obtained. The theory of the law in this respect seems to be, that the workman undertakes to bear all the risks attending the employment; and the danger and possible loss to himself and family is, it is presumed, paid for in the form of higher remuneration. Supposing this to be fair, so far as ordinary risks are concerned, surely it cannot be justly assumed that the collier is a consenting party to encountering risks arising from open violation of law, e.g., from the disregard of precautionary regulations the neglect of which is punishable by fine or imprisonment. I am told that damages are not now recoverable unless the injury can be proved to have been the direct result of the neglect of the defendant himself. What is needed is that it should be sufficient, in order to obtain compensation, to prove that the injury probably resulted from the neglect of a precaution ordered to be observed, but either habitually neglected or neglected at that particular occasion, either by the defendant himself or by some persons employed by him, unless it can be shown that the injury did not so result. In short, that proved neglect, the probable cause of the injury, should be *primâ facie* evidence that it was the real cause, and that coal owners should compensate for injury suffered by those they employ, in consequence of breach of law either by themselves or their agents. The object would, however, be much more perfectly attained if no one were allowed to work in any colliery without being insured against death by accident, to a sufficient amount to secure his family from destitution, which would have the effect of compelling those to bear the loss who profit by the labour, and who can most control the result.

It may be objected that either plan would impose a new and heavy tax upon collieries, and thereby injure a very important national interest. A little consideration will however show that it would be a great pecuniary advantage to the coal owners who do their duty—a large and increasing class—a heavy tax to those only who neglect it. Even supposing, contrary to all analogy, that high charges for insurance of colliers in dangerous mines, and low charges for those in safe ones, should have no powerful influence in rendering the dangerous mines safe, and the safe ones safer, the effect would simply be to transfer the burden of maintaining the families of those killed from those who ought not, to those who ought to bear it. By slightly enhancing the price of coal, the cost of precautions against accidents, or of compensation for injuries sustained, might be paid for without injustice or hardship to any one. An increase of one penny per ton upon the cost of the 66,900,000 tons of coal annually raised, would amount to nearly £280,000 a year, or enough to purchase annuities worth £200 a piece for the families of the thousand men and boys annually killed, leaving a large margin for expenses of management and extra risks, and more than enough to pay for all reasonable means of safety, not in themselves profitable as they generally are.

There is no doubt, however, that though the immediate effect might be only to relieve an enormous amount of severe and unmerited suffering, by increasing the cost of coal to a scarcely appreciable extent, a secondary effect, even more important and beneficial, would very rapidly follow.

It must be abundantly evident that though coal-mine owners can add the average cost of insurance (if all must pay) to the price of coal, they cannot add that which is above the average, which will therefore be a loss to them, while any below the average is a gain to the individual owners who succeed in procuring for their mines a reputation for safety. They would therefore have a very strong motive for adopting any improvements in the working or management which would induce the insurers to lower the charge of insurance. Nor would this be the only, nor, perhaps, the strongest inducement. The charge for insurance would be an indication of the risk, as estimated by those whose duty and interest it would be to estimate it correctly. Colliers would seek employment in the safest, and avoid the more dangerous mines, to which they would have to be tempted by higher wages, and the pits would be classified by the best, because the most experienced and unprejudiced judges. The extra charge for insurance, and the extra wages demanded for working in mines thus declared to be dangerous, would act like a heavy and constantly recurring penalty on those who persist in disregarding precautions; penalties far more certain of infliction and far heavier in amount than any a court of law would impose for neglect, however flagrant, short of manslaughter; penalties which must be charged, or the insurers would be ruined; penalties inflicted not on rare occasions, but constantly and inevitably, so long as the neglect of precaution continues.

The plan might, moreover, be so arranged as to act as a large and gratifying reward to those who succeeded in diminishing accidents, if, instead of lowering the charge for insurance, the insurers paid back a stipulated share of the profit to be spent for the benefit of the colliers in mines where losses were less than the average. On the occasion of such distribution of the profits resulting from successful carefulness, an excellent opportunity would be presented of proclaiming the success, explaining its causes, and enlisting the services of all the men to further improvement.

Can it be doubted how this would operate? For instance, Lundhill Colliery exploded because it was not worked with safety lamps, and 189 persons were killed. There is no intention of holding up the proprietors to special reprobation; probably they were advised that to use the safety lamps was an unnecessary expense. After the explosion some so-called safety lamps were found open. Would lamps which could not be opened, and which might have been supplied to every miner for less than £100, have been thought an unnecessary expense if the alternative had been either using them or paying, say £100 a year extra insurance against death by accident? Is it not morally certain that locked safety lamps would alone have been used, that most of the 189 then killed would be now living, their wives would not have been widows, nor their children orphans, the mothers childless, nor households desolate; or, if contrary to all reasonable expectation, and notwithstanding all care, the explosion had happened, a whole village might indeed have had to mourn for their dead, but would not have been pauperised. Mothers would have wept over their orphaned children, but the holiness of their grief would not have been mixed with fear of seeing those children pining from want, or of being compelled to consign them to the workhouse. Where the plan failed—and it would rarely fail—in preventing such catastrophes, it would at least alleviate the disaster.

To take another example, for months before the explosion of the Cymmer Mine, in 1855, by which 114 lives were sacrificed, the Inspector had over and over again pointed out its hazardous state, and urged upon both owner and manager, and that repeatedly, the necessity for increasing ventilation, and the exclusive use of safety lamps, but failed to convince them that it was their interest and duty to guard against the danger. They considered the Inspector timid and over anxious, and did not adopt these or any other precautions. Nay, it is even said in

the neighbourhood, that the men were actually threatened that if they would not go into the mine, which they knew was full of gas, they should never go in again. This could not be proved, for the men alleged to have been threatened were killed, and very probably no threats, *in words*, were used, but there is little doubt the men were made clearly to understand that if they shrank from the risk they would lose their employment.

If these men's lives had been insured, would not the insuring company have insisted, either that an extra heavy premium should be paid, or that a superintendent should be employed whom they could trust to keep back the men from exposing themselves to danger, and not urge them to foolhardy exposure? The insuring companies could not afford to neglect such precautions; they would rank as hazardous, and charge an extra rate of insurance for the men working in any mine where the superintendence was deficient or discipline badly preserved, or in which (if fiery) locked safety lamps were not alone employed; and thus would effectually induce the observance and introduction of precautions, by the simple expedient of charging highly wherever they were neglected.

That this would be the case may be certainly inferred from such having been the effect in the analogous instance of insurance against loss from fire. Mr. Williamson, manager of the Manchester Office of the Royal Exchange Assurance Association, says that the charging of higher premium of insurance against particular risks, has had a very powerful effect in introducing precautions against fire. For instance, it was formerly the practice to have the blowing engine, for cleaning cotton, in the same building as the factory. An extra premium of insurance was demanded for this, and now, almost universally, blowing engines are in separate buildings. To keep cotton-waste in a factory would vitiate the policy, as such waste is liable to ignite spontaneously. The owners of factories are very strict in preventing its being kept, and in some, any worker carelessly putting cotton-waste on the floor, instead of carrying it away at once, would be discharged.

Some years ago, two very destructive fires occurred in Manchester. One in consequence of the warehouse being lined with wooden panelling; the other from fire being communicated to an outside wooden cornice. The companies agreed to charge extra premium for insurance. The effect was to cause almost all wooden linings and wooden external cornices to be removed, and in about a year scarcely any remained in the town on warehouses containing valuable property. In numerous other ways the extra cost of insuring against fire where any dangerous construction or method of working exists, leads to the avoidance of danger, and the system has the effect of keeping attention constantly and powerfully directed to all the various sources of danger and means of avoidance. Mr. Williamson has no doubt that if colliers' lives were insured from death by accident, there would be introduced and enforced many precautions against danger which are now neglected or negligently enforced.

The agents of the insurance companies could in various ways secure a more constant attention to regulations than the Government Inspectors can. For instance, a Government officer would hesitate to pay for secret information, yet very generally colliers are afraid of openly complaining. An insurance office would have no such delicacy. An office might insist upon the manager, superintendent, banks-men, engine-men, &c., whom they considered careless or inefficient, being changed, or would be obliged to charge extra premium, because of those they insure being exposed to extra risk. An Inspector would hardly like to interfere unless the neglect were flagrant indeed. Moreover, this system should not be in substitution of—but an addition to—whatever the Inspectors can accomplish; and none would be more anxious than the insurance companies to give the Inspectors every possible support and assistance; and their servants would often procure for them information which is now studiously concealed from them. Again, the system of insurance, if well arranged, would act most powerfully in securing for measures of precaution the active co-operation of the men. The Vicar of Standish (whose parish is described as "the most accidentalist" in England) remarked, "Such a system, by showing the men that their lives were valued, would lead them to value them themselves." At present the men often oppose precautions, especially such as are new; they do not like the strictness of discipline which prudence requires; they will not complain of fellow-workmen, and get them fined or discharged, even for acts which endanger the lives of all; they resist the introduction of safety-lamps, and will open them even in a firey mine. If, however, their lives were insured, every time the premium came to be paid, which would probably be at short intervals, their attention would be called to the fact that the mine was considered either more or less dangerous, as the case might be, than others, and they would be led to think why it was so. They and their employers would alike have an interest in diminishing that risk, not only to avoid a remote and possibly never occurring injury, but also to lessen an immediate payment or to increase an immediate profit.

If the safest and probably cheapest mode of insurance were adopted—one in which the insured share the profits of diminished accidents,—then motives to carefulness and good management would be still more increased. It would be well to fix the rate of insurance somewhat above the calculated risk, so as both to guard against the possibility of the losses exceeding the income, and generally to secure some profit to be divided amongst the collieries which have had less than their average of accidents. This profit should not be divided among the individual colliers, for if so it would be spent in drink, but expended for their common benefit, for example, towards maintaining a school, playground, library, or reading-room, or in whatever way the men themselves preferred that was not very foolish. Advantage might be taken of the occasion for determining how the profit shall be employed, for pointing out to the men the success of the precautions by which it had been produced, and how it might be increased by still greater improvement and care. If such opportunities of pressing upon the men the benefit and duty of guarding their own and each other's lives were wisely used, much might be done to overcome their reckless disregard of danger and resistance to discipline, and the force of public opinion amongst them might be turned in favour of carefulness.

It may probably be objected that it would be unjust for Parliament to insist that the colliers shall be insured against death by accident, unless prepared to apply the same principle to all other workmen. It may be true that the principle ought to be extended to other workmen, but that is not a necessary consequence. Parliament has already determined that a class exposed to such excessive and peculiar danger as colliers, shall be protected by special law, and Parliament may quite consistently determine to improve that special protection without being justly called upon to extend it to other classes of workmen. Colliers require more than usual protection, because they are exposed to peculiar danger, are more isolated from the rest of the community than most other workmen, and therefore less than others under the protection of the ordinary law and of public supervision, and because accidents among them are not only more numerous, but when they occur, as they often do, so as to destroy many men in one little village, they are productive of misery more than usually intense.

The question, then, is not the expediency and duty of extending special protection against special danger, for that is admitted by the Act of 1855, but rather to determine how that special protection so urgently required can be most effectually, and with least annoyance, ex-

tended. Would it not be better, instead of very greatly increasing the number and authority of the Inspectors, and the severity of penal law, to throw the responsibility of the loss produced by accidents upon those who can do most to prevent them.

If it be objected, that it is hard to select coal mine owners as the only victims of such new legislation, who may not be more negligent of their duties to their workmen than other employers, it may be replied that the effects of their negligence are more evident. That the loss of a thousand lives a year out of less than a quarter of a million employed, together with a still greater multitude lamed, crushed, blinded, burnt, and injured in every conceivable way, is too great an evil to be left unredressed; and unless it can be shown that in any other trade the men are as much exposed, as helpless, and their class as easily defined, it is just to require that colliers should be protected more than others.

It may possibly be urged that the provisions of Lord Campbell's Act secure to the families of those killed in collieries fair compensation for their pecuniary loss. If this were so, the suggested plan would be little more than determining the amount of compensation, and securing its payment without the risk and costs of litigation. Unfortunately, however, the families of the sufferers can rarely maintain an action against the owners, and still more rarely obtain a verdict with substantial damages. An action is not maintainable by a collier or his family against the owner, unless the injury can be proved to be the direct consequence of the owner's own act or default. It might be possible, but would evidently be very difficult, to maintain an action against him for neglecting to enforce proper discipline, or for allowing safety lamps to be used which can be opened, or for employing an ineffective manager, or for other faults by which accidents are caused, which the owner might prevent, but an action could certainly not be maintained against him for injury done either by a fellow-workman's act or neglect, or by a pure accident. But besides the inefficacy of the law, there is the extreme difficulty of legal proof. In many cases the exact cause of the accident is matter of more or less plausible conjecture, not of clear proof. How, then, can the default of the owner be established? Moreover, a collier might well hesitate how he gave evidence casting blame on his employer or manager if he wished to continue at work. One who gave such evidence after the Cymmer explosion, and one, too, who had distinguished himself for courage and activity in rescuing others from danger, was refused work for many weeks, and was obliged to beg. Mr. Mackworth (Reports of Inspectors, p. 124) states that there was a combination to prevent certain colliers, whose evidence had implicated the management, from obtaining work—an enormous penalty to a working man, with his family dependent upon his wages for food. But, besides the difficulty of law, of proof, and of witnesses, is that of costs. A poor collier's widow has but a small chance of success against a coal mine owner, supported, perhaps, by an association of owners!

Mr. Mackworth reports (p. 116):—"Considerable expectation existed that the present Inspection Act would greatly facilitate the claims of the widows and orphans of the men killed, for compensation whenever the death was caused by default or neglect on the part of the owner or manager. Many cases have since occurred which have admitted of distinct proof, but in no case have the surviving relations ventured to press for such a demand for compensation as the law allows them. The power and influence arrayed against any attempt of this kind renders it almost hopeless to expect that Lord Campbell's Act will ever be of use to the mining population. The handsome public subscription for the widows and children of the colliers killed at the Cymmer explosion is an indication of the public feeling as to the compensation which should be awarded to the relatives of those whose occupation consigns them to an early tomb. A collier's wife becomes a widow, on the average, fourteen years sooner than does the wife of an agricultural labourer, and she descends at once from 25s. per week (her husband's wages) to 2s. 6d. per week, the allowance of the parish. This last payment comes in the main, by means of the rating, from the owner of the mine. Considering the short lives of the colliers, and the distress which follows their untimely death, it would be more equitable if compensation were awarded in every case by the owner of the mine, to those relations who were dependent on the labour of the collier. Such was the system adopted on the railways in France; and at Anzin, the largest collieries in France, which employ 7,000 persons under ground, the company have carried the practice into effect of their own accord. Every colliery in Belgium, and most of those in Prussia, have their benefit societies for administering permanent relief. Other countries possessing small mineral resources, which required to be zealously fostered, have already set the example; but on the grounds of justice and humanity alone, it may be well recommended, that in every case of fatal accident, whether from neglect or otherwise, full support or compensation to the survivors should be required from the owner. An ever-ready assertion, by which such propositions are met, is, that it would place a bar on mining enterprise. Were this the fact, I should cease to advocate it; but the total cost would probably amount to a charge on the coal of one-third of a penny per ton, which would be lessened by the amount of the existing poor-rates.* So far as the pressure of such a tax were felt, it would tend to diminish accidents, and as a colliery is entirely stopped until those killed by accident are buried, the gain to the owner, by the rendering such loss of profit more rare, would often amount to more than one-half the entire tax."

It would not be an unjust or impolitic extension of Lord Campbell's Act, to include under its protection colliers who are injured by the indirect act of their employers, by making them liable for the cost of maintenance of the families of those killed in their employ unless the accident were the fault of the sufferer himself; for it is clear that in every other case the accident must have been the result either of bad management or of the inevitably dangerous character of the employment. In the first and largest class of cases the owners clearly ought to pay, and in the last, it is more just and politic that the inevitable losses attending the getting of coal should be paid in the form of a slight and scarcely appreciable increase to its cost, than that the families of those killed in getting it should be reduced to abject poverty, and the rate-payers burthened for their support; especially is it expedient, as the certain result would be to direct the same degree of attention, care, skill, and outlay to prevent accidents, as are now employed in improving the economical working of mines, and probably with as much success.

Although a system of life assurance would undoubtedly be very beneficial to the men employed, and to the public generally, and probably to the coal-owners themselves, the expediency may be doubted of attempting to enforce it by law. There can, moreover, be no doubt that those who ought to, because they alone effectually can, enforce precautionary regulations the observance of which is authoritatively directed, ought to be held civilly responsible for neglect which is little short of criminal, and that the loss occasioned by such illegal neglect ought not to be borne almost exclusively by the innocent and helpless families of the sufferers.

* Mr Mackworth calculates upon a smaller amount of compensation than is above assumed. One-third of a penny per ton on the 66,900 000 annually raised would provide an annuity of about £11·13 a year for ten years for each family bereaved, without allowing for expenses.

DISCUSSION.

The Chairman said, he was glad that Mr. Holland, who to a high mastery of Sanitary Science, added more than common practical ability as an administrator, should, in the course of his own experience and observation in relation to another branch of production, have arrived at an affirmation of a principle of legislation propounded by him (the Chairman), with his colleagues, the Commissioners for Inquiring into the Labour of Young Persons in Factories, in 1833. The following were the terms of their recommendation:—"Some of the manufacturers have proposed that the Inspectors, who they think ought to be appointed, to insure compliance with any legislative regulation, should have power to inspect the factories, and direct what parts of the machinery should be fenced off; and that after such directions have been complied with, the manufacturer should be relieved from further responsibility. We concur in the proposition for giving such power of inspection, but we do not concur in the proposal to relieve the manufacturer from responsibility. We apprehend that no Inspector would be so fully conversant with all the uses of every variety of machinery, as to be acquainted with all the dangers which may be provided against. Excluding from consideration the cases of culpable temerity on the part of the adults, and assuming that the aid to be given when accidents do occur, shall afford no bounty on carelessness, the cases which remain for provision are those of adults, which may be considered purely accidental. Taking a case of this class, where mischief has occurred in the performance of the joint-business of the labourer and his employer, the question is, by which of these parties the pecuniary consequences of such mischief shall be sustained. We conceive that it may be stated, as a principle of jurisprudence, applicable to the cases arising from causes which ordinary prudence cannot avert, that responsibility should be concentrated, or as closely as possible apportioned, on those who have the best means of preventing the mischief. Unless we are to impose upon the workmen the obligation of perpetual care and the apprehension of danger, the nature of the injuries inflicted are of themselves evidence that all the care that can be taken by individuals attending to their work is taken by them; it is only the proprietor of the machinery who has the most effectual means of guarding against the dangers attendant on its use. If such an extent of pecuniary responsibility for the accidents which are incidental to the use of the machines is imposed upon him, those consequences will be more likely to be taken into account, and to be guarded against at the time of the erection of the machinery. The workmen are not prone to regard immediate dangers, still less dangers which are remote and contingent, and many of the accidents are of a nature apparently too uncertain to form data for insurance. It could be hardly expected that a workman on entering a manufactory should object that any portion of the machinery is dangerous, and that it ought to be boxed off. But the proprietor of the machine is necessarily the person who can best forsee all the consequences incidental to its use, and can best guard against them. By throwing upon him a portion of the pecuniary responsibility of those mischiefs, we combine interest with duty, and add to the efficiency of both. If the pecuniary consequences from unavoidable accidents were considerable, the imposition of the proposed responsibility may be met by the master, or by a deduction from the wages." In consequence of some evidence of the frequent fatal injuries and the common demoralisation of the navvies engaged in the construction of railways, he had got the subject examined before a Committee of the House of Commons, who had affirmed, that the branch of industry in the prosecution of which injuries occurred should be charged with the costs consequent upon those injuries. If the injuries were necessarily consequent upon the use of the processes, they would be charged upon the price of the commodity, as an insurance charge, and would serve at the same time as a bounty to whosoever avoided those charges by good measures of prevention. The simple principle was strongly opposed by members of Parliament, in the interests, or rather in the supposed interests, of the persons using such machinery or dangerous processes; and, as a compromise, Lord Campbell's Act had been adopted, which rendered parties liable to the consequences only of proved culpable negligence in the use of machinery. But by this compromise of principle, which took only a part of the consequences of the use of dangerous machinery or processes, and that part disputable and uncertain, the users were prevented in a great measure from taking the whole consequences as an insurance charge, to be paid for by the consumer, and were subjected to much litigation; the cotton manufacturers had as a necessary consequence subjected themselves to interference for the boxing off of machinery. Inspection was needed for other purposes than those. Subsequently, a number of the cotton manufacturers had found out that the original measure, as proposed by himself and his colleagues, was the best for them, and had expressed their wish to the Government to have it restored. It appeared that some shipowners were now complaining of the operation of Lord Campbell's Act. He thought that if the principle were carried out in its entirety, they would have no further cause of complaint. For information as to the working of the full principle of responsibility for all accidents, pure and blameless as well as culpable, shipowners and railway proprietors, as well as mining owners, might be referred to the experience of those subject to the law in France; and they would find none of the serious grievances which they apprehended, and which they doubtless experienced from the partial measure. The shipowners might be asked to consider by whom the principle of entire responsibility for blameless accidents, involving the complete insurance charge, was attested. It was by the late Mr. Thomas Tooke, the political economist, whose name was attached to the report, one deeply concerned for the shipping interest as a merchant, as Chairman of the St. Catherine's Dock Company and the Royal Exchange Company. That he fully considered the application of the principle to shipping, he (Mr. Chadwick) could attest, for he had had much discussion with him upon it. The shipowners might be referred to one example of the experience of the more full and satisfactory application of the principle to their branch of enterprise, which was equally applicable to mining enterprise. At the outset of our penal colonization, when transport ships were chartered for the conveyance of convicts, the loss of life was tremendous, and on some voyages amounted to fifty and even sixty per cent. of those embarked alive. Complaints there were, and inquiries, promises of increased precaution, and amendment. The shippers were, no doubt, honourable merchants—many of them as honourable men as owners of mines—and quite as good as many railway directors and patriotic millowners. It would be libellous to accuse them of any conscious designs or want of care for the human beings committed to their charge, or to impute to them the carelessness or recklessness of sailors, who, ignorant and uneducated men, would shut down hatches when they ought not, or neglected due cleansing; or the misconduct of ship-captains, who, for greed, culpably took in more cargo than they ought, and occupied the space due to passengers. If particular shipowners were negligent, it was argued, was this a reason why an honourable body of men, who contributed to the prosperity and wealth of the country, should be held responsible for them? And so the voyages went on, with partial mitigations, which made the loss about a third or a quarter in the mid-passage, being some gain upon previous averages. But still there was a great deal of trouble required to avoid outbreaks, and the clamour of humanitarians,

who were for insisting on punishments and impracticable regulations. At length the principle now under discussion was hit upon, and applied in the most complete manner, by a simple change of the form of contract for payment of the shipowners, from payment per head on the number embarked, to payment per head on the number landed alive. Of course, the shipper at once took into account the losses deemed inevitable, and charged for them, as, under the extended application of the principle of entire responsibility, they would in passenger ships consider the insurance charge in the passage money, as railway directors would charge it upon the fare, and mining owners would charge it upon the coal. Insurance was inconvenient, it was true, upon exceptional and disputable cases of misconduct, but with pure and inevitable accidents, and the regular course of enterprise, there was a wide and regular basis, which, as the experience of insurance proved, might be made available, and there was plain and straightforward sailing. But whilst the full application of the principle easily enabled the insurance charge to be placed upon the consumer of the commodity, or the passenger, the user of the service—it conferred upon the contractor a gain, as a bounty upon his active humanity, upon all he saved of the insurance charge, by the prevention of calamity. It saved him too from troublesome interference, and threats of litigation and punishment. Let them look at its action in this case of the transport-service. The shippers themselves, without any legislative provisions, or any official supervision or regulations thereon, appointed medical-officers to see to the preservation of life, and took other measures, which reduced the deaths from 1 in 10 during the voyage to 1 in 46, to the gain of the owners; and eventually the death-rate was reduced to below one-and-a-half per cent. or less than the average mortality of such a bad-class of lives living on shore. From ship-surgeons engaged in such service, he (Mr. Chadwick) had obtained valuable hints in the science of prevention, for the principle of insurance was extended to them, and they were not only remunerated in proportion to the number of convicts landed alive, but some benevolent and intelligent shipowners had even extended the beneficent principle to the sailors, who, as well as the passengers, were included in the surgeon's contract for remuneration. This principle had been acknowledged by surgeons to be that which kept their thoughts intent on the means of preserving the health of those under their charge. The beneficent principle of interest allied to duty was constant in its action, whilst duty alone, or honour alone—and benevolence even, were often inactive and uncertain. He (the Chairman) had struggled for the application of the principle to the transport of pauper emigrants; and where he succeeded, it was delightful to see how well it worked—to see the skippers on board cutting holes in the ship for proper ventilation, and duly, and with sanitary prescience, considering of proper space. He thought that members of Parliament should be led to appreciate a principle of the science of legislation, as embodied on this point in the Code Napoleon, the adjustment of interest in coincidence with duty, and that the general principle should be adopted for the protection of the people at large. Here, as in France, it would be found of general application. The mining owners, when made responsible for all accidents, as Mr. Holland now specially proposed, would do as the shipowners in the case of convicts did, in transferring the responsibility and the reward for preventive labour conferred by the insurance charge upon the ship surgeons,—they would transfer them to their mining managers and overlookers. Improvement and prevention would then go on in mines as he had shown them to have gone on on shipboard under the life-giving principle of responsibility and payment for the labour of prevention. Instead of finding little but trouble to themselves, and cost which they could not, under the present halting and defective principle of the English law, charge regularly, they would find gain to themselves under the operation of the full principle of the Code Napoleon. We Anglo-Saxons were, perhaps, somewhat more susceptible to a pecuniary interest as a motive power, and would display greater vigour in the prosecution of the principle. Instead of leaving the applications of mechanical science to the promotion of casual and feeble benevolence, the managers and owners would themselves take them up, issue large rewards for them, and prosecute them with vigour. Instead of merely complaining of the ignorance and recklessness of the poor untutored mining labourers, having experience of the waste from ignorance, and seeing the prospect of gain from knowledge, they would bestir themselves to aid measures for the improved training and education of the population; or, what would do the same thing, they would give the increased wages which were due to education as a means of more economical and safe service. Under the complete system they would be their own inspectors, or would have recourse to public inspectors, as agents for promoting every means of practicable improvement. Capitalists conducting these branches of enterprise, had alleged that the dangers from them were much exaggerated. If this were found to be so, the insurances charged for them would be inconsiderable, and let them join with each other to rid themselves of interference, and the liability to litigation, by urging the adoption of the full principle of undivided responsibility. If the charges were larger than individual proprietors ought to bear, the public would not object to purchase increased safety by some increase of the charges upon the commodity, or upon the service, which would follow the adoption of an equal law.

Mr. G. F. Wilson, F.R.S., said there was one source of danger noticed by Mr. Holland which was very important, and that was the drawing of the skip or cage over the pulley. He (Mr. Wilson) was lately going down some extensive mines in Staffordshire, when his attention was drawn to what was called a safety skip, so arranged that the rope should be detached before the cage reached the pulley, and the cage supported at the place it had reached. The arrangement seemed to him so simple that the wonder seemed not that it had been now invented, but that it had not been invented long ago. The proprietor of the collieries, Mr. Bagnall, a name well known in Staffordshire, considered the plan entirely successful, and informed him that it had been contrived by a practical mining engineer, Mr. Bailey, of Wednesbury. On seeing the title of Mr. Holland's paper, he (Mr. Wilson) had written to his friend asking if he could lend him any model or drawing which might be laid on the Society's table. The only drawings and description which could be furnished on so short a notice were some photographs, and the specification of his patent, with a drawing; these would, he thought, be of interest to any mine proprietor present, and he would therefore lay them on the table. As to the safety lamp, he had always been informed that colliers said they would have a good light, and as the wire-gauze shield diminished the light, they opened it; and he believed, unless the doing this were made penal on the men themselves, the practice would still be continued.

Mr. Varley said the public were much indebted to any gentleman who opened up a subject of so much importance as this. Coal had long been one of the chief necessaries of life, and even if it could only be obtained at one-half more than the present cost, it would be cheaper for general use than any fuel formerly employed. He had witnessed with satisfaction the various premiums which had been awarded by this Society for improvements in the safety lamp. He considered it a disgrace to the engineering and mechanical genius of the present age, that it should still be possible for a bucket to go over the shaft and precipitate its occupants to the bottom. Mr. Varley also alluded to various methods employed for the ventilation of coal mines, and suggested that, in his opinion, the safest method of lighting mines

would be to have plenty of open lights constantly burning in all parts of the mine, which he thought would promote ventilation and consume the dangerous gases.

Mr. Robert Hunt, F.R.S. said, that the subject which Mr. Holland had so ably brought before them involved a specific plan, by which he thought we might hope to preserve the working-miner from those accidents to which he was now subject, this means being a system of insurance. The Chairman had brought forward other circumstances involving risk, which he imagined to be analogous to those of collieries, viz., machinery in factories. He (Mr. Hunt) could not conceive for a moment the slightest analogy between accidents resulting from the uncovered machinery of factories, and the many dangers to which the men working in collieries were exposed; the one they could guard against; but the other, he believed, though he said it with much regret, they could not entirely guard against. At the same time, it was in the utmost degree important—it was important as an act of Christian duty—to use, to the utmost of their endeavour, the means of overcoming the difficulties with which they were beset in raising their fossil fuel. It was true, that a vast number of deaths were occasioned by the explosion of gas in collieries; many of these, however, arose, not from neglect on the part of the proprietors of the mines—not from carelessness on the part of the managers—but from recklessness and thorough foolhardiness on the part of the men themselves; and he knew, from having visited every mining district in the kingdom, that there was one belief which they could not drive out of the heads of those ignorant men—viz., that they would not die till their time came; and this engendered such a degree of carelessness that it seemed hopeless to attempt to deal with them. He felt quite sure, however, that the Collieries Inspection Act had done a great deal of good, for although there had been many terrific explosions, which kept up the number of deaths, yet if the general result were examined, it would be found to have been favourable, and every year since its introduction decided benefits could be traced to it. It had been said that a system of insurance would render the proprietors of collieries generally more careful as to the mode in which they carried on their operations. For his part he did not think so. He believed the proprietor's greatest interest was to preserve the lives of his men; for he knew that accidents happening in his mine were always attended with great cost to himself. They must remember that in general the proprietors themselves knew but little about the working of mines; they trusted those operations to their agents, who perhaps employed others under them; so that there were a number of people whose pockets were not immediately affected by accidents, but upon whom their occurrence mainly depended. He was quite certain that no system of legislation which should be compulsory, and that no system of inspection which should amount to something like the same thing, would be so effective amongst the proprietors as the persuasive system; and he was confident, from his knowledge of the proprietors, that although they partook of the peculiar characteristics of the Anglo-Saxon race, and were strongly wedded to the customs in which they were born—yet still they were open to conviction, and they would not continue to go on in their old course, if it were pointed out in a satisfactory manner that they were wrong. But he also knew that if an attempt was made to force them to adopt any particular system, they would turn round and say—"No; it shall not be done." He thought that the results of colliery inspection had been satisfactory wherever the Inspectors carried out their duties properly; and if they recommended to the managers of collieries, and, failing them, if they recommended to the proprietors of the mines, every means for the improvement of the colliery, they found that they were generally adopted; and he was perfectly satisfied, knowing those men as he did, that there were scarcely any that were not open to conviction. There were other subjects connected with this paper upon which he should have been disposed to offer a few remarks, but he would take the liberty of referring those points to his friend on his right (Mr. Hedley), the Government Colliery Inspector for Derbyshire, who, he had no doubt, would address the meeting.

Mr. John Hedley said he had listened with great pleasure to Mr. Holland's paper. There were many points in it in which, if the mining districts of England were alike in character, Mr. Holland might be right. For instance, in referring to the accidents in the mines in the north of England, it was mentioned that they were less frequent than in other districts. The roofs of the mines in the north were safer than in any other part of the kingdom. The danger from gas was not greater there than elsewhere. For instance, in the Barnsley district more gas was generated than in any part of the north of England. Mining operations had been carried on in the north for ages, and the mining population had grown with the extension of operations; they had become as it were part and parcel of the mechanism of mining. In the Midland Counties, in Lancashire and other districts, there had been a large introduction of strangers into the mines. English and Irish agricultural labours had been introduced, who were totally ignorant of mining operations; when directions were given to carry out certain details, they did not comprehend them, and did not carry them out. It was impossible that the proprietors could place an official at the back of each labourer to see that his orders were executed. General instructions were given, and they could only be generally carried out by giving directions to the various labourers employed in the mines, who were depended upon for carrying out those instructions. In the north of England they were carried out; in the Midland Counties and in Lancashire they were not carried out; the consequence was that accidents followed. Therefore, in making the comparison of the loss of life in each district, this must be taken into consideration. With regard to the improvements in mining operations, he felt bound to say that considerable progress had been made. He recollected several instances within his own district. In one very large mine the average loss of life was between six and seven in the year. He had carefully inspected that colliery, and was satisfied that such a state of things might be much improved. He consulted with the owners and managers, and made suggestions which, he was happy to say, were efficiently carried out; and now, where the average loss of life had been six or seven in the year, there had only been a loss of one life during the last two years. Moreover, this was not an accidental circumstance, but was entirely the result of improvement in the discipline and general arrangements of the mine. He quite admitted that an Inspector of mines had a great responsibility upon him. He did nor consider him so much an officer who went about to enforce measures of improvement by penal enactments. For his part he had made it his business to avoid that as much as possible. Mr. Hedley mentioned a case in which he had produced so strong an impression upon the mind of a manager by taking him a considerable distance along a very low and exceedingly ill-constructed road, that when he next visited him he found the road had been much enlarged and generally improved, whereby increased ventilation and safety had been secured. He thought that if he had pursued a dictatorial course an obstinate resistance would have been made to the carrying out of the necessary measures of improvement. Inspectors must not take the strict letter of the Collieries' Inspection Act, but he felt that they were bound to employ their tact and judgment in the administration of that act. In speaking generally of the Midland Counties, he must say they were improving there. In the present year he was happy to say they had had no explosion. The ventilation

of the mines had been improved, and there was also improved discipline. The result was that the loss of life would be considerably less this year than it ever was before. With regard to the question of insurance, he agreed with Mr. Hunt that the influence of this would not be so great on the owners as the expense incurred by the loss of life. If only a single life was lost by the falling of the roof, the colliery remained idle till the unfortunate sufferer was buried. He thought there was a greater loss of profit arising from that than would almost pay the insurance for a single year. He was himself an advocate for insurance, and wished to see the whole mining population one large insurance association, but he did not think there was sufficient inducement in the plan proposed in the paper to lead the owners to adopt it, although he should like to see a proper provision made for the families of those who lost their lives in mines. Mr. Holland had remarked that colliers would seek for work in those mines where the principle of insurance was carried out; but from his (Mr. Hedley's) experience amongst the mining population, he could say that the great inducement with the miner was the highest wages. He had seen large numbers of men applying for work in the most dangerous collieries, where large wages were given. He could not go with Mr. Holland in thinking that the reduced premiums paid to insurance companies would induce proprietors to improve their mines. If there was any case of wilful neglect, then the Inspectors must enforce the penalties. He was happy to say that in the Midland districts that course had not been rendered necessary.

Mr. Thomas Webster, F.R.S., said it was very satisfactory to have the experience of two gentlemen like Mr. Hunt and Mr. Hedley brought to bear upon this subject, whether their views were in favour of, or against, what had been adduced. At the same time, he thought those gentlemen had reproduced, in a most interesting form, and in the best way possible, all the old arguments against those penal enactments which were essential for the protection of the poor man. They had spoken of the recklessness of the men; that was unhappily known full well; it was a matter which had been the subject of observation for many years, but the same remark equally applied to many other occupations in which great personal risk was incurred by those who were employed in them, and therefore, so far as the recklessness was concerned, it was only confirmed by every other existing dangerous trade. The only remedy was the better education of the men themselves. That lay at the root of the matter—the giving them a knowledge that they ought to occupy socially, as far as self-preservation and self-respect were concerned, the same position as their masters. But there was a large question beyond that. It was satisfactory to hear of the improvements which had taken place in the Midland Counties, and he had as much faith in the persuasive system as the last speaker seemed to have. No doubt, if there were many such inspectors, and if all the mines were under such men, it was probable that no penal enactments would be required, or even such a plan as the one advocated by Mr. Holland; but although the persuasive system might do much, yet there was a great deal which it could not do. Giving full weight to all that had been said about the interests of the masters, he would ask—were not the masters as careless and reckless as the men themselves? People well-to-do, like the masters, would not give themselves trouble about these matters; they were indifferent to them. There were noble exceptions, no doubt, but there were also, on the other hand, disgraceful exceptions; and it was the disgraceful exceptions to which the arm of the law should be applied. It was necessary to legislate, if possible, for masters, who were as careless and inconsiderate as the men were themselves. Had Lord Campbell's Act done nothing in analogous cases? Was there anything so certain as the possibility of a man being subject to the penalty, and obliged to pay the costs? But this scandalous neglect of life might be made a misdemeanour; he thought they must look to that as the ultimate thing; and when coal mines for fuel had become essential to our existence he wished to know why they ought not to be placed under the same restrictions as railways and other things which had become necessary to the public. This was only a question of degree. Modern legislation had made persons responsible for these avoidable accidents which there occurred. No doubt many persons felt that Lord Campbell's Act worked very severely; but they must allow that all legislation worked hardly in the first instance. Lord Campbell's Act might have been applied in an objectionable manner, but that was incidental to human nature, and this corrected itself. It was true that most remarkable verdicts had been given by juries, and that some time ago it was almost impossible for a company to get a just verdict; but now the tide was turning, and both judges and jury looked fairly at the case, and they said—if the accident was unavoidable, and if the company did all they could to prevent it, then they were not to be held liable for damages. He would say, with great diffidence, in opposing the views of such gentlemen as Mr. Hunt and Hedley, looking at the analogy of other cases, they never would have that care for this neglected class of people—that proper care for them and provision for their safety, unless they made it penal upon the persons responsible, that all possible pains should be taken to prevent such accidents. Mr. Hunt had said that there was no analogy between coal mines and the uncovered machinery of factories. In his (Mr. Webster's) mind the cases were as analogous as they could be. They were both the creations of artificial life, and became necessary to it. People must be employed upon those pursuits. If the protection were afforded in the one case, why not in the other? He felt quite sure that the discussion of this subject could not do otherwise than tend to good.

Mr. Robert Hunt said, in explanation, with regard to the non-analogy between uncovered machinery and coal mines, that he meant to say that in one case they had to deal with a single evil and in the other with fifty. In the one case, by covering the machinery they protected the individuals from injury, whereas in the other case they had fifty different causes of accident to deal with before they could hope effectually to protect the men. With regard to education, he concurred in what had fallen from Mr. Webster, and he most especially desired to see what had not yet been carried out—that was, that the lower orders should be educated—not simply in learning the signs of the ideas—but that they should be taught ideas which should have direct reference to the thing they were employed upon. They heard of hundreds of men being killed in collieries, and they lamented the accident; they talked of thousands killed every year, and they were alarmed; but they should not forget that far greater numbers were killed in the metalliferous mines than in the collieries; and it was an appalling fact that the average duration of metalliferous miners' lives throughout the kingdom was not above thirty-three years.

Mr. Robert Rawlinson expressed the gratification he had felt at hearing the paper read, and also at the remarks of Mr. Webster. The last thirty years of his life had been passed upon public works, where men were habitually exposed to danger. He, together with the chairman, had something to do with the preparation of the evidence which led to the passing of Lord Campbell's Act, which in common justice ought to be called Mr. Chadwick's own Act. He thought the chairman was a little in error with regard to the custom in France. He heard the evidence given upon that bill, and as the law stood in France no exception was made. Every case of maiming or death was visited upon the person employing the labourer, and no excuse was taken. As an illustration of this he might state that a German labourer who who was employed in driving piles, on one occasion left

his own gang and went to another portion of the works. Whilst there he incautiously placed his hand upon a pile head which was being driven, and it was crushed. It was held that the person by whom he was employed was responsible for the injury, although this seemed scarcely just; but the French law certainly had this effect, that it removed the responsibility from the ignorant man to the educated man. It was argued that by educating men highly they diminished their tendency to run into danger. He argued from his own knowledge and experience that such was not the case. In the army, for instance, if a forlorn hope was to be led, the fear of death did not stop an educated officer from running the risk. He had the hope of promotion in view, which was equivalent to higher wages in another sphere. As Mr. Webster had said, the penalties must be paid by the coal owners and those benefited by the risk. There was one cause of danger which should not be overlooked, and which extended not only to the colliery workers, but also the inhabitants of the district. There were large numbers of old worked-out shafts which had no proper covering. It frequently happened that they were not covered over in any way, and in other cases the covering was of wood, which rotted in a few years. Then, again, as to the bursting of water into the mines. Where old workings were known to be full of water, the coal owners would go on working till they tapped that water; an inundation of the mine took place, and many lives were lost. He did most sincerely hope that the government would take more stringent means to prevent these occurrences in mines, and they must visit the consequences upon the coal owners before they could look for any improvement.

Mr. Holland would say a few words in reply upon the discussion. He had not stated that the means he had proposed would entirely prevent accidents in coal mines, but he had expressly said that some accidents could not be prevented by any precautionary measures. All he contended for was that it would tend to prevent some of these accidents and diminish their number. He was not so sanguine as to hope that the thousand lives lost annually would be saved. If they would save 500, or even 200, it would be a great thing. He had a confident expectation of saving 360 lives a year, or one a day, by the use of the means he had pointed out. He was obliged to Mr. Hunt for the remarks he had made, and he could not but think that upon a little more reflection, that gentleman would become an advocate of the views he (Mr. Holland) had put forward—not for a compulsory system of insurance, but a compulsory payment from those who caused the accident, either by themselves or their agents, for the losses which their culpable negligence had occasioned. When a coal owner, by himself or his servant, caused the death of one of his men, he should be compelled to compensate the family, as far as money could do so, as he would compensate a person not in his employ. The same protection which the law gave to third parties should be given to persons in the employ of coal owners. It would be very beneficial for collieries to be insured; but he did not assert that it would be desirable to make this compulsory. He had not much confidence that all coal owners would adopt the precautions which were proved to have been successful. There was a difficulty in getting them to use the proved successful precaution of safety lamps. Mr. Hedley knew very well that the difficulty in getting safety lamps fairly used was extreme; they had been pertinaciously rejected both by masters and men; and Mr. Hedley's evidence showed that the success of safety-lamps in preventing accidents was most signal. If they would not introduce safety-lamps, which scarcely ever failed, and where the supposed failures were only 7 in 1000, was there any reasonable expectation that they would use other precautions. When the British Association met in Birmingham, a gentleman advertised that he would exhibit a contrivance to prevent the sudden running-down of the cage with the men. That contrivance had been a good deal used; but he was informed, that although gentlemen of almost every profession went to look at the apparatus, and expressed their high approval of it, not a single coal-owner or manager of mines went to see it, because it was something new, and involved expense in its adoption. It took a long time to get improvements introduced, and he wished to quicken the progress. Accidents were most expensive to coal-owners. If the whole cost of the accidents were thrown upon the proprietor, a great inducement to prevent them was held out. Certain classes of accidents were very difficult to guard against, and they became dangers almost incidental to the business. But even these dangers could in some cases be diminished. The falls of roofs in the northern mines were far less numerous than the average in other districts, and less numerous in some mines than in others in the same condition. Why was this? For the reason he had stated, viz., that in the mines in the north of England men were specially employed to prevent such occurrences. The Coroner for Preston had informed him that the reason why the falls of coal were so numerous there was that the men were employed to put up the props themselves, and they were so eager to get the coal that they neglected the propping. In the northern mines it was not so, but separate workmen were employed for that purpose. His firm conviction was that a system such as he had proposed would diminish the accidents very considerably. It would be profitable to the coalowner and beneficial to the public, and he believed it would be advantageous to the country at large. But it was not upon that ground alone he rested his case; it was not merely because it was good economy, but because it was merciful and just; and He who had enjoined them to do justice and loved mercy would bless their efforts.

The Chairman then moved a vote of thanks to Mr. Holland for his paper, and it was passed by acclamation.

The Secretary announced that on Wednesday evening next, the 7th December, a Paper by Mr. J. C. Morton, "On the Forces used in Agriculture," would be read.

THE LATE PROFESSOR GEORGE WILSON.

The public have sustained a sad and serious loss in the death of Dr. George Wilson, the first Professor of Technology in the University of Edinburgh, and Regius Keeper of the Industrial Museum. Dr. Wilson was in the active discharge of his duties up to the 18th ult., when a renewed attack of inflammation of the lungs, from which he had previously suffered, rapidly undermined his delicate constitution, to which he had throughout life given too little respite from zealous labour, and he expired on the following Tuesday evening. He had scarcely done more than reach the middle term of life, and it might be said he was only on the threshhold of the task to which he had devoted his life. In 1853 he was appointed to the joint offices above referred to, and it was at that period that the long-delayed project of establishing an Industrial Museum for Scotland in Edinburgh was first seriously contemplated by Government. Five or six years have since been spent in settling and unsettling the plans, and in Parliamentary battles for supplies, but last session the first instalment was passed for the erection of the building (the site having been purchased years several ago), and Dr. Wilson only lived to see the first active steps taken for the erection of the museum, which he had devoted the whole interval since his appointment to push forward, and to collect the materials which should make it as complete an exposition as possible of the Industrial Arts and Sciences of civilised nations.

The members of the Society of Arts had ever sympathised with the labours of Dr. Wilson in endeavouring to procure for Scotland that which this Society has so long advocated as important for England, and of which it, a few years since, laid the foundation by forming, with the assistance of the Royal Commissioners for the Exhibition of 1851, in the Society's House, under the superintendence of Professor Edward Solly, the collection of animal substances used in the Arts and Manufactures now exhibited at the Kensington Museum.

Dr. Wilson was a most accomplished chemist; he was profoundly versed in all the physical sciences; he was an elegant scholar, and a graceful and imaginative lecturer and writer. As a man he was esteemed and beloved by all who knew him for his catholicity of spirit, his benevolence of disposition, and his uprightness and integrity of character.

The honours of a public funeral were paid to his remains on Monday last. The obsequies were attended by the Lord Provost of Edinburgh, Magistrates and Council, the Professors of the University, and by the Directors and Members of all the learned and mercantile Societies in the city, most of whom have inscribed in their minutes their sense of the loss sustained by them, and their gratitude for many services rendered to them by the deceased.

UNSINKABLE SHIPS.

The following letter has been addressed to the Editors of the *Mechanics' Magazine*:—

Gentlemen,—With reference to the article in the number of your Magazine of the 4th November, respecting "Unsinkable Ships," I inclose you a specimen of wood which I obtained at Madagascar about ten years ago, which, you will perceive, is of extraordinary lightness, and appears to come quite up to the requirement suggested by Mr. Atherton for the filling in of his unsinkable ships. The piece of wood which I have sent to you measures $1\frac{1}{2} \times 1\frac{1}{4} \times \frac{5}{8}$ inches, and weighs 20 grains, whereas a piece of well-seasoned fir of the same dimensions weighed 150 grains! I regret that I cannot recollect enough about the tree from which the wood was obtained to give much information about it, but I believe it was a species of cactus, the stem being about six or eight inches in diameter. The tree abounded about the Bay of Antonga, from whence I obtained the piece of wood now sent. It appears admirably adapted for lifeboats, &c. Probably you will be so kind as pass the specimen on to the Society of Arts, as it may be viewed with interest by the members.

H. D. CUNNINGHAM.

I am, &c.,

Bury, near Gosport, 16th November, 1859.

[A specimen of the wood referred to is now at the Society's house, for the inspection of members.—Ed. *J. S. A.*]

Home Correspondence.

SUPPLY OF COTTON FROM INDIA.

Sir,—Referring to your last publication, I find that the chairman, Sir Thomas Phillips, in his opening speech of the session, has made allusion to the supply of raw cotton received from India. The subject is one of incalculable importance, inasmuch as, during the last ten years it has become more and more evident that the increasing demand for fabrics of cotton has outstripped the rapidity of its growth; hence there is probably no other subject so well deserving of attention. The apprehension, not to say alarm, which has thus been excited, has originated a society in Manchester, "The Cotton Supply Association," for the purpose of affording information or aid wherever needed, for the cultivation of the article, whether in India, Africa, or elsewhere. It is, therefore, not surprising that such an intense interest should have arisen in the cotton manufacturing districts. Those most interested are ever watching very narrowly all the proceedings which have relation to India. On this account every one would feel delighted to receive any reliable information of increasing success, not alone in the culture of cotton, but in the improved husbandry of all the resources of that vast country.

Having reference to the inaugural speech of the session, the Chairman is reported to have stated, "That in the year 1857 more than one-fourth of the raw cotton imported into the United Kingdom was grown in British India." The importance of this fact he considered deserving of notice, as an indication of the prosperity of our Eastern possessions.

You will no doubt remember that it was during the session of the year already under observation, namely, 1857, that a very interesting paper "On the Cultivation of Cotton" was read by J. B. Smith, Esq., M.P., in which he drew a most deplorable picture of our neglect of India, showing that, notwithstanding the well-known capabilities of that country for the growth of cotton, we were indebted to the United States for no less than *seven-ninths* of our consumption, thus leaving the remaining *two-ninths* to be supplied from India, Africa, Egypt, the Brazils, West Indies, and all other places.

The existence of a disparity in the above statements at once so striking, in relation to the occurrences of the same year, and published under the authority of the Society, as the well-considered convictions of two of the most painstaking members of the body, must necessarily arrest attention.

Some explanation of this affair may possibly be looked for from one or both of the parties themselves; but meanwhile there are before us the annual accounts of our imports, and these may serve to throw some light upon the subject.

It appears that there is no great variation in the imports of cotton from other places than the United States and India, therefore the comparison instituted will rest mainly upon the extent of our imports from those countries.

Taking these accounts under review for the last seven years, we find that in the year in question, 1857 (see * in table), we had the smallest import from the United States, and probably in consequence of this deficiency, the largest ever known from India.

Within the period of these seven years the variations and the uncertainty of imports from India may be indicated in their range, as from below one-tenth in 1852, to upwards of one-fourth in 1857, and, in round numbers descending to one-seventh only in the year following, 1858.

Import of Raw Cotton into the United Kingdom during the last Seven Years.

	From the United States.	All other places except India.	Total without India.	From India alone.
	450lb. Bales.			387lb. Bales.
1852	1,789,100	346,700	2,135,800	221,500
1853	1,532,000	246,900	1,778,900	485,300
1854	1,665,800	198,400	1,864,200	308,300
1855	1,628,600	253,400	1,882,000	396,100
1856	1,758,300	246,900	2,005,200	463,000
*1857	1,482,000	276,100	1,758,100	*680,500
1858	1,863,300	218,300	2,081,600	361,000

Annexed I hand you a table, showing from public documents the annual imports of the last seven years, and would draw your attention to the two countries referred to, from which it will be obvious, that, on some account or other, the chairman has been led to select, for purposes

of illustration, not the last year of the imports, but one which has been exceptional. I am, &c.,

HENRY ASHWORTH.

The Oaks, near Bolton, Nov. 23, 1859.

SIR JOHN BOWRING AND THE OPIUM TRADE.

Sir,—Had time permitted on Wednesday evening last, I should have offered some observations on Sir John Bowring's comments on the opium trade.

In the first place, Sir John denied that "the trade is carried on in violation with our treaties in China," as "there was not one word in our treaties with China which had reference to the opium trade." No fact is more notorious than that the Chinese government has from the first prohibited the introduction of opium into the empire. There has been no opium imported into China but what has been smuggled there in contravention to imperial laws. The trade has been essentially illegal, and Sir John Bowring confesses that one of his principal objects has been "the legalisation of the traffic." If, then, opium was prohibited and had no legal existence, why should it be mentioned in treaties, like other articles on which a duty of five per cent. was paid. Why the Chinese authorities exhibited their common sense and consistency by *not* mentioning it. Had they treated it like saltpetre or gunpowder, they would have acted contrary to their own laws.

But if "opium" is not mentioned in treaties, "smuggling" is, and that frequently. In those treaties we have solemnly engaged to co-operate with the Chinese authorities to suppress smuggling of all kinds. These treaties state that when a vessel bearing the British flag should be found to have smuggled articles on board, the cargo should be forfeited. But I do not know an instance of our government at Hong Kong making an attempt to carry out the provisions of such treaties.

Sir John Bowring says that the consumption of opium in China has led to good instead of evil. Let us hear what others say on this question. Dr. Ball, an English physician, long resident in China, says, "Throughout vast districts, and in all the towns, may be seen walking skeletons, and families wretched and beggared by opium smoking." Mr. Lay, her Majesty's late Commissioner at Canton, says, "The opium trade is ham-stringing the Chinese nation." Mr. Majoribanks, president of the Select Committee at Canton, says, "the misery and degradation occasioned by it are beyond belief," and Mr. Montgomery Martin, who was for many years her Majesty's treasurer in China, says, "I think that it is desolating China, corrupting its government, and bringing the fabric of that extraordinary empire to a more rapid dissolution." In proof that the consumption of opium is vastly injurious to the inhabitants of India as well as China, I might copiously quote from General Alexander, Mr. H. G. Tucker, Deputy Chairman of the East India Company, the late lamented Sir Stamford Raffles, and a great many others, the very mention of whose names would occupy too much of your space.

If, as Sir John Bowring says, opium has been such a useful pioneer of the Gospel, how is it that missionaries, one and all, have united in anathematizing it. Let me mention a few of their names—the Rev. A. A. Thelwell, Dr. Medhurst, Rev. E. B. Squire, Rev. Howard Malcom, Rev. George Smith, now Bishop of Victoria. These and other missionaries have testified from their own experience that the illegal opium traffic has been a most formidable barrier to the mission cause.

While the testimony remains so unanimous, I cannot surrender my conviction that the opium trade is an unmitigated curse to China and to England.

I am, &c., J. PASSMORE EDWARDS.

Sir,—The late hour at which Sir John Bowring concluded his paper on China on Wednesday last having precluded discussion, may I be permitted to call the attention of your readers to one or two statements connected with the opium question, to which I was anxious to have referred at the time. It is, in the first place, asserted that, previous to the Elgin treaty, opium was admissible at a duty of 5 per cent., under a clause of Sir H. Pottinger's treaty. Now, Sir Henry Pottinger himself issued a proclamation warning all persons against demanding the admission of opium under that clause, stating that, "It being well-known to be declared illegal and contraband by the laws and Imperial edicts of China, any person who may take such a step will do so at his own risk, and will, if a British subject, meet with no support or protection from her Majesty's consuls or other officers." So much for the legality of the trade. Sir J. Bowring next complains of "the audacious statement that the crimes and miseries of the opium trade exceed the horrors of the slave trade." Whether this statement be overcharged or not, it originates with a gentleman thoroughly competent to form a judgment, Mr. Montgomery Martin, who held a high official position in China. Another statement to which Sir John objects, in the Parliamentary paper to which he refers, that "there was little to choose between the opium trade and piracy," was made in the first instance by Captain Elliott, in a despatch to Lord Palmerston. The assertion that more deaths occur among 600 Europeans from delirium tremens than among 90,000 Chinese from the effects of opium, is made in the paper. In the despatch to Lord Clarendon, it is given as the opinion of an individual medical man, and certainly anyone who will read the enclosures to the despatch in question, particularly the letters of Dr. Hobson and Dr. Medhurst, whose authority is introduced as of great weight, and who, while deprecating exaggeration, concur in censuring the course pursued by England, will feel convinced that, after every deduction has been made, the evils which result are of the most fearful description.

Sir John next states that opium smoking has put a stop to intemperance in China. Considering that the use of the drug has not, as yet, extended to the mass of the population of the interior, some other cause must be sought for the diminution of drunkenness, if, indeed, the Chinese ever were an intemperate nation. This is further shown, because in the blue book Sir J. Bowring labours hard to show that the number of smokers is at the outside 3,000,000, out of a population of 412,000,000. We next have the extraordinary inference that the use of opium is rather favourable than otherwise to missionary efforts. As missionaries are almost unanimous in stating that they are met by the taunt that the religion of those who bring opium cannot be a good religion, the allegation is undeserving of notice.

It is said that opium has not interfered with the export of our manufactures to China. Can anyone contend that, had the Chinese never imbibed their unhappy taste for opium, they would not be better customers to Yorkshire and Lancashire?

It would be easy to produce medical testimony to prove that the evils resulting from opium are greater than those resulting from spirits, fearful as the latter are, but I must not trespass longer on your space. I may say, for those who are opposed to the system pursued by our Indian government, that their opinion remains unshaken, that (to quote the words of Mr. St. George Tucker) no considerations of revenue can justify us in inflicting on the Malays and Chinese so grievous an evil.

I am, &c., R. N. FOWLER.

Cornhill, Nov. 26, 1859.

THE CHAIRMAN'S ADDRESS.

Sir,—I read with much pleasure the address of Sir Thomas Phillips to the Society, published in the *Journal* of the 18th instant. As one of those who many years since took an active part in the management of the old Society, I have watched the steps which have been taken by the various councils elected since the incorporation of

the Society by royal charter. The steady growth of the Society in public estimation is evidenced by its present large and constantly increasing number of members, and the result of the uniformly impartial manner in which the plans brought forward for the promotion of Arts, Manufactures, and Commerce have been carried out.

The address by Sir Thomas Phillips, just issued, refers to several subjects which I had hoped would have set the pens of the members and your correspondents to work, with a view to aiding the Chairman and our present Council in carrying them out, involving as they do the prosperity of the Society's future.

I am most anxious that the address should not be passed by in silence by the members. If there is any one subject which the Council can take up with advantage to the commercial community, I believe the question of obtaining more specific information relative to our Colonies is the one of paramount importance. Exhibitions have of late done something to make their products more generally known than previously, and some invaluable lists of the products of a few of the Colonies have been the result. If nothing more than a complete list of the products of our colonies were to be published in the *Journal* it would be of service. Our Colonies, however, have no home in England. There is no place to which the merchant can go and consult a collection of the imports from them; no library of the commercial literature of our Colonies open for general reference, and no public institution where persons arriving from our Colonies can go and exchange notes with the merchants and traders in London. It is true that there are some clubs and private associations in the City, but the information acquired by them from time to time is not afforded to the commercial world at large; and if the Society will take steps to supply these wants, I believe it will tend greatly to increase its popularity and add largely to the number of its members.

But there is another subject alluded to in the address which is of vital importance, as regards the increasing prosperity of the Society, viz., its future home. I can well remember many predictions of the downfall of the Society made at the time of its incorporation—and among them was the assertion that it might struggle on for a time, but when its present lease ran out, the Society would no longer be able to exist. I am not an alarmist. I am not one of those who believe that the Society of Arts has fulfilled its destiny, and is, therefore, at the end of the next eight years, to become a thing of the past. I believe, on the contrary, that the Council is exercising a wise foresight in calling the attention of the members to the fact that the present lease has only a short period to run; and I cannot doubt that they will respond largely and liberally to the appeal of the Council to aid it in the establishment of a Building Fund. And I would suggest the propriety of such fund being at once commenced. I cannot doubt that the Society which gave birth to the great Exhibition of 1851, and found means to carry it out, and has now proposed to obtain a guarantee fund of £250,000 in aid of an exhibition in 1862, will readily obtain such funds as it may require to secure to it the advantages of a suitable home, free from the too frequent cause of downfall to many societies, viz., a heavy rental. If books were at once opened, many members would, I feel confident, enter their names as donors to the fund, whilst others would be willing to become annual subscribers.

I fear that I have already extended this note to too great a length, but feeling a deep interest in the present and future prosperity of the Society, I trust I may be excused if I have too hastily and I fear but feebly endeavoured to direct attention to two of the important objects which the Chairman pointed to in his address.

I am, &c.,

T. U. E.

BELL CASTING.

Sir,—With reference to the remarks of Mr. Loseby "On the Qualities of Bells," in the *Journal* of the Society for Nov. 25, I take the liberty of suggesting that the failure of the Westminster Bells may be attributable to the method in which they are cast. The evidence as to the value 8, assigned to "force of hammer," as the "principal direct cause," may be sufficient, but it is not given. At the same time, it will still remain a question, whether such an effect ought to have been produced from such a cause. As a matter of opinion, I should say decidedly not, and that the effect so produced is decided evidence of inferiority. No one acquainted with the art of casting in bronze or bell-metal, can fail to be aware of the very great difficulty attending it, and how, with all precautions, as far as they are known in this "sterile field," the result is sometimes unsatisfactory. A very careful and anxious watch over such results has led me to the conclusion, that these failures are mainly to be resolved into an imperfect system of cooling, and, therefore, of crystalization and contraction in the casting. When this is the case, the casting, bell or anything else, is in a state of improper tension; it frequently has holes on the surface; with many, unsuspected, in the interior; and although it may not crack (as some steel bells have done) under the influence of a change of temperature, or without being touched externally, yet it is actually, and at all times, in a breaking condition.

I speak from considerable experience, when I say that most of the difficulties vanish under a proper and well-considered system of cooling, and that it is a waste of research and time to lay the blame on the copper, the tin, or the fuel.

To obtain a good result with a large bell, there is required a more expensive and careful arrangement than is usually supposed. But, with it, I feel no doubt but that success is certain; or, so certain, that there will only remain the element of the temperature of the metal at the time of casting, to be carefully attended to.

If the bell is cast in a metal-case, or in one formed of many pieces, for convenience, and the thickness of the loam or sand so regulated that the thinner portion shall be co-temporaneous with that of the thicker portion, I believe that a durable bell may be made, and that coal may be used as safely as wood, for fuel.

These hints are put forth with great deference to the experience of others, and without any of those details which they can supply.

My view is, that an equably formed mass, of the dimensions, material, and form of a bell, ought to remain perfect under more severe trial, as regards the hammer, than these have been subjected to, and, the arrangement respecting swinging and striking ought not to be important.

I am, &c.,

F. E. W.

Nov. 26th, 1859.

EXAMINATIONS AND THE YORKSHIRE INSTITUTIONS.

Sir,—Your correspondent, Mr. Rowbotham, in his zeal to repudiate the connection of the Sheffield People's College and the Church Institute with the Yorkshire Union of Mechanics' Institutes, should have adhered to the truth, which he has not done in stating that the Working Men's College is the only Institute in Sheffield connected with the Yorkshire Union, and to which the remarks of Mr. Chester solely apply. The Sheffield Mechanics' Institution, of much older standing, has been long associated with the Yorkshire Union, and has been compelled to remove to cheaper premises, owing to financial difficulties arising partly from the burden of local rates, partly from the inconveniences of a building most injudiciously constructed at a cost of about £8,000, and inadequate for anything but lectures and public meetings, and partly from the establishment of a free

library, which does more harm than good to Institutions which require class instruction, and have to depend upon the payments for the use a library.—I am, &c.,

BARNETT BLAKE.

THE LAW OF PATENTS.

Sir,—Your correspondent "Cosmos," who expresses himself so warmly upon the evils of the existing patent laws, appears to labour under some misapprehension as to their operation. He speaks of the necessity of obtaining a separate patent for each improvement which may be embodied in a machine, and seems to think that it rests with the Law Officers of the Crown, or their clerks, to determine the number of patents for which the unfortunate inventor must apply, conveying a gentle hint that in this invidious task they are not altogether insensible to the charms of additional "fees."

Now this impression is entirely erroneous, and is simply the result of the heated imagination of "Cosmos," who appears to be smarting under some of those grievances which fall to the lot of patentees, who, to do them justice, are not backward in making their complaints known. The rules of the Commissioners provide that "every application for letters patent, and every title of invention and provisional specification, must be limited to one invention only; and no provisional protection will be allowed or warrant granted where the title or the provisional specification embraces more than one invention." This rule, however, is not intended to apply to the case of several improvements made in the same machine, and which improvements together form one invention; and if "Cosmos" will only take the trouble to look over the weekly lists of grants of provisional protection, he will see that he is under a mistake. The object of the rule was to check the including of several distinct inventions under one patent, and it is in fact a great boon to the honest inventor.

I do not wish to set myself up as an apologist for the new patent law, which might, doubtless, be amended in many particulars, nor do I intend to reply *in extenso* to the complaints of the irate "Cosmos," but I cannot refrain from denying that "the alteration in the law has been popular because it has added to the incomes of patent agents, solicitors, commissioners, and all those indirectly interested in patents who are paid by the fees of inventors." The fact that, since the alteration of the law, the number of patents annually applied for has increased from a comparatively small number to nearly 4,000, speaks sufficiently for its popularity with the inventors.

With regard to the abandonment of the patent system for rewards by the State, I must be allowed to remark, with all due respect to "Cosmos" and Mr. Mill, that I am convinced such a method of remuneration for inventive talent is utterly visionary and impracticable, and can only be expected to gain the favour of those who are unacquainted with the subject in its various bearings.

I am, &c.,

E. P. H. VAUGHAN.

15, Southampton-buildings, W.C., Nov., 1859.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....British Architects, 8.
Medical, 8½. Dr. Cockle, "On certain points of Diagnosis in Mitral Valve Disease."
Tues. .....Civil Engineers, 8. Continued Discussion upon Mr. Grantham's paper, "On Arterial Drainage and Outfalls."
Wed. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Society of Arts, 8. Mr. J. C. Morton, "On the Forces used in Agriculture."
Medical, 8½. Lettsomian Lectures, Dr. F. W. Pavy, Professor of Physiology, Guy's Hospital, "On certain points connected with Diabetes," with experimental illustrations.
Thurs. ....Antiquaries, 8.
Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principle of Vegetable and Animal Chemistry, and their application to the Arts and Purposes of Life."

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 25th*, 1859.]

Dated 12th August, 1859.

1861. L. A. Possoz, 37 Rue de Rivoli, Paris—Imp. in the manufacture and baking of sugars.

Dated 15th October, 1859.

2359. R. Smith, Islington—The purification of water and other fluids.

Dated 25th October, 1859.

2435. G. Canouil, 93, Curtain-road, Shoreditch, Middlesex—New machinery for priming percussion caps without danger of explosion, also a new fulminate not hitherto employed.

Dated 2nd November, 1859.

2494. B. Browne, 52, King William-street—A self-heating ironing apparatus.
2496. R. H. Hess, Newton-street, Hoxton—Imp. in gas burners.

Dated 3rd November, 1859.

2498. J. Leeming and J. C. Ramsden, Bradford—Imp. in looms for weaving.
2502. W. Wilson, Newcastle-upon-Tyne—Imp. in machinery for the manufacture of felted fabrics, suitable for the bodies of hats, caps, and bonnets.
2504. J. Howard, Fenchurch street — Improved machinery for moulding hollow bricks and tubular articles. (A com.)

Dated 4th November, 1859.

2506. A. Binckes, Cornbury-place, Old Kent-road—Imp. in optical instruments.
2508. G. N. Buller, 28, Bartlett's-buildings, Holborn—An improved mode or method of ornamenting articles composed wholly or partially of jet.
2610. J. A. Maxwell, 53, Chancery-lane—Imp. in hydraulic engines to act either alone or in combination with steam and steam engines.
2512. F. H. Holmes, Northfleet—Imp. in apparatus for transmitting light.
2514. A. V. Newton, 66, Chancery-lane—Imp. in type-setting and distributing apparatus.
2516. W. Hill, Coombe Haye, near Bath—Imp. in lightning conductors.
2518. J. Chesterman, Sheffield—New and improved methods of, and furnace for, heating, hardening, and tempering clock springs, watch springs, band saws, steel for dresses, such as crinoline steel, and other like purposes.

Dated 5th November, 1859.

2520. C. Mackenzie, Stornoway, N.B.—Imp. in machinery or apparatus for cutting and dressing staves for casks, barrels, and other wooden vessels.
2522. F. Pichler, 162, Great Portland-street, Oxford-street, and H. J. Wigley, 5, Gloucester-place, Gloucester gate, Regent's-park—The arrangement and construction of wheeled carriages or other vehicles or machines, in such manner that the occupant or occupants thereof may propel the same by alternating the weight of the person or persons riding.
2524. G. T. Bousfield, Loughborough-park, Brixton—Imp. in machinery for grinding and polishing sheets of plate and other glass. (A com.)
2526. W. Mannix, M.D., Wolverhampton—Imp. in the manufacture of manure.

Dated 7th November, 1859.

2528. A. L. Dowie, Glasgow—Imp. in effecting communications or signalling between distant or distinct parts of railway trains.
2530. G. Pacey, 2, Waterloo-street, and Upper Priory, Birmingham—A rein handle and holder applicable for riding or driving either for single, double, or team reins.
2532. H. Barker, Hastings, Sussex—An imp. in clay, meerschaum, and other pipes.
2536. A. Templeton, 7, Skinner-street, London, and J. Lawson, Glasgow—Imp. in the manufacture of chenille or like fabrics suitable to be used in woven and other ornamental piled fabrics.

Dated 8th November, 1859.

2540. J. Thomson, Dundee—Imp. in the manufacture or production of Brussels and velvet pile carpet fabric and hearth rugs.
2542. H. Johnson, Lincoln's-inn-fields—Imp. in watches or timekeepers.
2544. T. S. Bottom, Park-terrace, Old Ford, Middlesex—Imp. in the manufacture of chenille.

Dated 9th November, 1859.

2546. J. Hamer, Longsight, Manchester—An improved material for insulating the wires of electric telegraphs, for lining articles of dress, for covering clothing, casing or lining steam boilers; pipes, cylinders, and other vessels, conduits, or chambers, and for other similar purposes, to which the said material is or may be applicable as a non conductor, for preventing or diminishing the transmission of heat or of the electric fluid.
2548. D. Fulton, Glasgow—Imp. in cylinders or rollers for printing and other purposes.
2550. G. Spill and D. Spill, Stepney green, Middlesex—An imp. in the manufacture of bands for driving machinery, and for various other purposes.
2552. W. Clark, 53, Chancery-lane—Imp. in the construction and application of electric telegraphic wires or conductors.

Dated 10th November, 1859.

2554. J. Edwards, 77, Aldermanbury, London, and J. S. Wright, Birmingham—Imp. in the manufacture of buttons.
2556. J. Tenwick, Clarendon-street, Albion Foundry, Portsmouth—Imp. in the construction of street gutters.
2560. W. Fletcher, Kilburn, Derby—Imp. in machinery for making looped fabrics.

Dated 11th November, 1859.

2562. F. D. Jones, 29, Tavistock-street, Covent garden—A weaver's loom, with combs opened at the summit, and with moveable floating chains. (A com.)
2563. T. Blinkhorn, Spalding, Lincolnshire—Imp. in pumps.
2564. R. A. Brooman, 166, Fleet-street—The preparation of a salt and means of combining, mixing, or applying the same to render fabrics, pulp, wood, oil, and other substances uninflammable. (A com.)
2565. R. A. Brooman, 166, Fleet-street—An improved method of preparing plates and cylinders for printing from. (A com.)
2566. A. Jacquelin, Paris—Imp. in the manufacture of carbon, and in apparatus employed therein.

Dated 12th November, 1859.

2567. R. Lansdale, Pendleton, near Manchester—Imp. in machinery or apparatus for washing and cleansing fabrics, which improvements are also applicable to churning.
2568. W. Burgess, Newgate-street—An imp. in mowing and reaping machines.
2569. J. Scott, Sunderland—An imp. in anchors.
2570. A. Vickers, Bristol—A method of opening and shutting two or four gates or doors simultaneously, and for fastening the same when either open or shut, applicable to railway crossings and other purposes.
2571. C. Norrington, Green Bank, Plymouth—Imp. in the protection of ships or vessels, forts or batteries, from cannon shot, shell, or any other projectile.
2572. E. A. S. Burgess-Burgess, 107, Strand—Imp. in the preparation of anchovies.

Dated 14th November, 1859.

2575. P. Graham, Oxford-street—Imp. in machinery or apparatus for cutting wood.
2576. A. Applegarth, Dartford, Kent—Imp. in surface block printing.
2577. J. Madin, Fitzwilliam-street, Sheffield—Imp. in furnaces and appliances connected therewith, for hardening and tempering crinoline or sheet steel, and measuring the same.
2578. J. Walworth and R. Harrowby, Bradford, Yorkshire—Imp. in smut machines or corn screens.
2579. J. and G. Goldberg, Manchester—Certain imp. in the construction of purses or 'portmonnaies,' and in an improved lock or fastening applicable to purses, bags, or other similar receptacles.
2580. A. R. Arrott, St. Helens, Lancashire—Imp. in the manufacture of carbonate of soda.
2581. C. H. Brooks, Great George-street, Westminster—Imp. in apparatuses for paying out and hauling in telegraph cables.
2582. J. Holgate, 33, Great Dover-street, and J. Henderson, Ramsgate—Imp. in locomotive engines, partly applicable to other steam engines.

Dated 15th November, 1859.

2585. W. H. Ward, Auburn, U.S.—An improved turn-table for railways and other purposes.
2586. E. Borlase, Allenheads, Haydon-bridge, Northumberland—Improved apparatus for separating metals and metallic ores, when mingled with other substances in the state of slime.
2587. J. Donald and P. Smith, Johnstone, Renfrew, N.B.—Imp. in apparatus for raising and for extracting liquids.
2588. C. Chalmers, Merchiston Castle, Bank Morningside, Edinburgh—Imp. in gas stoves, for heating buildings, apartments, and other similar places.
2589. W. Elliott, Norwich—An improved method of raising water and other liquids.
2590. C. P. Alvey, Commerce-place, Brixton-road, Surrey—Improved machinery or apparatus for the manufacture of envelopes.
2591. W. H. Ward, Auburn, New York, U.S.—Imp. in tanning hides and skins.
2592. W. Wilkins, Banbury, Oxfordshire—"A ridge tressel," or apparatus which may be employed on the ridges of buildings to support persons and planking.
2593. A. V. Newton, 66, Chancery-lane—An imp. in the manufacture of hose or flexible pipe. (A com.)
2594. T. D. Perkin, King David Fort, St. Georges-in-the-East, Middlesex—Imp. in the manufacture of colouring matters. (A com.)
2595. J. Graham, Warrington Junction, Lancashire - Imp. in treating and applying products obtained when galvanising iron.

Invention with Complete Specification Filed.

2614. J. Wilcock, 89, Chancery-lane—Imp. in the construction and arrangement of the boiler and working parts of steam fire engines, parts of which are applicable to engines for other purposes. (A com.)—19th November, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, November 25th*, 1859.]

November 25th.
924. W. A. Martin & J. Purdie.
1287. J. Harmer.
1289. R. A. Glass.
1291. A. Prince.
1311. W. Weild.
1313. P. Aitchison and T. Binks.
1315. H. N. Nissen.
1321. R. A. Brooman.
1324. M. Davis.
1329. W. Gossage.
1366. H. N. Penrice.
1421. G. C. Ash.
1425. A. Smith.
1430. G. Smith.
1494. L. D. Owen.
1555. R. Kay, J. Manock, J. Whittaker, & T. Booth.
2059. J. G. N. Alleyne.
2073. M. A. F. Mennons.
2157. J. Dales.
2201. D. Stewart.
2221. J. H. Johnson.

[*From Gazette, November 29th*, 1859.]

November 29th.
1325. A. Smith.
1326. W. Grimshaw.
1330. J. Fry.
1333. I. Blackburn and R. Blackburn.
1335. A. Micklethwaite, J. Peace, and S. J. Hobson.
1336. E. Leeson.
1339. W. Smith.
1340. J. S. Cockings.
1341. S. Carr & G. Butterworth.
1343. J. Wansbrough.
1348. F. Roberts and A. Roberts.
1350. G. H. Cottam and H. R. Cottam.
1351. F. W. Saltonstall and A. Bush.
1356. S. Bury.
1357. S. Bury.
1370. A. R. Arrott.
1377. G. Davies.
1379. C. James.
1424. O. Maggs.
1446. N. C. Szerelmey.
1452. H. F. Smith.
1456. T. Cattell.
1457. T. Orrell, jun.
1539. W. E. Newton.
1559. T. Bell.
1599. J. Watkins and J. Pugh.
1778. E. Merrell.
2170. T. B. Daft.
2267. J. Macintosh.
2269. J. Macintosh.
2277. W. Macfarlane.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, November 25th*, 1859.]

November 21st.
2767. T. Roberts, J. Dale, and J. D. Pritchard.
2798. A. V. Newton.

November 22nd.
2782. J. Broadley.
2788. C. E. Heinke.
2789. J. Orr.
2816. C. A. Tissott.

November 23rd.
2840. G. Collier & J. W. Crossley
2867. A. Bullough & W. Bullough

[*From Gazette, November 29th*, 1859.]

November 24th.
2793. H. Bougleux.
2802. F. N. Clerk.
2810. W. Woofe.

November 25th.
2828. L. C. Stuart.

November 26th.
2800. J. Brown and J. Adin.
2829. J. Brown.

Patent on which the Stamp Duty of £100 has been paid.

[*From Gazette, November 25th*, 1859.]

November 22nd.
1045. H. Clayton.

[*From Gazette, November 29th*, 1859.]

November 24th.
877. T. A. Cook.
919. J. Barlow.
1073. A. Cointry.

November 25th.
884. R. B. Feather.

November 26th.
900. S. C. Lister and J. Warburton.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name	Address.
4,214	Nov. 19th.	Self-acting Apparatus for Water and Liquid Manure Tanks	Charles Henry Farrer	Solway House, Wigton, near Carlisle.
4,215	,, 23rd.	The Knee-cap Gaiter	Bowley and Co.	53, Charing-cross, S.W.
4,216	,, 25th.	Handle Strap	John Stewart Margetson	Cheapside, E.C.
4,217	,, 26th.	Bottle	Mesdames Burgess	107, Strand, W.C.
4,218	,, 22th.	Blotting Book	Howell, James, and Co.	Regent-street, St. James's, S.W.

Journal of the Society of Arts.

FRIDAY, DECEMBER 9, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded as soon as possible to the Secretary of the Society of Arts.

FOURTH ORDINARY MEETING.

Wednesday, December 7, 1859.

The Fourth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 7th inst., J. Bennet Lawes, Esq., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Baxter, George	Deane, Sir Thomas
Belcher, Capt. Sir Edward, R.N.	Geddes, John
Browne, William	Hinxman, Henry James, M.D.
Cliff, John	Rose, Edwin
Dallmeyer, John Henry	Veale, George

Williams, H. R.

The Paper read was—

ON THE FORCES USED IN AGRICULTURE.

By J. C. Morton.

The three forces to which I shall refer are steam-power, horse-power, and manual labour. Each of them has employment in our present English agriculture, and one object of this paper is to point out the extensive fields open, especially to the first and last of them, in the agriculture of the future. For there are three classes under which all the operations of the farm may be arranged, and they correspond exactly to these three forces which we have at our command.

In the first, where the greatest uniformity of process obtains, the greatest power is needed, and a purely mechanical force, acting through levers, wheels, and pullies, is in this way sufficiently under our control for their performance, and this class of operations increases in extent and in importance with almost every permanent improvement of the land, *i.e.*, with everything which tends to the uniformity of its condition. In the second class as much force is needed; but rocky subsoil, awkward hedgerows, crooked roads, and scattered produce, interfere with any possibility of uniform procedure. Some machinery, more pliable than cranks and rods, is needed by which to carry out the purpose of the mind, and here, therefore, it must work by means of the teachable and powerful horse. This class of operations diminishes in extent and importance with every permanent improvement of the soil, *i.e.*, with every removal of those obstacles to which I have referred. In the third class the care and cultivation of individual life, vegetable and animal, are concerned: no great power is needed, but there is need for the constant and immediate exercise of the will, varying, it may be, at every successive moment, and here, therefore, the human mind can work only by its most perfect instrument—the human hand. It is plain that everything by which on the one hand land is brought to a uniform condition, and by which, on the other, the quantity of its living produce is increased, will extend the first and last of these three fields of agricultural operations, and will diminish the necessity of employing horses.

And this is no mere speculation: it is the principal lesson of the agricultural experience of the past few years. If we knew for several successive years exactly the employment of our agricultural labourers, its nature, its quantity, and its reward, on each of the farms which make up the surface of Great Britain; and if we also knew the quantity and the manner during all these years of the horse labour of all these farms, its cost per acre and its effect; and if, in addition to all this information, we had the full experience, now very considerable, of the use of steam power upon the farm, not only for threshing and grinding and cutting, but for cultivating the soil, we should certainly learn from it how rapid has been the extension of those circumstances under which steam cultivation becomes possible, and how perfectly along with it the demand for agricultural labour has been maintained. Such a review of agricultural experience, would, however teach us more than this, for by a comparison of the experience of different farms we should learn the most economical mode of obtaining these powers and the best way of applying each within the field thus open to it. We should learn how to ensure the most economical and efficient condition of our steam engine and its machinery; we should learn how to obtain the most economical and efficient horse labour, and by so large an experience those circumstances would be pointed out under which the best farm servants are to be procured and retained.

The forces used in agriculture, thus considered, form therefore a very extensive subject, and it is only two or three illustrative remarks under each of these several aspects of it that can be made within the hour.

In the first place, then, let me attempt a more particular comparison of steam power, horse power, and hand power for the cheap performance of mere labour. In describing steam-engines the term "horse-power" is used as a unit of force. The power exerted by a horse is assumed, on the authority of experiment, equal to the pull or lift of 33,000 lbs. 1 foot per minute; and to this agricultural experience agrees, for if a pair of horses draw a plough along with an average pull of 300 lbs. at an average rate of 2½ miles per hour, *i.e.* of 220 feet per minute, it is the same as if those 300 lbs. were pulled over a pulley, *i.e.* lifted that height in that time, and 300 lbs. lifted 220 feet per minute is just the same as 66,000 lbs. lifted I foot high per minute, which, as the performance of a pair of horses, is exactly the 33,000 lbs. a piece at which their force is valued by the engineer. Now, it is not on a comparison merely of the *cost* of horse power in the animal and in the engine that so great superiority of the latter will appear as really belongs to it. In addition to this, the performance of which they are severally capable must be taken into account. An ordinary 10-horse power locomotive agricultural engine will, according to the Chester judges of the work done by Fowler's steam plough there, cost in coals and oil and water and attendance, and tear and wear of implement and engine, but excluding interest on capital employed, nearly 45s. a day, or about 4s. 6d. an hour, which is 5½d.

per hour for each nominal horse power exerted, but as the real force exerted is more often that of 20-horses in the case of a 10-horse power engine, we must really divide this by 2, and call steam-produced horse-power worth 3d. per hour. Now the cost of horse labour on 21 farms in different parts of this country, of which the particulars have been kindly given to me, did not exceed 5d. per horse for each of the working hours of the year. Those farms employ 282 horses, and they cost for food, for depreciation of value and saddler's and blacksmith's bills, £7,815 a year; their implements need £870 a year to keep them good; and the ploughmen and boys employed about them cost £4,241 a year in wages—about £13,000 in all, or £46 per horse per annum; and supposing that there are 2,500 working hours in the year, this is rather less than 5d. per horse per hour.

Besides this, the estimated expense of Fowler's engine was, I believe, excessive, and the nominal power of it was certainly below the actual force at which it could be worked with the estimated quantity of coal consumed; for of 30 engines tried at Chester only one consumed the 11 lbs. of coal per hour for every horse power produced, which is the consumption named for Fowler's engine, and the majority did not consume more than 6 to 8lbs. during that time.

A horse at plough with an average length of 120 yards of furrow loses one-third of his time on the headland in the mere act of turning the plough. At the dung-cart not one-third of his time is employed in the actual conveyance of the load, two-thirds are lost standing at the heap and in the field and returning with the empty cart. Or rather let me say this loss of time is a necessary part of his employment, however he may be engaged. He can pull 33,000 lbs. 1 foot high in a minute, but he cannot keep that performance up for 10 hours at a time.

On six farms the details of which I have so ascertained as that all the ploughing, scarifying, harrowing, rolling horse-hoeing, carting—all the horse-labour in fact on each—is converted into lbs. lifted so many feet per minute throughout the working year, I find that the actual performance per hour through the year is not 33,000 lbs. lifted 1 foot per minute, but more nearly one-half that quantity, varying from 14,000 lbs. in the lowest case, to 19,000lbs. in the highest.

No doubt, even in the case of steam power, there must be periods of waste labour—ploughs must be turned upon the headland even if it be done by steam—but these occasional periods of comparatively fruitless work are no necessary condition of steam power; *it* is better if maintained continuously, and machinery will be invented to reduce this waste time to a minimum with a positive advantage to the efficiency of the engine. Whereas in horse-labour, the waste time is necessary for the maintenance of the power itself. And it is plain that, along with the 5d. per hour for every horse, which on the average it may cost, there has to be taken into account a performance on the average of the year of only 19,000 lbs. lifted by it 1 foot high per minute as its best result—whereas in the case of the steam-engine *its* 3d. per horse per hour has to be taken along with nearly twice as large a performance as *its* best result.

And the relative cost of the two forces is affected not only by the question of time during which each can be continuously maintained, but also by the quality of the performance of which each is capable. In threshing, uniformity of speed is a condition of good work; it is more easily maintained by steam-power than by horses. In ploughing, the avoidance of trampling and of pressure generally is almost a condition of good work: it is more easily obtained by steam-drawn machinery for the purpose. But to this I shall recur.

Let us now estimate the cost of manual labour engaged in what I call mere work, *i.e.*, where the least degree of skill is called for. I have four facts in illustration of this point:—

1st. A man will dig 8 perches of land, or say 2000 square feet, nearly a foot deep, in a day. In doing so he lifts probably three-quarters of it through at least, a foot in height, that is to say, he lifts 1500 cubic feet, weighing at least 150,000 lbs 1 foot high in 10 hours' time, and to do it therefore he must maintain upon the average a lift of 250 lbs. per minute all that time. Of course in addition to the mere lift there is the labour of cutting off this earth from the firm ground to which it was attached. In my second case, then, this portion of his labour is very much reduced; 2nd, three men will lift—I have often paid them for doing it—100 cubic yards of farm-yard dung, and fill it into carts in 10 hours' time. The 33 cubic yards which fall to each man's share, or about 14 cwt. a piece, weigh 50,000 lbs., and this is lifted over the edge of the cart, or 4 feet high—equal to 200,000 lbs. lifted daily 1 foot high or 330 lbs. per minute. This is one-fourth more than in the last case. Now take one where there is no labour in detaching the weight from any previous connection. 3d. A man will pitch in an hour's time—I have often seen him do it—an acre of a good crop, tied in sheaves to an average height of full 6 feet, on the cart or waggon. Straw and corn together, such a crop will weigh more than 2 tons, say 5000 lbs. In doing this he therefore lifts 300,000 lbs. 1 foot high in 10 hours' time, or 500 lbs. per minute. 4th. My fourth case is of much the same kind. One man and five boys, or women, equal as regards wages—and I will therefore assume equal as regards power to three men—will throw into carts upon an average of Swedes and mangel wurzels, 3 acres of a good crop, say 70 tons in all, in a day of 9 hours' length. They lift then 150,000 lbs. 4 feet, being say 600,000 lbs. 1 foot; being 200,000 lbs. apiece in nine hours' time, or about 370 lbs. a minute.

These four cases indicate the mere force of a man then at a cost of say 3d. an hour, as equal to a lift of 250, 330, 500, and 370 lbs. per minute; the two former being cases where the load has to be detached as well as lifted, and the third being performed under the influence of good harvest fare.

But now compare this even in the best case with the duty of the steam-engine, or 33,000 lbs. 1 foot high per minute for 3d. an hour, and compare it with the actual average performance of the horse, 16,000 lbs. lifted 1 foot per minute for 5d. an hour. In order, at the best rate named, to do the work of the steam-engine, 66 men would be required, at a cost not of 3d., but of more than 15s. per hour, and in order to do the work of the horse 32 men would be needed at a cost of 8s. instead of 5d. an hour. It is plain that if we can take much of the mere labour of the farm out of the hands of the labourer, and put it into the hands of steam power for its performance, there is an enormous amount of saving to be made in the cost of agricultural production. It is plain that it is mere folly in the labourer to think that as regards the *mere* labour of the land he can compete with either steam power or with horse power. Strength of body is desirable, and sinew hardened by long practice in hard labour has a considerable marketable value, for that, however hardly it may sound, is the aspect of the matter in which the interests of the labourer most directly appear—but it is plain that for sheer lift and the mere putting forth of force, horse-power, and still more that of untiring steam, must grind the soul out of any body that shall pretend to competition with them. It is in the cultivation not so much of mere strength of body as of skill and intelligence that the safety of the labourer lies, and in his capability of education he is perfectly secure.

As the matter at present stands then, and confining ourselves to that large and increasing class of operations in which the power required is great and the process almost uniform, and looking only to the cost per unit of work done, we have seen that steam power stands decidedly first in the race, horse power is a tolerably good second, and the agricultural labourer is literally nowhere. There are, however, two considerations which greatly

affect the position of horse power in this competition, and place it much farther back than it would at present seem to be. They both affect its fitness for those acts of cultivation where it is plain that there is the greatest room for an extended use of steam-power. I refer 1st, to the injury done to the land by the trampling of draught animals; and 2dly, to that irregularity of employment on the farm for horses during the year, which in effect makes you keep upon a large farm several horses all round the year for the sake of their work during a few weeks of spring and autumn. If a steam-engine, which costs nothing when it is idle, can be used to take this extra work, and so reduce the horse labour of the farm to an uniform monthly amount, then its cost has to be compared, not with that of the horses which it has displaced only during the few weeks in question, but with the cost of those horses throughout the year. It is this fitness of the engine for the cultivation of our stubbles in autumn, and so its power to displace so many teams throughout the year which would otherwise be kept just for the few weeks of most laborious time, that greatly heightens the economy of its employment. And as to the superiority of its work of cultivation, I will just quote the statement of a ploughman on the clay land of the oldest steam-cultivated farm in England —Mr. William Smith's farm, of Little Woolston, in Buckinghamshire—that in turning back the Wheat stubble in the autumn, with the horse-drawn plough he used often to uncover the foot-prints of the horses' shoes which had trod there at that depth when turning in the bean stubble for the seed 12 months before. Of course it is no part of good agriculture that all the produce of the land is to be made out of a particular layer called the soil, which has to be cultivated, turned to and fro, and stirred and mixed, upon an impervious floor hardened by a perpetual trampling, below which lies the subsoil. All recent improvements of the soil have proceeded upon the idea that there is no essential or necessary distinction between it and the subsoil—that *thorough* drainage and deep cultivation both increase fertility, and that the existence of anything like a pan within 30 inches of the surface is injurious. The ability of steam-power for the deepest cultivation, and its applicability at the same time to the thorough cultivation of any depth to which it may be desired to stir or turn the soil without any pressure on it except by the wheels of the implement employed, must ultimately obtain for it the preference over horses for all mere ploughing and stirring, especially of clay land. And a very large share of the horse labour of ordinary agriculture will thus be handed over to the steam-engine.

Let us consider how much. I will refer to three instances: On a farm of 675 acres, occupied by Mr. Melvin, at Bonington, near Ratho, in West Lothian, the whole horse labour of cultivation and carriage being converted, as I have already said, into weight lifted, amounts to upwards of 100,000 cwt. pulled, *i.e.* lifted 1 mile per annum. Of this the ploughing and scarifying alone amounts to 27,000 cwt., or more than one-quarter; the harrowing, rolling, and drill cultivation amounts to upwards of 20,000 cwt. and the carriage of dung, crops, and produce amounts to 60,000 cwt. lifted 1 mile. The carriage is here an enormous proportion, more than one half of the whole horse labour of the farm, and much beyond its average amount in ordinary experience; but still even here one-quarter of the horse labour goes in mere ploughing, which can all be done by steam-power, and *so* done as that an 8-horse power engine shall displace more than eight horses and do their work much more effectually.

Again, on a farm of fen land of 790 acres, occupied by Mr. Aitken, near Spalding, Lincolnshire, where the horse labour of the farm is nearly the same as in the last instance, or equal to 100,000 cwt. lifted one mile per annum, the carriage does not exceed much more than a quarter of the whole, while the ploughing is nearly 40,000 cwt., 4-10ths of the whole labour, and the harrowing and rolling about 35,000 cwt. per annum.

On Lord Ducie's farm at Whitfield, Gloucestershire 260 acres, the horse labour amounted to 37,000 cwt. lifted 1 mile per annum, and of this, 12,000, one-third, was carriage; nearly 15,000, or 4-10ths, was ploughing and cultivating; and the remainder harrowing, rolling, and drill culture. This seems to be a pretty ordinary division of the labour, and if it applies generally to arable land it would appear that though farm carriage and all the lighter work of harrowing, drilling, and rolling continue to be done by horses, there are still 4-10ths of the horse labour of the farm which may be done by steam. I know that a great deal ought to be said of the great advantage of this substitution owing to the more thorough performance of the cultivation which steam-power will accomplish. Ample evidence exists on steam-cultivated farms in this country on this point, but I will leave it to be adduced by others who may follow me, and I will continue to speak merely of the saving of expense which is thus effected. It appears then that on arable land two-fifths of the horse labour of the farm can be handed over to a power which is capable of nearly twice as much duty for about one-half the expense. One other remark on this point, and I have done. On examining the horse labour of a farm of 240 acres of arable land under alternate husbandry, it will be found that it does not much exceed 500 days of a pair of horses in the year, and that the need for it is distributed among the months extremely unevenly. Not more than 35 days of a team per month are wanted in December, January, and February; about 45 days a month are wanted in March and April, May, and June; about 15 days are wanted in July; about 60 in August, and 90 in September, and 55 in October, November, and December. August and September stand highest, and as there are not generally more than 24 working days in each of these two months, there must be a provision of at least three-and-a half pair of horses all the year, in order that the work of August and September may be done. Now, the two-fifths of the horse labour, which is proper for steam-power, is not going merely to displace two-fifths of these seven horses through the year; for the ploughing and cultivating being done by steam, will take (not two-fifths) but more than half of the labour of the incumbered months of March and April, May and August, and September and October, and so reduce the amount to something like 35 days' work during each month of the year, which two pairs of horses will more than easily accomplish.

I believe then that by steam-power at least three out of every seven horses on arable land may be dispensed with all the year, at a cost not exceeding the cost of these horses during the three or four months when alone they are really needed on the land.

The first class of operations then upon the farm, which includes the ploughing and turning of the soil, will be taken by steam-power out of the field of horse labour, just as threshing, and cutting, and grinding have been taken by it out of the field of hand-labour.

To the second division of farm work I shall refer but very shortly. It includes such cases of ploughing and cultivation as are taken, by very rocky subsoil and very crooked hedgerows, out of the scope of the steam-driven plough; it also includes the lighter class of horse-work, such as harrowing and horse-hoeing, which however might very well be done by steam; and it more especially includes the work of carriage, which, considering the scattered position of the produce to be collected, and the crooked roads along which it must be drawn, I see no probability, as long as these remain, of getting done except by horse-power and manual labour in the usual way. Mr. Halkett does, indeed, propose to remove these obstacles, and is therefore able to accomplish all by steam. The third class of operations includes the lighter work, requiring skill

and thought as well as labour. The planting of a seed equidistantly within the land may be done by machinery, but the culture of the young plant, much of the hoeing of the land immediately around it, and its treatment during growth according to its condition, must be left to the hand. When ripe it may be harvested by horse-drawn implement; our corn crops are reaped, our potatoes may be dug, and roots are cut from the ground by horse-drawn machines—they must however be gathered into bundles or heaps, and ultimately removed by the help of manual labour.

When stored they are threshed, and ground, and cut, and steamed by steam-driven engines, but they must be administered as food by manual labour. Leaving the vegetable, which, even when living, may be treated to some extent by machinery, and when no longer growing becomes at once the subject of steam-driven processes, we come to the treatment of the animal which it feeds, and here we leave altogether the region of machinery actuated by steam, and are confined to the hand, directed by intelligence.

Is it not a remarkable thing, however, that agriculture, which was once wholly the work of men's hands, but which has long since given up the tillage of the soil, and the carriage of the manure, and the sowing of the seed, and three-fourths of the hoeing of the crops to be accomplished by the horse—which has latterly given up the threshing of the grain and the cutting of its straw to be effected by steam-power, which is rapidly abandoning the work of reaping to the former and of cultivation to the latter, should nevertheless require more labourers than ever?—that steam being first, and horse-power second, and the agricultural labourer nowhere in the race, considering the three merely as economical producers of power, the last should nevertheless be wanted more than ever?

The explanation lies in this: that agriculture is more and more becoming the work of intelligence and skill as well as power—those parts of its processes, where intelligence and skill are wanted, are becoming a larger portion of the whole. Cultivation is more perfectly performed, and over a greater extent of land—the crops cultivated require more labour and are more productive—the stock consuming them is proportionally larger and needs proportional attendance. Probably each acre cultivated in 1759 employed more manual labour in its cultivation then than each acre cultivated now; but how many more acres are there under cultivation now than then? Each bushel of wheat grown half a century ago involved so much more labour then that 8s. was the lowest price at which it could be grown with profit; but how many more bushels per acre does land upon an average yield at present? Each lb. of beef and mutton cost more in wages 30 years ago than now; but we have a double and triple store of food for stock; we have two crops of fattened sheep and cattle where formerly we had one, and each supplies a double quantity of meat.

But, whatever the explanation be, the fact is certain that the use of steam power on a farm is a part of that system which employs most labourers in agriculture. Mr. William Smith, of Woolston, who has an 8-horse engine for 110 acres of arable land and 70 acres of pasture, and works this engine only 14 days a year in cultivation, and not more in threshing, employs regularly throughout the year seven men and four boys, equal to nine men upon the whole, or one to every 12 acres of arable land and 8 of grass—"more than any farmer in the neighbourhood employs." His steam cultivation, he tells me, costs him on the average 10s. 10d. annually per acre on his clays, and 8s. 3d. annually per acre on his lighter soil. It has displaced exactly the 2-5ths of the former horse-power which I had anticipated that it would; and he says that 70 per cent. of the cost of engine work is manual labour and only 30 per cent. engine food, while of the horse work displaced only 20 per cent. is manual labour and 80 per cent is horse food.—Mr. Pocock, who farms 300 arable acres and 300 acres of grass land near Farringdon, employs regularly 22 men, 8 women, and ten boys, equal to 30 men in all, or 1 for every 10 acres of arable and 10 acres of grass. He, too, uses steam power for threshing, grinding, and cutting, and employs one of Fowler's steam ploughs.—Another gentleman occupying 410 arable and 190 pasture acres, on the fat land below the chalk hills of Wiltshire, and who does all his cultivation by steam, says:—

"Steam cultivation will lessen horse labour I think one-half, and in some cases two-thirds. A neighbour of mine who has a steam-plough, told me that he usually kept 18 or 20 horses; he now hoped to do with six. Another who occupies about 2,000 acres of arable and pasture, hopes to do with 13 horses. My own impression is that there will be more manual labour required where steam culture is adopted, and that a more energetic class of men will obtain higher wages."

Mr. Randall, of Chadbury, near Evesham, who cultivates 500 acres arable and 200 acres of pasture, employs with slight variation 30 men, 7 women, and 12 boys throughout the year, with 70 additional men for three weeks in harvest time; in all, equal to about 42 men regularly throughout the year, or 1 to every 12 acres of arable land and 5 of pasture. He too uses a steam cultivator, and says steam cultivation makes no difference in the manual labour needed on the land. All these, more or less, are instances of the cultivation of clay land, on which, if by force of *character*, labour-giving crops are cultivated, of course the labour of cultivation must be greater than on lighter soils. It is these lighter soils however, generally, which are devoted more especially to the growth of what are called fallow crops, and taking the ordinary rotation on each class of soils into account, we may therefore fairly compare the experience of the steam-cultivated farms, as to the labour they require, with the labour bills of other farms, though not quite so heavy. This "1 man to every 10 or 12 acres of arable land, and 8 to 10 acres of grass," deducting 10s. per acre for the latter, is equal to a labour bill of 50s. per acre per annum on the plough land; and it is unnecessary to say that this is a very unusual amount.

On a number of farms in Gloucestershire, whose management I examined many years ago, where the pasture formed from 1-tenth to 5-tenths of the whole, the labour bill reached 50s. per acre very rarely indeed. It was more generally between 30s. and 40s.

On a fen farm near Spalding, of which a most elaborate account of the labour used upon it has been kindly given me by the tenant, Mr. Aitken, I find that on 790 acres almost wholly arable, the actual wages paid had during the last three years averaged £1,260, or about 32s. an acre. On another similar farm, near Chatteris, on 900 acres arable and 120 pasture, the last year's wages were £1,556, which is about 35s. per acre on the arable.

On one of the crack farms of East Lothian, of 630 acres wholly arable, 22 men are kept regularly and 35 lads and women, besides 25 or 30 people for three or four weeks in harvest, and the wages, therefore, must be about £1,200, not £2 an acre, though potatoes, one of the crops requiring most labour, are very largely cultivated.

The wages on the College farm, near Cirencester, of 400 acres arable and 40 pasture, are £700 a year, or 30s. an acre on the plough land. Mr. Stratton's farm, Manningford, Bruce, near Pewsey, Wilts, 590 acres arable, 65 acres pasture, and 160 down, costs about £1,200 a year in wages, or £2 per acre on the arable land. Mr. Dods, of Anick Grange, near Hexham, occupying 310 acres arable and 100 pasture, employs 7 men and 9 women annually, and extra for a month 7 men and 7 women. His wages cannot amount to more than £500, or not much more than 32s. an acre on the arable.

And, as a last instance, I will take the farms of Mr. Edmonds of Eastleach, near Lechlade, Wilts, 2,000 acres arable and 430 acres pasture, employing on an average, and taking harvest into account, about 120 men and 20

to 40 women. His labour bill must, I should suppose, from his rates of wages, which he has kindly given me, amount to at least £3,200 a year, which is 32s. an acre. It must be admitted then, that on a comparison of these figures, the labour paid for upon steam-cultivated farms is even more than on farms where steam-power is used only to drive the threshing mill.

Agriculture is, in fact, experiencing the truth taught in the history of all other manufactures—that machinery is, in the long run, the best friend of the labourer. This truth is taught even more impressively by a review of agriculture generally, than it is by the case of any individual farm. Here are we, twenty-one millions of people, producers and consumers, living in this island, on a great farm which we may, by the help of such statistics as we possess, describe as nearly 19,000,000 arable acres, and probably nearly as much grass, employing as farm labour, in-door and out, about 950,000 men and 120,000 women, besides 300,000 lads and 70,000 girls, or averaging them by their probable wages, as has been done before, let us say equal in all to 1,150,000 men, or one to every 17 acres of arable, and nearly as much pasture. We feed and use some 1,500,000 horses, of which probably 800,000 are strictly for farm purposes. We are annually inventing and manufacturing labour-saving machines at an extraordinary rate, and every year at least 10,000 horses are added to the agricultural steam-power of the country, certainly displacing both animals and men to some extent. We have taken the flail out of the hand of the labourer, and the reaping-hook is going; on many a farm he no longer walks between the handles of the plough—he no longer sows the seed—he does but a portion of the hoeing and the harvesting—and yet, so far from being able to dispense with his assistance, he is more in demand than ever he has been.

I have had returns sent to me by all the leading manufactures of steam-engines for agricultural purposes. Within the past ten years upwards of 40,000 horse-power has been added to the forces used in agriculture in steam alone. If I may single out Messrs. Clayton and Shuttleworth of Lincoln, Garrett of Saxmundham, Hornsby of Grantham, Ransome of Ipswich, and Tuxford of Boston, they alone are furnishing 10,000 horse-power annually to the farmer. Messrs. Tuxford, among the first to start the locomotive agricultural steam-engine, inform me that for the earliest suggestion of it they are indebted to Mr. John Morton, of Gloucestershire, then agent to the late Earl of Ducie, who 20 years ago recommended them to put these little engines upon wheels, thus foreseeing the fitness of these powers made locomotive to the circumstances of English agriculture. Messrs. Ransome, of Ipswich, were I believe the earliest to receive the commendations and the prizes of the Agricultural Society of England for their engines, and now the leading manufacturers of them, Messrs. Clayton, of Lincoln, send out 10 of them each week, or 4,000 horse-power per annum.

Of reapers, again, since 1851, Burgess and Key have sold upwards of 1,900 of their improved M'Cormick's reaper, of which 771 were sold last year; and they now hold four times as many orders as they did 12 months ago. Crosskills have sold 500 of Bell's reaper, and 800 of Hussey's; Messrs. Dray have sold 800 of their improved Hussey's reaper; Messrs. Garrett have sold 600 of Hussey's; 250 of Wood's clever little reaper have been sold last year, and the Cuthberts, of Bedale, who have just begun the manufacture of their equally clever machine, sold 100 before last harvest, and could have sold four times as many. In all, probably 4,000 reaping machines were at work last harvest, capable of cutting more in a day than 40,000 labouring men, and yet there never was such a harvest as the last for the difficulty of procuring harvest men. Notwithstanding all this addition to the forces and the machinery of agriculture, more labourers than ever are required, and as more labourers are not forthcoming, wages rise.

It is, indeed, possible that some of this general rise in wages of the past two or three years is owing to the labourers in agriculture being, if anything, rather a diminishing than an increasing body; to that I shall refer directly; it is sufficient for the present to declare, what ample experience confirms, that the need of their assistance is increasing.

Of the truth of this, the following is perhaps an extravagant illustration. It is from a gentleman well known in the agricultural world, who has known East Kent for 50 or 60 years. He says:—

"I should be pleased to give you any information in my power, but I cannot answer one of your 12 questions. We have no custom in East Kent as to farming, and no fixed prices for any labour. For instance the price of cutting Wheat last harvest was from 12s. to 35s. per acre. If our labourers can only work half their time the ensuing winter, the prudent ones have saved sufficient to keep them during the winter. Almost all our labour costs us double, and in many instances treble to what it did ten years ago. Neither servants nor labourers seem to care about anything but themselves, and not one farmer in 100 in East Kent can get his work done at a seasonable and proper time. The labour market will ultimately beat us all. I have seen round here one, two, three, and four sacks of corn an acre lost in the stubbles for want of hands. There are hundreds of acres of land around here, which lie as they did after harvest, such as I have not known but once for the last 60 years; and that was in 1816 or 1817. I care naught about a man's capital, it will all go. The farms are all taken as they fall by bankers, brewers, butchers, chemists, jobbers, grocers, publicans, doctors, drapers, builders, &c. If I occupied a poor land farm, and was *obliged* to hold it, I would have a sheep-walk, and my son and I would manage it ourselves."

Whatever discount may properly be deducted from this gloomy picture, and however plain it is that its remedy is to be found in steam-power and reaping machines and such like, it may in the meantime be quoted as one of many illustrations of the fact that the increase of st am-engines and machines need create no fear for the agricultural labourer.

Here however I would say it is no part of my business to fear or to lament the progress of events, however they may happen to develop. Even if the result should be that agricultural labourers are to form a diminishing class—that at most only one of the labourer's family is trained to take his father's place, it may certainly be doubted whether his lot in future life, or that of his brother who has gone as a carpenter, mechanic, a soldier, or a sailor, is to be preferred. The man will do his best to bring up his family for their good and as he best knows how—and if wages fall, most of them will naturally endeavour to obtain a maintenance in some better way. I confess my belief to be that there are natural safeguards enough in human nature to make the *natural* result within a Christian country, and in a matter so exclusively one of mere maintenance, mere profit and loss, a perfectly safe one, and even a desirable one. Only let the artificial interference between the buyer and the seller be done away with; let knowledge of the state of the market, whether for labour or for its produce, all over the country be general; let the price of agricultural and all other produce be the natural result of simple competition among consumers, and the price of agricultural labour be the natural result of simple competition among employers; let intelligent self-interest—and self-interest in the long run always *is* intelligent—let intelligent self-interest lead to the use of machinery and steam—in fact lead *where it will*,—and the greatest happiness of the greatest number will the sooner be attained.

As, however, I have shown, if fears and lamentations have any place at all, it is in behalf of the masters rather than of their men.

One illustration more of the present value of agricultural labour in this country, and on this part of my subject I have done. In the autumn of 1849, just 10 years

ago, I applied, through the correspondents of a weekly agricultural paper, for information on this subject, and from most of the English counties and many of the Scottish ones I obtained answers to printed questions as to what is the present wage of able-bodied men, what is their weekly wage at harvest-time, what is the ordinary daily wage of women in the field—what is the cost of mowing clover, of mowing meadow grass, of mowing barley, of harvesting a good ordinary crop of wheat—what is the ordinary rent of cottages, and so on. Within the past month I have done the same thing again, and have been told the rate of wages by 93 gentlemen, residing in 12 Scottish and 35 English counties. There is thus the opportunity of making a very fair comparison of wages at a sufficient interval of time.

Let me quote a few instances, taking the weekly wage of an ordinary able-bodied man as the criterion, and, of course, endeavouring to do it without boring you by quotations from so many separate reports.

In Aberdeenshire Mr. M'Donald, of Huntly, reported the wages of ploughmen in 1849 to be £16 a year, with board and lodging; they are now £22, with board and lodging. Mr. Grigor, of Forres, reported 10 years ago the ordinary weekly wages of an able-bodied man to be 9s. to 10s.; now he puts it at 11s. Mr. Bell, of Ferryden Farm, Forfarshire, reported it at 10s.; he puts it now at 12s. in winter, and 15s. in summer. Similarly Fifeshire wages were 9s. and 10s.; they are now 11s. and 11s. 6d. In East Lothian the wages were worth 10s. a week, or 10s. with coals hauled free; and now they are valued at 12s. to 15s., &c. In Mid Lothian Mr. Melvin reported the annual wages of the married ploughmen at 910 lbs. of oatmeal, 12 cwt. of potatoes, two meals daily during harvest-time, the hauling of four tons of coal, and £17 in money; he now reports them at 1,050 lbs. of oatmeal, eight cwt. of potatoes, four weeks of harvest food, coals carted, house rent free, and £21 in money. Go, now, to the south of Scotland, and in Wigtonshire Mr. Caird reported wages 10 years ago at 9s. a week; he puts them now at 12s. A woman's daily wage was 8d., and it is now 10d.

In Northumberland wages, according to Mr. Grey, of Dilston, were 12s. weekly, with cottage and garden, and carriage of coals free; they now are 15s., with house and garden free, and Mr. Dods, of Hexham, gives to good ordinary labourers 15s. a week in winter, and 18s. a week in summer. Mr. Drewry's wages at Holker, North Lancashire, were 13s. 6d.; they are 15s. to 16s. 6d. Mr. Evans, of Wigan, in South Lancashire, reported wages to be 12s. a week; Mr. Twining, in the same neighbourhood, reports them now at 14s. From Lincolnshire I had four reports of the wages of able-bodied men, and they run thus—10s., 9s. to 10s., 11s. to 12s. and 9s. to 10s. I have four reports from the very same employers now, and they run thus—12s., 12s., 12s., 10s. to 12s.

Mr. Spencer, of Knossington, Leicestershire, told me 10 years ago that 8s. to 10s. were the wages of the able-bodied men, and he puts them now at 11s. to 12s. Take now the case of Norfolk: Mr. Cubitt, of North Walsham, 10 years ago put the wages at 7s. to 8s., and the carters 1s. to 2s. extra; now it is 9s. and the carters 10s. 6d. In Northamptonshire Mr. Grey, of Courteen Hall, Northampton, reported 8s. and 9s. as ordinary wages; he puts them now at 12s. weekly.

In Warwickshire Mr. Burbury, of Kenilworth, who reported 8s. to 9s weekly in 1849, reports 11s. weekly in 1859.

In Worcestershire Mr. Hudson, of Pershore, who named 8s. formerly now says 10s., or 9s. with 2 quarts of beer a day, are ordinary weekly wages.

In Oxfordshire Mr. Druce, of Eynsham, stated 8s. weekly, the carters and the shepherds having cottages rent free in addition; wages now are 10s. to 12s., ploughmen and shepherds from 12s. to 14s.

In Wiltshire, the worst paid county in the kingdom, wages were some ten years ago, 6s. to 7s. for ordinary labourers a week; they are 8s. a week at present.

In Kent they were 9s. and 10s. and are now 11s. to 12s. From Sussex I had three reports formerly, 8s. to 10s., 10s., and 10s.; and I have three reports now, 11s., 11s., and 12s.

From Dorsetshire I had five reports, averaging 7s. and 8s. a week with cider or beer and with cottage free "in some cases." I have two reports now, the one names 9s., and the other says the payments make the money equal to 12s. weekly.

In Devonshire the wages were 8s. to 10s., and they are 11s. to 12s.

In Cornwall they were 8s. to 9s., and they are 10s. to 12s.

All this proves, then, that the labouring force in agriculture is better paid than it used to be, and that the enormous extension of machinery and of steam power lately has not been to the injury of the farm labourer.

Although however one is naturally glad to know this, yet no one has any right to seek for the labourer any more than that share which falls to him as the natural result of mutual competition. It is for the national interest that food be produced at the least possible expense; and in the second part of my subject, which refers to the most economical provision and maintenance of the forces used in agriculture, the cost of the labour of the farm is as much concerned as is the cost of horses or the cost of steam. It is indeed the first of these to which I most desire to draw attention. The economical application of steam-power, and whether Mr. Fowler's plough, or Mr. Smith's cultivator, or Mr. Halkett's system be the cheaper, will ultimately, by large experience, be determined. Messrs. Howard have, I understand, sold 70 or 80 sets of Smith's apparatus, and Mr. Fowler is so busy that he can hardly keep pace with his orders. Tens of thousands of acres have been this autumn ploughed or worked by steam; and it will be quite within the scope of our subject if the means by which this has been done should be the point on which the subsequent discussion turns. It will also be in keeping with the subject as announced, if the most economical provision and application of horse-powers should engage the principal attention; but of all the forces used in agriculture, that of the labourer himself is the one to which I think we can most usefully confine ourselves.

On the question of efficient steam, agriculturists are willing to accept the judgment of engineers and of the outside public. On the question of efficient horses the public are not likely to add anything to the experience or the judgment of the farmer; the question of efficient labourers is one on which wide differences exist, on which the possession of mere manhood is enough to justify independent thought—on which men of different professions therefore do not feel bound to accept one another's judgment, and on which I believe that the most good is likely to arise from a discussion at a meeting of townsmen with agriculturists. All that I can do in the short remainder of the hour is to indicate the points on which that discussion should turn.

The object is to retain—indeed I now should say to obtain—a sufficient number of well qualified agricultural labourers. The Oxford Farmers' Club met the other day, and Mr. Mein, who is, I believe, agent to the Duke of Marlborough, read a capital paper on this very subject. His method of obtaining more men was none the less sensible for its simplicity; it was just to *offer higher wages*. And this is, I presume, essentially the solution of the difficulty.

He said in effect: We have not provided constant employment nor wages at which a comfortable living can be had, and no wonder that our men have brought up their children to other trades to be better paid; we have not paid young men wages according to their ability; married men have been paid at one rate, and young unmar-

ried men have been paid at another and much lower rate; they have thus been treated as children, but they are not children, and no wonder they have left us. Our remedy is to improve the condition of the labourers in their cottages; to give them more regular employment and better wages (it resolves itself into this, whether a farmer upon 400 acres had better spend 100*l.* more in labour during the winter or lose 200*l.* at harvest time in shed and damaged corn); to give the labourers more task work, and allow them to earn fair prices at it, simply according to their ability; and lastly, on occasions of unusual pressure, to give unusual wages. Even at harvest, hitherto, he said, "the prices have not been anything to compare to the daily wages of the tradesman; nay, not enough to induce Paddy to join us in this district."

But there are other points besides the amount of wages to be paid. These will indeed increase, not by the exhortations of our public speakers, but by the pressure of competition among masters, and are high or low just according to the relation between the resident population and the employment for them, so that in Wiltshire they are 8s., while in some parts of the north they are almost twice as much.

But besides the amount of wages there is the mode of payment, which greatly affects the character and position of the labourer. It may be (1), in money solely; it may be (2), partly in board and lodging in the house; it may be (3), partly in money, along with an immense variety of perquisites. These three include, I believe, all the various systems of payment adopted. Of the last I give two instances from the extremes of the island, Forfarshire and Dorsetshire. Mr. Bell, of Ferryden Farm, Forfarshire, writes to me as follows:—

"Our ploughmen receive per annum £17 in money, 6½ bolls oatmeal (140lbs. a boll, present price 17s. 6d.); 1½ Scotch pint warm milk (3d. a pint), during summer six months, 1 pint in winter ditto; 15 cwt. potatoes, and house and garden, at say £3. This for married ploughmen. Unmarried: £20 and £22, 1 pint warm milk daily all the year, 6½ bolls meal, and fire and lodgings in a bothy. At hay and corn harvest they get two bottles of beer daily, and bread and beer while leading to the stackyard. Married men get all their fuel driven by their masters."

I value these wages at £34 6s., or 13s. weekly. The daily workers, when getting something like steady work, have 12s. a week in winter, 15s. in summer, with no beer or other allowance.

In Dorsetshire, Mr. Saunders, of Watercomb Farm, Dorchester, writes to me as follows:—

"In answer to your inquiry respecting the wages of the labourers of this part, I will give you an account of what I pay my agricultural labourers of different callings. They all live on the farm near their work, where it is convenient for most of them to go in to dinner every day. I have 18 cottages for which I never receive any rent, as my men all live rent free, and most of them have good gardens besides other potato lands free. It is a very great accommodation to labourers to reside near their work, quite equal to 1s. per week to a man not to have to travel a mile to his work morning and evening, and all have their regular pay wet or dry weather, no loss of time except they are working by piece work, which most of them get in their turn during the year, when they generally earn from 10s. to 15s. per week, according to circumstances, besides their yearly privileges, which I will state below, and which many of my labourers have said to me at different times 'is nearly half our living,' referring to a cottage and garden, potato land, and the privilege of having grist over that of buying bread of a baker, as I regulate the grist by allowing a peck a head to the family of workers in a house. I think our system is nearly equal to other counties, where they give nearly double the wages, and no house nor other privileges, nor pay for wet days. In this county we agree for a family at a certain sum from the 6th of April to the 6th of April in the following year; some of my men have continued on my farm with me for more than 30 years without change, where they are good labourers. This I believe is about the general run of our county as an average. I will now state how, and in what way I pay my horse-men, as you term them:—

	£	s.	d.
House, good garden, worth to let, £4 per year	4	0	0
Weekly wages 8s., and 30 perch of potato land ploughed in with their potatoes, often growing 15 sacks, now worth 10s. per sack, and allow the seed out, would be £5 ...	25	16	0
200 Furze faggots, carried home free to the cottage	1	0	0
28 cwt. of best coals, carried home at 1s. per cwt. and cost to fetch from ship	1	14	0
Extra for harvesting, cash £1, and one gallon of ale per day	2	0	0
Every journey with team, 1s., average one per week ...	2	12	0
3 quarts of ale per day at haymaking, for eight weeks, at 9d. per gallon	1	7	0
1 bushel of wheat per week, if a family of small children, none to go to work, at 5s., not much advantage now, say 6d. per week, but when dear 3s.	1	5	0
	£39	14	0
The whole of horse-man's wages is about 15s. per week.			
My shepherd has the same as the horse-man, except he earns about £3 extra for sheep which he shears when no pay is taken up from him, and he has 1s. per score for all lambs bred, which at about 600, is £1 10s.; and also 6d. for every ram let or sold, generally £2 10s. in all ...	7	0	0
Take from this the difference of carter's journey money, which is	2	12	0
Leaving in favour of shepherd...	4	8	0
Wages and perquisities as carter's account	39	14	0
	£44	2	0

Shepherd's wages weekly 17s., all but 2s. in the year.

Labourer 7s. per week, house as above, garden, potato land in many cases, 200 of furze, 15 cwt. of coals; grist, as I have before stated, at one peck per week for every one who works, great and small, some at 5s. per bushel, and some at 6s. per bushel, and most of my labourers have piece-work at different times of the year when convenient. I consider, on an average, a good labourer's place with me is full 12s. per week.

This is a most elaborate scheme of payment, and certainly a very liberal one, though I do not value the items so highly as Mr. Saunders does by about £6 a year, making the yearly wage of his ploughmen £33 14s., or as nearly as possible 13s. a week. Now, over large districts in England another system obtains, of which Mr. Manser, a tenant farmer, at Dumpton, near Ramsgate, gives the following very interesting account:—

"Our ploughmen here are generally single, and yearly servants, and are boarded and lodged by the farmer or by his bailiff. They are hired from the 11th Oct. to the 11th Oct. each year, and though they sometimes continue for several years with the same master, a fresh agreement takes place every year. They commence as lads at 13 or 14 years of age; their duties then are to drive the horses and attend to them in the stables, and we almost invariably find that the younger these boys go to service (as it is here termed) the better ploughmen and the better labourers they afterwards become. They begin at about £5 wages per annum, which is usually increased every year, as their strength and ability increases, or as master and servant agree; the increase goes on at a ratio of about £1 per year, and our head horse-man or waggoner gets from £12 to £14 per year; the cost of their board varies according to the price of provisions, and when they are boarded by a third party it is generally partly in money and partly in kind; they always have meat three times a-day, and cannot be boarded on an average at less than 8s. per week per head. In some few instances where there are cottages near, married men are employed as ploughmen at wages of 14s. per week, and a cottage rent-free; if they have to pay rent they are usually allowed about £5 extra for harvest, in addition to the 14s. per week." He adds, "Our labourers pay about 2s. 6d. per week rent for their cottages, and for this many get but a miserable home. I know of nothing in this neighbourhood so disgraceful as the want of accommodation for our labourers. They are (many of them) driven to reside in the worst parts of the towns, many of them in hovels, built or rather stuck up for the sole purpose of investment, without any regard to health, comfort, cleanliness, or morality. No garden attached, or anything else to make a poor man's home comfortable, completely away from the eye of his master, and all others that feel an interest in his welfare. The consequences I need not describe; with every inducement for him to spend his spare time and his hard earnings at the public-house or beer-shop, often having from two to three miles to go in all weather to his labour, never knowing the luxury of hot dinner except on a Sunday, or a meal with his family; the children run the streets in the

worst parts of the town, and get early imbued in every vice and wickedness. With no father near to instruct or correct them, how can it be otherwise? I do hope this subject will be pressed before the public on every favourable opportunity. I find on examining my labour account that my best men, on an average of the year through, earn about 16s. per week, or a little over £40 per year. This includes harvest and haymaking, as well as lost time from weather or other causes, and is the man's earnings independent of the rest of the family."

For all these various customs of payment there must of cou se be the general assent of the labourer, and the concurrence both of master and servant, in order to their establishment and maintenance; and so long as a labourer agrees to take certain wages there is not the shadow of a place for interference by any other person between him and his master. The fitness of customs, however, whether in the interests of agriculturists who find that labourers are more difficult to hire, or in the interests of labourers themselves, may very properly be discussed, even by those who have no greater interest in the subject than that which they hold in the well-being of any other class of their fellow-countrymen.

It is plain, on a very short acquaintance with the subject, that every system which has been, and I will say can be, devised, is liable to abuse. And this, moreover, is also true—that each is liable just in proportion to its excellence in the hands of a well-disposed man. The direct payment of a stipulated sum of money for stipulated services to be rendered is, of any plan of wages, the least liable to abuse; but it is, at the same time, that which furnishes the least scope of any for the establishment of friendly relations between masters and men.

Then, on the other hand, that system which gives food and fuel and accommodation is the best of all, when administered with kindness; for the extras are worth to the labourer much more than the sum at which they would be valued to him in a money payment; but there can be no doubt that it is more liable to abuse than the simple money payment. The abuse of the money payment, it is plain, does not affect the relation of labourer and employer at all; it lies in the scope afforded by it for the utter ignoring of the man in any other than this relation. The abuse in the case of payments of food, &c., does affect the due reward of labour; for, notwithstanding the agreement on this score, the quality of all these articles cannot be defined so exactly as their quantity. The payment, too, of all this household stuff as wages is a thing which affects householders only, and the young men who are leaving us are those whom we want to keep. To do so, then, as Mr. Mein, a large employer of agricultural labour, tells us, we must just offer wages which will keep them. That is the simple truth.

It is not however the whole truth of the matter. It must be admitted that the relation of master and servant is, by force of circumstances, mixed up in agriculture with much besides a mere bargain for the sale of services, with much that is personal; that there is much more scope for the development of kindly personal feeling between the two than there is in the case of any other class excepting household servants. Of course this personal feeling may show itself in much that is of great money value besides mere wages, and in much that is of higher value than money is capable of measuring. A young man will, notwithstanding lower wages, keep his place for the sake of advantages of greater value to him than the increased sum he might otherwise receive. He may see that his master takes an interest in him personally, showing it in helping forward his education, and by seeking ultimately a better position for him than he can offer himself, and this is soon observed and thought of. But there is a reverse side to this picture, and just in proportion to the closeness of contact which the terms of service enforce between the two *may be* their recoil asunder as soon as they are once more free.

If there be a plan which would strengthen the bond between the two more than any other, one would imagine it to be the very common one in England of lodging the younger labourers in the farm-house, and giving them partial board as well as cash. But what is the ordinary experience on this point? In the parish in which I reside, Old Michaelmas Day sees a complete sweep of the young men and lads who have lived during the past year in the house of their master. The evening schools each winter present a new array of faces—and the masters are for a while at least and necessarily as much strangers to their lads and many of their men as if they paid their wages through a clerk, and had as little opportunity of personal acquaintance as a manufacturer with his hundreds of mechanics.

It is plain that it is not in the *system* but in the administration of it that merit and demerit lie, and that, while sufficient wages (that is, just as much as labourers can get) are given, a personal interest in the labourer as a neighbour is what will bind him to his master.

If I had in a single sentence to describe the relation of master and servant in the agricultural world, it would be to assert that nowhere is it better and nowhere is it worse. The two are thrown close together, and character is on both sides known, and therein lies the explanation; the two are never—as is unavoidably the case when one man pays 500—they are never indifferent to one another; they love, honour, and respect one another, or they distrust and hate: and while, in the former case, there is a noble scope for exerting a useful influence for their well-being over those who are employed—the latter, in the very closeness which is the condition of agricultural service, has scope enough for bringing forth its fruit.

The combination of sufficient wages, with a greater opportunity for personal good-will than any other trade affords, is what may, and often does, honourably distinguish agricultural labourers and employers amongst the multitude of English occupations.

One further word and I have done. The whole value of the expression to which this good-will leads arises out of its origin in a personal feeling—it cannot be deputed without altogether losing its character. Anything like the transference of my personal duty and pleasure in such a thing to a public society does, in my opinion, spoil the whole affair.

There are societies, as we all know, long established in England for distinguishing the worthy among agricultural labourers by public testimony to their worth. If that worth had shown itself in public-spirited conduct, nothing could be more appropriate than a public acknowledgment of it. When it is, however, only personal and domestic worth (far more worthy, let us all admit it, than the other), nothing can be more grotesquely out of place.

These societies have however been established and are supported by a real if unwise philanthropy, and I would not say one word in discouragement of their object, however unwise may be their plan. Benevolent men have truly seen that the relationship of master and servant is but a part of the truth affecting them and carrying the superiority of the employer over his servant into another field where no superiority exists, they have read the commandment, as if it were addressed to the former only, and as if it said of the latter: "Thou shall be a father unto him." The system of rewards for good conduct, for long servitude, and for morality, is founded on a mistaken idea of this kind. It is a mistaken idea—let me repeat it. Along with the paternal relationship, with its powers and responsibilities, wherever it really exists, there has been implanted the natural love of the father as the safe-guard of the child, and the docility and helplessness of the child as its counterpart. Neither of these conditions apply to the relationship of master and servant. The commandment has been mis-read. It is really addressed to both alike, and it prescribes a perfectly mutual and equal duty in words addressed to each —"Thou shalt love thy neighbour as thyself."

This is the law which supplements the bare relationship of master and servant, and makes the operation of

it perfect. But I will not pursue the subject further, only adding as at once the natural corollary of this proposition, and as bringing us back more directly to the subject of this paper, that the more we encourage genuine individual manliness in our labourers with its efforts after real self-improvement, in intelligence and skill, and its higher sense of individual responsibility, the more likely are we to attach the young men to us, and to obtain labour of the kind of which steam-power is rapidly proving the necessity. This is not to be done, either by taking all the difficulties of his position out of his way, or by offering rewards to him proper only to the qualities and condition of a child.

As affecting the reception of these few words of criticism, allow me to say one word of myself:—They must not be received as if they came entirely from an outsider. I have for many years directed and paid the labour, on certainly a small farm, costing, however, about £700 a year in wages paid to the agricultural labourer. I claim to know the style and character of the man by many years' experience; for I have a larger number of personal friendships in his class than in any other class of her Majesty's subjects. I mention all this merely as affecting the weight which might attach to what I have said on this—the last of the forces used in agriculture to which I have to allude. I have more than exhausted the time permitted me, and it only remains for me to indicate the probable results, so far as our subject is concerned, of that progress which we all see in English agriculture.

That the services of the labourer will more and more require the combination of skill with mere force, and that a larger number of well-qualified men is being and will be needed, seems plain. That horse-power will be displaced by steam at least two-fifths, I believe; and, as there are now at least 800,000 horses used upon our farms, there is scope enough for many years to come for all our agricultural mechanics.

The grand result will, no doubt, be a continual increase of produce and fertility, and that which the Registrar-General puts as a fulfilled prophecy into the mouth of the Englishman of a century ago may with equal probability of truth be uttered now:—

"Our fertile soil sustains 21 millions of people in its whole length from the Isle of Wight to the Shetland Islands. We cannot—for the mighty power is not given us—say, let there be on the European shores of the Atlantic Ocean—Three Great Britains. But the means exist for creating, in less than a hundred years, two more nations, each in number equal to the existing population; and of distributing them over its fields, in cottages, farms, and towns, by the banks of its rivers, and around its immemorial hills: and they will thus be neither separated by longer roads nor wilder seas, but continue neighbours, fellow workers, and countrymen on the old territory; wielding by machines the forces of nature, that shall serve them with the strength of thousands of horses, on roads, and fields, and seas—in mines, and manufactories, and ships. Subsistence shall be as abundant as it is now, and luxuries, which are now confined to the few, shall be enjoyed by multitudes, for the wealth of the country—its stock and its produce—shall increase in a faster ratio than the people."

DISCUSSION.

The Chairman said it was now his duty to invite the meeting to discuss the very able paper they had heard read. It appeared to him that there was very little question that steam power theoretically was a much more economical power than horse labour, and horse labour again more economical than manual labour. But the great problem to be solved in agriculture was, what were the proper proportions in which these three forces should be made use of. There could be little doubt that it would be found eventually that the proportions between those forces found to be most economical, would differ in proportion to the size of the farms, and also the quality of the land. The question whether steam power would be found most economical upon heavy lands and small farms, or upon light lands and large farms, was one which opened a large topic for discussion, and upon which he was sure many gentlemen present would be anxious to express their opinions.

Professor John Wilson would rather give a different version to the case. He thought they must look upon the man, upon the horse, and upon the steam-engine, not as sources of power, but as the media through which power could be communicated. The real power existed in the material upon which those three forces were fed, and in this respect he thought he could show them that the whole question was one of pounds, shillings, and pence. They knew very well that a steam-engine could not work unless they gave it coals, and a certain amount of water; a horse could not work well unless it was well fed; and a man could not work unless he was properly nourished, because the force existed in the food which these three engines or machines, as they might be called, consumed. They had heard from Mr. Morton of the manner in which these three machines were fed. They knew it was to the interest of those who employed a steam engine to have an efficient one, and a low-priced engine was a dangerous tool to play with. They knew how proud a man felt of a handsome team of horses, and how well they were fed and attended to. But did they pay that attention to the agricultural labourer? Was it not the fact that he did not receive the same amount of attention as the other two sources of power mentioned? If therefore the man was to be placed in competition with the machine, he ought to receive the same amount of attention as the machine did; otherwise he was placed at a disadvantage, and he thought it should be the policy of the employer to remunerate the labourer in such a manner as would enable him to get the largest amount of work out of him. He spoke, of course, of physical force—not mental. The mental force required another mode of treatment. The steam engine could work without horses, but it could not work without the application, not only of a small amount of hand labour, but also of skill. They must therefore look upon these three applications of power as the media through which the power was communicated; the real generator of power was the substance supplied; and that was the subject of pounds, shillings, and pence—the real question for farmers to consider, for in that their principal interest was involved. He had heard, with some surprise, the statement as to the condition of the agricultural labourers in Wiltshire. With regard to the north it was the fact that a very numerous body of that class of labourers, though not actually on strike, were almost in that state, having had several meetings amongst themselves to discuss these matters. He hoped the good sense of the employers of labour there would come to the rescue, and lead them to give proper consideration to some strong points which had been brought before them, though he was no advocate for strikes. In all cases where they set men to hard work—such as that on railways, it had been found that a badly fed man could not exert the power which a well fed man did; and he thought no one could reasonably expect that a labourer at eight shillings a week was capable of doing a full amount of work, so as to be fairly placed in comparison with either a well fed horse or a properly supplied steam engine.

Mr. Smith (of Woolston) stated the mode in which he had arrived at some of the returns furnished by him to the author of the paper, so as to explain any apparent discrepancies between his own and the other returns. He bore testimony to the great value of Mr. Morton's paper. According to the estimates given by Mr. Morton, in which he entirely concurred, the saving of steam-power over manual and horse labour amounted to nearly 50 per

cent.; and, upon the total number of horses at present employed in agriculture, there would be a saving of 300,000, or equal to £9,000,000 a year, one-half of which would be real gain to the country. If the other half went into the pockets of the labourers in the shape of increased pay, it would be a matter of gratification to him; for he believed the increased production of the soil under steam cultivation would still enable the farmers to secure their profits.

Mr. S. Sidney thought that the time had scarcely arrived for working out the Chairman's suggestion, and ascertaining the comparative amounts of hand labour, horse labour, and steam labour that could most profitably be employed on a farm of given quality and acreage. Steam cultivation had, within the last two or three years, been brought to the stage of an economical success, but until Mr. Fowler, Mr. Smith, and others, had fully supplied all the customers who were clamouring for steam cultivators, until it was as easy to obtain a steam cultivator as a set of barn machinery, the calculation suggested by Mr. Lawes could not be made over a sufficiently wide area to give it any practical value. The high importance of Mr. Morton's paper lay in the fact that he had availed himself of his peculiar advantages, as editor of an established agricultural newspaper, to collect precise facts, showing the present state of British agriculture, and specially in reference to the employment of manual power, horse power, and steam power. Thirty years ago the ratepayers of the kingdom were labouring under perpetual fear lest unemployed unskilled labour should devour in poor rates the whole substance of the land, and under the influence of this terror various expedients were proposed, by men eminent for rank, talent, and literary ability, to increase the amount of manual labour. The horse was to be dismissed, as working too much and too cheaply, and we were to retrograde to the spade. This was one of the theories of Robert Southey—cottage farms and spade cultivation—and it was supposed that there was a sort of magical influence in the spade, which would, in some mysterious manner, multiply without measure the fertility of the soil. A great name in political economy, Mr. John Stuart Mill, who, however, had failed totally whenever he approached practical questions of trade, colonization and agriculture, had suggested pauper colonies in Ireland, where a number of five-acre farms were to be cultivated with borrowed capital, spades, and hoes. These terrors and these fallacies had past away. Mr. Morton had shown, by facts and figures, what everyone familiar with the agricultural condition of the country knew by common report. Instead of being deluged with labour there was a positive drought. Wages were rising, and farmers were consulting and contriving how to attract and retain the class who, thirty years ago, were treated by the poor law and its administrators as if they were some noxious vermin, whose increase was to be obstructed by every possible means. Mr. Morton had shown by figures, which were rather under than over the mark, that while the system of mechanical and intensive cultivation increased, the demand for manual labour in those departments where machinery could not be employed, had increased also; that wherever a horse could do a man's work, it was more rapid, more effectual, and consequently cheaper, and that wherever steam power could be applied, it was even cheaper compared with horse labour than horse labour was when compared with that of man. It must be observed that economy in agricultural operations meant more produce. The exertions of agricultural engineers had destroyed the fallacy of the spade (most valuable in its place) as a means of raising the sustenance of the nation. He (Mr. Sidney) had made a few calculations, for the purpose of giving some idea of how much was gained by the improvements which had brought mechanical ability of a high order, and the science of the chemist, to assist in the cultivation of English farms of average size and fertility. Mr. Smith's farm, at Woolston, in Buckinghamshire, consisted of 110 acres of arable and 70 acres of grass, of good quality. The labour appeared to be performed by seven men and four boys, equal to nine men, the number usually taken to represent in England 45 souls. These men lived, he undertook to say, better than the peasant cultivators of France and Germany. Were this farm divided into six-acre farms, it would probably support double the number of peasant proprietors; it would keep no sheep, a goat or two, no ox-beef, but an occasional supply of the flesh of a worn-out milch cow. There would be, as surplus, a little wheat, rye, and, perhaps, flax. The arable would be fallow every third year. But with hand-power, horse, and steam-power, he (Mr. Sidney) would undertake to say that the Woolston farm, being never in naked fallow, produced 6 quarters to the acre, but say 5 quarters on 27 acres, or 135 quarters of wheat, 135 quarters of barley, and with clover and other green crops, roots and beans, at least seven thousand pounds of mutton from 100 sheep, two thousand pounds of pork, from say 10 pigs, and an increase on cattle, purchased or reared, of five thousand pounds of beef; in all, fourteen thousand pounds of meat, besides feeding the family of the farmer himself. These calculations, very much under the mark, would show, not only that full-sized farms were necessary to support agricultural progress, but that it was on large farms, as distinguished from five-acre farms, that the nation must be fed. Mr. Morton's paper had conclusively shown that this progress had been obtained with positive benefits to the labouring classes, who had not been sacrificed, as was once feared, to machinery. He (Mr. Sidney) thought that the distressed classes now were the farmers, hard driven for labour, with high wages and low prices. He believed their only safety and resource lay in adopting steam cultivation, and tempting labourers to stay and increase by improved cottage accommodation. The wages question settled itself, and was beyond the power of laws.

Mr. Edwin Chadwick, C.B., had rather expected that the discussion would have turned upon the points which the chairman had suggested, namely, upon the comparative value of mechanical forces; but he was glad to find that it had been directed to the social and economical effects either already obtained or promised by the introduction of machinery into agriculture. It was most important to discuss the effects of machinery upon the great mass who had to use it—the labourers. In the statistics given by Mr. Morton of the rise of wages, he (Mr. Chadwick) submitted that one large and important fact was omitted. Mr. Morton had stated the progress of wages in different counties, but he had not mentioned another progress, viz., the progress of the efficiency of the labourer; because, according to his own inquiries, the efficiency of the labourer had borne its relation to the improved forces introduced. The farmer in Dorsetshire only paid 8s., and the farmer in Lancashire and some of the northern districts paid 16s a-week, and the latter got his work done cheaper at the higher wages than it could be done at the lower. Moreover, there was yet room for further improvement by the advance of wages to the operative class. Some time ago there was a notion of getting up a Land Improvement Company, the object of which was to improve particular districts, and to put the land into better condition, by employing a better class of labourers. Those who were engaged in that project were good judges of labour, and they proposed, as the cheapest plan, to employ, not the agricultural labourer of the district, where the law of settlement and low wages prevailed, but navvies whose wages were 3s. per day. Truly efficient labour, he submitted, could only be obtained by the advance of wages. The increased development of labour which the improved circumstances of the country would produce, would effect this object. The extensive emigration that annually took place, and the

demand for labour in manufactures would raise wages; and he expected and hoped that it would bring this country into the condition of the American labour market, and give an immense stimulus to the introduction of machinery. With respect to what had already been done, he would take the opportunity of congratulating his friend, Mr. Wren Hoskyns, that in the introduction of steam for ploughing, which he had so long laboured for, the corner in the shape of profit over manual labour had been turned. He might mention, by way of contrast, looking to the state of things abroad, that in many parts of the south of France the constant price of ploughing by oxen was at the present time five francs a day for the men and the oxen to do the work, whilst the amount of work done was a quarter of an acre per day. That was paying at the rate of 20 francs per acre, but it was a mere scratching of the surface of the soil some three or four inches deep, whereas steam-ploughing did the work much better at about one-third or one-fourth that price; in other words, the light land which the farmer in France paid 20 francs an acre for ploughing in that way, could be done by the steam-ploughs now in use at 6s. per acre, and instead of being ploughed three or four inches deep, it would be ploughed seven inches deep. The economical, as well as the social part of the question, was, he thought, well resolved by a labouring man on one occasion, when he (Mr. Chadwick) went to see Mr. Smith's plough at work upon the farm of the Prince Consort. Upon his asking the man how those steam-ploughs answered, the reply was that they answered exceedingly well, as he (the labourer) got half-a-crown a day wages. He (Mr. Chadwick) was extremely desirous to see the use of steam culture extended, because he was sure wherever the steam implement went, two shillings or half-a-crown wages per day would go with it. But in contemplating the extended introduction of machinery, one important point must be considered, viz., the state of education of the class of agricultural labourers, upon whom the management of these new steam implements would devolve. In the larger use of that same power in the manufacturing districts, it was the frequent remark of Mr. Fairbairn upon coroner's inquests, when accidents occurred by the bursting of steam boilers, that for the proper management of the steam engine a higher degree of education was required than had yet been applied to the labouring classes. If that were so in places where they were paying 20s. or 25s. a week wages for the management of an engine, what must be the case in the agricultural districts, where the wages were so much lower? It was only by the exercise of intelligence and watchfulness that they could reach the highest order of economy. That had been peculiarly displayed in the case of the Cornish engine, in the use of which men were put upon piece work, which was not the case in the north. There had been great improvements in the steam-engine in Manchester, but in Cornwall they did as much work with 2½ lbs. of coal as was done in Manchester with 10 lbs. It was found that farmers were frequently dissatisfied because their engines did not realise all the promises of the manufacturers of them. The answer to that was, that the fault was not with the engine, but with themselves, in not employing more intelligent men to superintend it, and in order to do that they must pay bettter wages. But unfortunately, in the present state of education in the agricultural districts, if higher wages were offered, the men were not to be found to do the work with the greatest amount of economy, and in order to attain this end, their education must be improved. It was true that prodigious advances in that direction had been made. On going into one of the district schools that day, where a steam-engine was used to prepare the food, he found that boys were placed under the men for the purpose of being educated in working those engines. He thought this was largely an educational question. Besides the employment of machinery, which was so valuable, he thought the small farmers should not attempt a too great use of steam-power, and that there were many useful lessons to be learnt from America, where labour was dear, and also from the continent, were coal was scarce. He would conclude by expressing his high opinion of the remarkably able paper which had been read.

Mr. Wren Hoskyns said, if he had wanted evidence of what the general advancement of agriculture in this country had been able to effect, it could not be more satisfactorily furnished than had been done in the eloquent and philosophical paper they had heard that evening. He was struck with the tone of the paper; because, although the subject was a physical one, yet it went also into the metaphysical portion of the question, and all those who read it, whether connected with agriculture or not, could not but consider it as a most useful production, showing that agriculture had made other strides than in matters connected merely with mechanical improvement. With regard to the remarks of the chairman as to the desirability of establishing something like a specific relation between the forces now employed in agriculture, he (Mr. Hoskyns) had come to the same conclusion as Mr. Sidney —viz., that they had not yet sufficient data for the discussion of that question, because he could not submit to the idea that they had as yet attained to the development of the steam-engine in the cultivation of the soil, which they were destined to witness. Far be it from him to derogate from such splendid specimens of well-applied labour and employment of capital with a courage and determination not surpassed in any department where human ingenuity had been applied, as had already been afforded by the use of the steam engine in agriculture; but, for specific reasons connected with agriculture itself, he could not believe that the point at which they had now arrived, afforded a true test of comparison between the steam engine and horse and manual labour. One reason why the problem was more difficult, was that the varieties of soil were so much greater than many people were aware of. The difference between the cultivation of light soil and stiff waxy clay was as great as possible, and any conclusion at present arrived at could only be of a very general character. For when they said a steam engine would plough a shilling per acre cheaper than by the ordinary method, it could only apply to some general average of the soil. But when they saw what horse labour could do upon light soils, where they could cultivate every day in the year, because the labour was less severe, and compared that with soil which did not allow of access to it, except for a month in spring and a couple of months in autumn, the comparison between horse labour and the steam-engine was most difficult. It had been stated by Mr. Mechi that a horse required sixteen hours of rest for eight hours of work. That was understating the case, because a horse required eight months of idleness for four months of work, on a soil which would not admit of the tread of his foot except when sufficiently dry for profitable cultivation to take place. He could not conclude without a word upon the condition of the agricultural labourer, as spoken of by Prof. Wilson. There was no doubt much truth in what the professor had said. A fair estimation of what the labourer was able to do, was not possible, because his powers were not entirely brought out—either in a physical or moral point of view. If they had more skilled and intelligent labour, they would have better results from the elements composing it, and especially from that best element of all —the will. He did not know a better foundation for this than a juster distribution of the labourer over the soil, and increased facilities for restoring the due proportion of cottages for the residence of the labourers near their work. Owing to the imperfect laws which had reduced the means of living near their work, it was a fact that labourers did half a soldier's day's work in going to and from the farm. He hoped that residences would be pro-

vided for the labourers, in a way that would make them a better investment of capital than they were at present. For some reason or other, which it was difficult to fathom, cottage accommodation could not be provided, so as to make it profitable. One of the best inducements to provide this accommodation would be the power of doing so without loss to the landlord.

Mr. Howard (of Bedford) said he agreed with every statement in the paper. He subscribed fully to the opinion that the general employment of steam power in agriculture would tend to increase the employment of labourers. Within his own knowledge it had in a small degree extended the growth of root crops, and he could refer to a case in which 35 acres of roots were grown upon land which had never before been so cultivated; and if they grew root crops they increased the crops of corn, and increased also the employment of labour. Looking at the increase of population in this country since the extension of steam-power in our manufactories, they would be surprised to find that it took 200 years, previously to the introduction of the steam-engine, to gain an increase in the population of 2,000,000, whilst since its introduction the population had increased 10,000,000. He thought the most effectual means of raising the intelligence of the farm labourer was a more general introduction of steam-power. A farmer who paid a man merely to swing a flail, could not afford to pay for intelligence. It was nothing more than the exercise of brute force; but to a man who paid £500 for a steam-engine, a shilling per day additional would be a trifle in the wages of the men he employed to direct that machinery. If they sought to raise the intelligence and wages of the labourer, the surest means of effecting it was the more general employment of steam-power.

Mr. Alderman Mechi said he felt it nothing less than a duty to pay his tribute of thankfulness and admiration to Mr. Morton for his able paper. He entirely agreed with the tenor of it. He was quite sure that in his calculations of the economy of horse-power over human labour, and of steam over horse labour, Mr. Morton had not overstated the case. He (Mr. Mechi) had employed a steam-engine on his farm for the last ten or eleven years, though it was regarded by his neighbours as an act of folly to use a steam-engine upon a farm of 170 acres. His experience during that period had convinced him that the employment of steam-power had not diminished the demand for labour, but had rather increased it, whilst it produced a most beneficial effect upon the profits of the farmer and the intelligence of the labourer. They were all creatures of prejudice, but he had yet to learn that agricultural prejudices were stronger than those of other people, and he hoped that the showing of Mr. Morton that £50 out of £100 could be saved by the substitution of steam-power for horse labour, would tend very largely to remove all prejudice upon that point. With regard to the scarcity of labour, no doubt the cause had been correctly stated by Mr. Chadwick. When they looked at the vast increase that annually took place in the exports and imports of this country, they must see that the mere keeping the accounts, and the handing of the goods about, must absorb an enormous amount of labour. Looking at his own immediate locality, he found that men had been abstracted from agriculture to be employed in the manufacture of implements for foreign exports. He also found that the knowledge that better wages could be obtained in our colonial possessions induced many to emigrate who had derived considerable advantage from that emigration. Still he thought a good master had not much trouble in getting good labourers. He had employed the same men for many years, and they had become intelligent by the improvements carried out upon the farm. Those men still remained with him, and he had no difficulty in getting in his harvest at a moderate rate of wages, whilst others complained on that score. He agreed with what had been said, that something more ought to done than the mere payment of wages and the using men as machines which could be laid aside at any time. There was the relation between the employer and the employed to be considered. With a proper regard for that feeling, and by a more general introduction of piecework, which was, after all, the cheapest, he experienced no difficulty in getting and retaining men of great physical and improving mental capacities. With regard to the economy of horse-labour and steam, they must look at it not only in a pecuniary point of view with respect to the direct saving effected, but also to the amount of land that was set free for the production of human food by that substitution, namely, by feeding those 300,000 horses with coals instead of with corn and hay. He calculated that at the lowest estimate, there would be in the United Kingdom 2,300,000 acres of land set free for feeding human beings instead of animals. That alone was a great desideratum in these times, when population was pressing so hardly upon production. With regard to the various applications of steam-power in the operation of a farm, looking to the improvements they might expect to be made, he saw no reason why, by improved arrangements, in addition to the turnips, &c., being cut up, the food should not be delivered by means of machinery, and why steam should not be made to do nearly everything upon a farm which was now done by manual labour.

Mr. Thomas Scott said it was a gratifying fact which they had heard, that the great pioneers of steam culture—the inventors—had more orders upon their hands than they were able to keep pace with. The whole subject of this evening's discussion had been in fact reduced to the great agricultural question of the day—steam cultivation; and when Mr. Hoskyns said it was judicious to wait a little longer, he (Mr. Scott) would only say that three or four years ago he felt for those great self-sacrificing inventors, but he was happy to add that no such feeling was now called forth. Having noticed the results of steam cultnre upon the crops, he found that they were such as justified any man in adopting the present machinery, even admitting it to be still far from perfect. A few days ago he entered into an examination of the cost of the operation by Fowler's steam plough, extracted from the carefully kept books of a farm, and he found it to be 4s. 4d. per acre as the actual cost, to which must be made a fair addition for repairs and allowance for wear and tear. If that were the fact, the cost of steam ploughing was very much less than that of the common ploughing, and the produce of the land was greater. It was therefore manifestly to the interest of the cultivators of the soil to abandon the present system, which entailed a daily loss, and to avail themselves of steam machinery, now that the opportunity was afforded them of doing so. He recollected an instance in which some improvements in cotton spinning were devised, which were severely criticised at the time, and when a friend of his asked an old cotton spinner why he did not adopt the improvements, he replied that it was only ten years since he had put up his machinery, and he should wait till it had repaid the cost before he put up new machinery, although it was clearly pointed out that he was doing so at a loss of £50 per week. So it was with those who persisted in the use of horse labour instead of steam-machinery. It had been shown that there was an advantage of fifty per cent. by the employment of the steam-plough; he, therefore hoped that those who were holding back for improvements would be induced to adopt the machines as they were at present, when the advantages they derived would be such that they would be in a position to avail themselves of any improvements that might be hereafter introduced.

The Chairman said he had great pleasure in proposing a vote of thanks to Mr. Morton for his valuable and important paper. At that hour of the evening he would not

detain the meeting farther than to remark that it had been very clearly put before them that the employment of steam power had a tendency to increase the demand for agricultural labourers, the amount of their wages, and also their intelligence. That was a point which was, to his mind, more important than any other which had been brought forward.

The vote of thanks was seconded by Mr. Wren Hoskyns, and passed unanimously.

Mr. Morton, in acknowledging the high compliment paid him, wished to take this opportunity of returning his best thanks to those gentlemen who had been kind enough to answer the troublesome inquiries he had addressed to them upon matters of fact which he had introduced into his paper.

The Secretary announced that on Wednesday evening next, the 14th inst., a paper by Mr. William Hawes, "On the Great Eastern," would be read. On this evening R. Wygram Crawford, Esq., M.P., will preside.

EXAMINATIONS.—HERTFORD LOCAL BOARD.

A public meeting, convened by the Hertford Local Board, for the purpose of explaining the objects of the examinations instituted by the Society of Arts, was held at the Town Hall, on Thursday evening, the 1st December. There was a very numerous attendance, and the attention paid to the addresses of the various speakers showed that the subject was generally regarded as one of interest and importance. The Rev. J. W. Blakesley, B.D., Chairman of the Local Board, presided. Amongst those present were—The Right Hon. W. Cowper, M.P.; Sir Minto Farquhar, Bart, M.P.; The Mayor (H. Gilbertson, Esq.); Harry Chester, Esq., Vice-President of the Society of Arts; Hon. and Rev. Godolphin Hastings; Revds. C. Deedes, G. E. Arnold, G. Yeats, J. Christie, T. Lander, and W. Spencer; Dr. Woodhouse and Dr. Towers; Messrs. J. J. Gripper, Y. Crawley, G. Ludlow, G. Hancock, &c.

The Chairman said he could not take the chair on this occasion, without expressing his sincere wish that some gentleman occupying a more prominent situation in the neighbourhood than himself had been appointed to the post. He desired to declare his hearty approbation of the great movement of which the institution of the Local Board in this town was one part. It was but a humble part of a great machine, but it was a useful part—a sort of connecting link between the Society of Arts and those who were to be benefited by the system of examinations it had instituted. The Local Board in this town would know something of all the persons who offered themselves as candidates for examination; they would be able to point out to them their essential defects; and he trusted they would not seldom be able to put them in a way of overcoming those defects and of eventually obtaining the coveted distinctions conferred by the Society of Arts.

The Right Hon. W. Cowper, M.P., said—That the Hertford Literary Institution, of which he had the honour of being a member, had long been considering how they might secure for Hertford the benefit of the schemes of adult education which were extending themselves through the country. The plan of examination instituted by the Society of Arts had been so useful in many towns, that they thought it might with advantage be introduced into this. The Literary Institution had, therefore, taken steps to form a Local Board, and the Board had appointed as their chairman a gentleman whose attainments and character were a guarantee that its influence would be used for the best purposes, and that it would maintain the character which they all desired such an important body should maintain. The functions of the Local Board ought to be limited to conducting the Previous Examinations, or assisting in the general examinations, but he hoped it would take upon itself to review the means of education in the town, and to set on foot some better means of teaching than had hitherto existed. Mr. Cowper went on to show the benefits which would accrue to those who availed themselves of these aids to self-education. He thought there was no occupation which shut a man out from so employing his leisure time as to succeed in obtaining the distinctions which the Society of Arts offered. Alluding to the early-closing movement, to which he cordially wished success, he pointed out what favourable opportunities this would afford for the improvement of the mind by study, and concluded by proposing the following resolution:—

"That the operation of the Local Examinational Board, in union with the Society of Arts, recently established at Hertford, is calculated to be highly beneficial to this locality."

Sir Minto Farquhar supported the resolution.

Mr. Harry Chester said—He came to the meeting as the representative of the Society of Arts, and he would explain to them what the Society of Arts was, and what were its objects. Mr. Chester then gave a brief account of the origin and past history of the Society, mentioning the fact of its having originated the great exhibition of 1851, and alluding to the measures it was now taking to have another great international exhibition in 1862—if there should be peace, or a great national exhibition if there should not be peace. He then stated what were the nature and objects of the Union of Institutions with the Society, and explained the mode in which Local Boards should co-operate with the Society's Central Board. These examinations were open to all the world, and any one could offer himself for examination, through a Local Board in union with the Society. The working man could come in and take his certificate as well as the man who had received a higher education. But they did not allow persons in the higher classes of society, or persons who had received a superior education, or certificated schoolmasters, or pupil teachers, to compete for the prizes. They might try for a certificate, because all who got 75 marks were entitled to a first-class certificate; but if they allowed them to compete for the prizes, it would not be fair towards those who had fewer educational advantages. Mr. Chester then proceeded to speak of female education in connection with female employment, which had lately engaged so much attention, suggesting that there was no reason why women should not be employed in book-keeping, as they were in France. He concluded by recommending a union of the literary institutions of Hertfordshire, whereby greater facilities could be obtained for carrying on adult instruction, by the employment of lecturers and teachers for the whole county.

The Mayor of Hertford (Mr. Gilbertson) adverted to the mode in which the question under consideration had been brought before the inhabitants of Hertford, through the instrumentality of the Literary Institution, which had taken up the matter very warmly, and had liberally determined to admit, without charge, as Associates of the Institution, persons giving a *viva voce* declaration of their intention to study with a view to examination. He concluded by proposing the following resolution:—

"That this Meeting pledges itself to use its endeavours in furthering the object proposed by the establishment of the Hertford Local Examination Board."

The Rev. C. Deedes seconded the resolution.

Mr. Y. Crawley, in proposing a vote of thanks to the Chairman, and to Mr. Harry Chester, said—The Local Board had done itself honour by electing Mr. Blakesley to preside over it. They must all have been delighted with Mr. Chester's address, and he hoped this would not be the last visit paid by him to Hertford.

Mr. Ludlow seconded the vote of thanks, which was carried unanimously.

The Chairman and Mr. Chester having briefly acknowledged the vote, Dr. Towers proposed a vote of

thanks to the Right Hon. W. Cowper and Sir Minto Farquhar for their attendance, which having been duly acknowledged, the proceedings terminated.

The following gentlemen constitute the Hertford Local Board:—

The Rev. Joseph Williams Blakesley, B.D., the Vicarage, Ware, *Chairman*.

The Rev. Charles Deedes, Fengeo, Hertford.

The Hon. and Rev. Godolphin Hastings, Hertingfordbury, near Hertford.

The Rev. Nathaniel Keymer, Christ's Hospital, Hertford.

The Rev. Thomas Lander, Hertingfordbury, near Hertford.

The Rev. Henry Fenwick Skrimshire, Hertford.
,, William Spencer, . ,,
,, George Yeates, . . ,,
Mr. Young Crawley, , . ,,
,, Robert Dimsdale, Essendon, near ,,
,, Edward Samuel Errington, . ,,
,, Henry Gilbertson, . . ,,
,, John William Grove, . . ,,
,, George Hancock, . . ,,
,, J. T. Hannum, Christ's Hospital, ,,
,, Samuel Hatchard, . . ,,
,, Daniel Pierson, . . ,,
,, Henry Robins, . . ,,
,, John Marchant, jun., Port-Vale, Hertford, *Hon. Secretary*.

NATIONAL GALLERY, BRITISH SCHOOL, SOUTH KENSINGTON.

The following regulations for the admission of the public have been arranged by the Committee of Council on Education, and the Trustees of the National Gallery:—

1. The separate entrance to the National Gallery, British School, provided at the request of the Trustees of the National Gallery, will be open for the public on Mondays, Tuesdays, and Saturdays, and for students on Wednesdays, Thursdays, and Fridays, in the daytime only.

2. The public will be admitted to the National Gallery, British School, also through the Museum, every day, and on those nights when the Museum is open, according to the regulations of the Museum. On those nights the National Gallery, British School, will be lighted by the Department.

3. Wednesday being a public day at the National Gallery, and a students' day at the South Kensington Museum, will hereafter be a students' day at the National Gallery, British School, and the public admitted on payment (6*d.*) to the South Kensington Museum will be admitted also to the National Gallery, British School, through the Museum only, the National Gallery students being admissible by the separate entrance.

4. On Wednesdays, Thursdays, and Fridays, when only Students are admitted to the National Gallery, British School, the public admitted by payment (6*d.*) to the South Kensington Museum will be admitted to the National Gallery, British School, through the Museum only.

5. The National Gallery, British School, was opened on Monday, 5th December.

Home Correspondence.

THE OPIUM TRADE WITH CHINA.

Sir,—I should have been glad if the opportunity could have been given me when I read my paper on China, to reply to any gentleman disposed to impugn any statements. Further controversy might thus, perhaps, have been avoided; as it is, the insertion of two letters in the pages of the last number of your Journal, calls upon me for some reply.

It would have been well if a little more calmness and fairness had been exhibited in connection with this opium question. A newspaper that inserted, in prominent type, long vituperative commentaries, refused compliance with my simple and natural request that they would give in their columns the whole text upon which the commentaries were founded. Both Drs. Medhurst and Hobson—excellent and trustworthy witnesses, who have been often and most properly appealed to by the opponents of the opium traffic—have frequently expressed to me their annoyance and disgust at the extravagant exaggerations and unwarrantable mis-statements forced into publicity by gentlemen with more zeal than knowledge. It is with such exaggerations and misrepresentations that I have to deal. For I am no approver of the opium trade, no advocate of the use of the drug; no patron of the smuggler; no partisan of immorality in any shape; but having had the advantage of long official experience, I have brought forward some important facts for the consideration of those interested in the matter at issue. My reward has been the suppression of much that I did say, and vehement censures on what I never said.

I stated that the ancient histories of China proved that drunkenness was formerly a common national vice in that country. Mr. Richards, who has prominently distinguished himself by his attacks upon my statements, and who is, I believe, the Secretary of the Anti-Opium Committee, speaking with extraordinary complacency of his own extensive "reading" and utter contempt for mine, ridicules my "brilliant discovery" of a "fact utterly unknown to other Chinese scholars," and especially as he does not himself remember having met with any reference whatever to the ancient drunkenness of the people. Yet in the Shoo King, the most famous—the best known, of all Chinese books of ancient history, attributed to Confucius, and translated by Dr. Medhurst himself, there is a whole section on the abuse of spirituous drinks both by princes and people. It complains that the wine, or arrack, intended for sacrifice, had become a "celestial infliction" by creating dissoluteness among the multitude. The empire had been corrupted by the drunken habits of the natives; "small and great states are ruined; and wine is, without exception, the cause." Wan Wang called upon his subjects to refrain from all excess, and is reported to have had influence enough to prevent "townsmen and villagers from daring to intoxicate themselves." But the people returned again to their excesses. Show is declared to have "wildly given himself to wine," and to have been followed by the "multitude," so that the offensiveness of their dissolute habits brought down calamities from Heaven. The Emperor made himself a pond of wine, in which he riotously bathed with naked men and women. The drinking clubs are also spoken of, and ordered to be proceeded against, as the members may deserve capital punishment. There was a succession of imperial decrees against drunkards and drunkenness. That the vice is now rare in China nobody disputes. Mr. Richards says I sent home elaborate calculations to prove that the smokers of opium do not exceed two or three millions. The statistics are not mine, but Dr. Medhurst's. The averments circulated in England were that two or three millions of persons were poisoned and *died* of opium smoking. Dr. Medhurst's figures showed that the whole number of smokers of imported opium did not exceed those who were represented as "murdered" by its use. No calculation was made, for the materials were wanting of the multitudes in every part of the empire who consume Chinese opium, and who consume it because foreign opium is inaccessible to them. Wherever our observations have gone, we know that opium has to a great extent supplanted, what in the judgment of Sir Benjamin Brodie and in mine, is the *more* deleterious Samshoo, one of the

vilest of intoxicating drinks, though *less* deleterious in Mr. Fowler's opinion. No doubt misery and crime enough may be traced to excess in either, but as to the character of the crimes produced by such excess, I should have supposed there could be little difference of estimate.

The introduction of opium (as is now allowed by all) is not prohibited by treaty engagements, but smuggling undoubtedly is, and the opium attempted to be smuggled was at any time liable to confiscation. But it is a fact, an undeniable fact, that the opium trade was encouraged, protected, patronised by the Chinese authorities; that by an understanding with the mandarins it was carried on without the smallest risk, and no chest was ever seized that had passed through the well-known and openly recognized channels. The fixed toll was regularly levied. It is not true that Lord Elgin compelled the legalisation of the opium trade by his late treaty "at the cannon's mouth." For more than two years opium has been regularly entered at several of the Chinese custom-houses, and the duty, which, probably, of old went to the mandarins, is now paid into the Imperial treasury. What I regret in Lord Elgin's treaty is that the duty fixed is unreasonably high—about 8 per cent. on the value of the drug. I do not think more than the usual rate on *ad valorem* goods, namely, 5 per cent., can be collected by the Custom-house. Smuggling, therefore, will not be put down by its legalisation, and what is still more vexatious is, that this opium duty is not to be (as all other duties are) subject to after-revision.

The suppression of smuggling is not the concern of foreigners. I did, notwithstanding, all that depended on me to diminish its evils. I refused to allow claims against the Chinese for opium dealings to be entertained by the consular courts. In spite of the most violent opposition, and exposing myself to great unpopularity and censure, with the concurrence and co-operation of the other ministers of the treaty powers, I established at the most important port in China (Shanghai) a system of inspectorship, by which custom-house frauds were effectually put an end to, and the tariff duties are now regularly levied. The opium houses were undoubtedly more benefited by the ancient than they can be by the present state of things, for they are now amenable to treaties and subject to custom-house regulations, and this is my answer to those who speak of my sinister interests in the question.

When I went with the other legations to the Tientsin river, in 1854, I had the full support of the United States Commissioner, Mr. M'Lane, in my attempts to obtain the legalization of the import of opium—this trade being interdicted to citizens of the United States. And in 1859, Mr. M'Lane's successor, Mr. Reed, advised Lord Elgin that as the trade in opium is not mentioned in the English treaty, and the Chinese laws have been virtually abandoned, he will not be a party to the "inconvenient masquerade" of prohibition, and agrees that to legalize the importation is the least unsatisfactory way of settling the question. Diplomacy could suggest no other solution. There are, I know, many attendant evils, but they are beyond the reach of legislation.

The two first authorities quoted by Mr. Edwards in support of his views, are "Dr. Ball, an English physician long resident in China," and "Mr. Lay, her Majesty's late Commissioner in Canton." I never heard of such an English physician, and I am quite sure there never was such a British Commissioner. I knew an American missionary and an American dentist, bearing the name of Ball, and several gentlemen of the name of Lay have been assistants in the consular service.

With regard to the impediments which opium smoking places in the way of missionary labour, I would ask whether the missionaries have had success in those more privileged regions (if such there be in China) where opium is not smoked? I have known several instances where medical missionaries have checked the opium smoker in his headlong career, and entitled themselves to his respect and gratitude, rendering the same service as Father Matthew did in the rescue of many a whiskey-drinking Irishman, whom he induced to take the temperance pledge, but I never heard a Chinaman reproach "the religion of Christians" on account of the opium trade. Nor can I see, while China opium immediately provides for any deficiency in the supply of the opium of India or Turkey, how the prohibition of the Bengal drug is to lead to an increased demand for British manufactures; and I would add that there is a very large importation of opium from independent Indian states, through Tibit and the western provinces of China.

I am, &c., JOHN BOWRING.

Larkbear, Exeter, December 5, 1859.

SUPPLY OF COTTON FROM INDIA.

Sir,—Surely most of your readers will consider that Mr. Henry Ashworth's remarks, on the facts given by the Chairman of Council, relative to the supply of cotton from India, are hypercritical. It seems to me that the fact of it having been possible for India to furnish in any one year more than one-fourth of our whole supply of cotton, was most important, and was fairly stated. The criticism is the less to be regretted as it furnishes an interesting addition to the information which has already been given in the *Journal* on this subject. I wish Mr. Ashworth, with his deservedly great influence among enlightened and rising manufacturers, would direct his attention towards bringing in some dozen candidates for admission into our Society, out of the class which we especially like to see joining us.

I am, &c.,
GEO. F. WILSON.

3rd December, 1859.

THE YORKSHIRE INSTITUTIONS.

Sir,—Mr. Blake, in your last number, charges me (in a rather off-handed manner, I must say, and, I should hope, unthinkingly,) with not stating the truth, when I said that the Working Men's College was the only Institution in Sheffield in connexion with the Yorkshire Union. I can only say, in answer, that my regard for truth compels me to reiterate that statement. The hon. secretary of the Mechanics' Institution, Mr. Beal, assures me that my statement was correct, and that nothing had been paid for some years to the Union. I certainly, myself, did not notice any report this year—and how an Institution can belong to a Union to which it has not paid the subscription for some years, sends no report, and with which all connexion is repudiated by the Secretary, I leave Mr. Blake to show. With a knowledge of these facts, I think I was fully justified in saying that the Working Men's College was the only Institution in Sheffield in connexion with the Yorkshire Union. I am, &c.,

THOS. ROWBOTHAM.

People's College, Sheffield,
Dec. 7th, 1859.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Prof. Tyndall, "On the Radiation and Absorption of Heat."
Geographical, 8½. 1. Mr. W. H. Purdon, "On the Physical Configuration of the Valley of Kashmir." 2. Lieuts. Mayne, R.N., and Palmer, R.E., and Chief-Justice M. Begbie, "Journeys in the districts bordering on the Thompson, Fraser, and Harrison Rivers, British Columbia."
Medical, 8½. Clinical Discussion.

Tues. .....Syro-Egyptian, 7½. Mr. W. F. Ainsworth, "On the Natural History of Dragons."
Civil Engineers, 8. Annual General Meeting.
Medical and Chirurg., 8½.
Zoological, 9. 1. Dr. Gray, "On the new genera of the family *Gorgoniadæ*." 2. Mr. Gould, "On the food and structure of the Dipper (*Cinclus aquaticus*)." 3. Capt. Blakiston, "On Birds collected during the late North American Exploring Expedition."

Wed. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Society of Arts, 8. Mr. William Hawes, "On the Great Eastern."
Geological, 8.

Thurs. ....Antiquaries, 8.
Chemical, 8. 1. Dr. Moldenhaner, "On the production of Starch." 2. Prof. Bloxam, "On the application of Electrolysis to the detection of the poisonous metals, in mixtures containing organic matter." 3. Mr. Barratt, "On the Carbonates of alumina, and the sesquioxides of iron and chrome."
Linnæan, 8. 1. Dr. Seemann, "On the genus *Spathodea*," 2. Mr. Spruce, "On the mode of branching of Amazon Trees." 3. Mr. Oliver, "Notes on the Society's British Herbarium." 4. Mr. Mitten, "On Indian *Hepaticæ*, and Mr. Wool's Hora of Paramatta."
Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their application to the Arts and Purposes of Life."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 2nd*, 1859.]

Dated 2nd August, 1859.

1784. H. Fletcher, Swan-court, Manchester—Certain imp. in sewing and embroidering machinery.

Dated 16th September, 1859.

2110. T. Richardson, New Bridge-street, Newcastle-upon-Tyne—Imp. in the manufacture of sulphuric acid and in applying the heat generated in the process.

Dated 27th September, 1859.

2180. F. Simpson, City-terrace, St. Luke's, Middlesex—An improved method of fastening or securing envelopes and other like receptacles, also for affixing postage stamps, receipt stamps, and all other similar labels requiring adhesive properties.

Dated 5th October, 1859.

2254. J. A. Herbert, Guildford, Surrey—Manufacturing of oxychloride of lead. (A com.)

Dated 13th October, 1859.

2338. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith, Liverpool—Imp. in the manufacture of bread, biscuits, and like articles, and in the machinery and apparatus connected therewith.

Dated 19th October, 1859.

2390. J. K. Blackwell, 73, Gloucester-terrace, Hyde-park—Imp. in reverberatory and other furnaces. (A com.)

Dated 24th October, 1859.

2420. P. M. A. Laurent, Havre, France—Certain imp. in eye-glasses for optical instruments.

Dated 4th November, 1859.

2519. J. G. Meyer, Paris—The employment of the "tacca pinatifida" as a substitute for straw now used in various manufactures.

Dated 10th November, 1859.

2558. S. Evans, W. Evans, and H. Evans, Derby—Imp. in polishing thread and yarn, and in machinery to be employed for that purpose.

Dated 15th November, 1859.

2584. W. H. Ward, Auburn, Cayuga, New York—Imp. in wheels for railway engines and carriages.

Dated 16th November, 1859.

2596. C. Green, Winnington, near Northwich, Chester—Imp. in the method of applying heat in the manufacture and drying of salt.
2597. W. Baker, Downham, Norfolk—Apparatus to facilitate the delivery of coins, for the giving of change and the like.
2598. W. Johnson, 47, Lincoln's inn-fields—Imp. in gas burners. (A com.)
2599. R. White, Edinburgh—Imp. in shirts.
2600. T. Greenwood and J. Batley, Leeds—Imp. in the construction of the beds of lathes, and the tables of planing machines.
2601. G. Taylor, Leeds—An imp. in the mode of manufacturing wrought-iron crank axles.
2602. J. Burrow, Ashford-parsonage, Bakewell—Imp. in umbrellas and parasols.
2603. J. Ward and H. Burman, Stratford-on-Avon, Warwickshire—Imp. in machinery for making bricks and tiles, and for moulding peat and plastic substances.

Dated 17th November, 1859.

2604. J. A. Drieu and A. Legeay, 18, Welbeck-street, Cavendish-square—A tissue, being a substitute for leather, mill-board, and papier-maché.
2605. I. White, Nailsea, Somersetshire—Imp. in glass furnaces.
2606. D. Jones, Dartmouth-street, Birmingham—Imp. in metallic casks.
2607. R. Lanning, Clifton-villas, Maida-hill West, Middlesex—Imp. in obtaining alkalies and alkaline compounds.
2608. T. Robinson, St. Helens, Lancashire—Imp. in steam engines.
2609. J. L. Jullion and G. Firie, Stoneywood Works, Aberdeen—An imp. in the manufacture of paper.
2610. J. McKenzie and S. T. Wentworth, 16, St. Martin's-le-Grand—Imp. in breech-loading fire-arms.

Dated 18th November, 1859.

2611. J. H. Brierley, 19, Milton-place, Halifax, Yorkshire—A belt or band fastener.
2612. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of carbonate of soda.
2613. J. Pinchbeck, Camden-street, Islington—Imp. in consumers' compensating gas meters, which are partly applicable to ordinary consumers meters.

Dated 19th November, 1859.

2615. S. Corbett, Wellington, Salop—An imp. or imps. in pulpers for pulping food for cattle.
2616. W. Clark, 53, Chancery-lane—Imp. in the preservation of animal and vegetable matters. (A com.)
2617. W. Blinkhorn, Sutton, near St. Helens, Lancashire—The novel application of certain materials to the manufacture of bricks, quarries, or tiles to be employed principally in the construction of furnaces as "fire-bricks."
2618. J. Knight, Newton Heath, near Manchester—Certain imp. in or applicable to looms for weaving, part of which is applicable to lubricating axles and bearings for other purposes.
2619. E. Barlow and F. Hamilton, Bolton-le-Moors, Lancashire—Certain imp. in carding engines.
2620. A. H. Le Pontois, L'Orient, France—Imp. in machines for distributing seed and manure.
2621. J. Bancroft, Halifax—Imp. in the manufacture of fabrics adapted to be used for curtains, coverings of furniture, table covers, and such like uses.
2623. A. Godchaux, 45, Essex-street, Strand—Imp. in the mode of printing forms, or models, or copies of penmanship and designs on paper, and other fabrics.
2624. J. Petrie, jun., Rochdale, and J. Lord, Manchester—Imp. in machinery or apparatus for drying rags, wool, and other fibrous materials.
2625. A. V. Newton, 66, Chancery-lane—Imp. in the mode of and machinery for drying cloths. (A com.)
2627. G. Laidlaw, Glasgow—Imp. in hats and other coverings for the head.
2628. H. Naylor and W. Crossley, Calder Vale, near Todmorden, Lancashire—Imp. in pickers used in looms for weaving.

Dated 21st November, 1859.

2630. P. Jochem, Paris—Imp. in brakes for railway and other carriages.
2632. J. Cowan, Liverpool—Imp. in 'bracing' or connecting the angles or borners of chairs and other like articles of cabinet-furniture.
2736. J. Apsey, Cornwall-road, Lambeth, and W. G. Buckwell, Phœnix Stone Works, East Greenwich, Kent—Imp. in boilers and other furnaces, smoke consuming and steam generating.

Dated 22nd November, 1859.

2638. E. T. Hughes, Chancery-lane, London—Imp. in weaving silk and other materials, and in the machinery or apparatus employed therein. (A com.)
2640. J. Shand, 245, Blackfriars-road, and J. Rowley, 3, St. George's-road, Notting-hill, Middlesex—Imp. in fire engines, part of which improvements are applicable to other pumps.
2644. W. E. Newton, 66, Chancery-lane—Certain imp. in obtaining compensation for the effects of changes of temperature in time-keepers. (A com.)
2646. R. Mushet, Coleford, Gloucester—An imp. or imps. in the manufacture of iron and steel.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, December 2nd*, 1859.]

December 25th.
1371. J. Burrow and W. N. Wilson
1378. J. Wood and W. Wood
1383. J. Ferrabee
1388. W. B. Nation
1573. S. Fisher
2022. F. C. Bakewell
2377. J. Reynolds

[*From Gazette, December 6th*, 1859.]

December 6th.
1395. C. de Bergue.
1396. J. B. Howell, J. Hick, and W. Hargreaves.
1408. G. J. Farmer and G. B. Hardy.
1413. M. H. Picciotto.
1423. H. Lee Corlett.
1447. C. H. Waring.
1465. A. V. Newton.
1504. W. Russell.
1507. M. A. F. Mennons.
1514. H. Doulton.
1517. J. Mills.
1515. A. Chesneau.
1531. W. Coppin.
1535. B. Burton.
1550. G. Chapman.
1583. C. H. G. Williams.
1699. F. C. Bakewell.
2038. E. R. Dann and E. Goldschmidt.
2112. J. Beck.
2276. E. O. Tindall.
2278. A. M. Ferry.
2309. J. Earl.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, December 2nd*, 1859.]

November 28th.
2839. J. Gibson
November 30th.
2841. E. J. Emmons
2849. J. Longbottom
2861. F. Siemens

[*From Gazette, December 6th*, 1859.]

December 1st.
2874. J. Apperly & W. Clissold.
December 2nd.
2866. T. Crabtree.
2869. J. Denis.
2878. E. D. Draper & G. Draper.
2882. A. E. L. Bellford.
2884. D. Crawford.
2896. C. Schiele.
2898. J. Longbottom.
2940. W. Lund.

Patent on which the Stamp Duty of £100 has been paid.

[*From Gazette, December 2nd*, 1859.]

November 30th.
939. J. Newall

[*From Gazette, December 6th*, 1859.]

December 1st.
936. J. Norton.
December 2nd.
983. J. H. Johnson.

Journal of the Society of Arts.

FRIDAY, DECEMBER 16, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded as soon as possible to the Secretary of the Society of Arts.

FIFTH ORDINARY MEETING.

Wednesday, December 14, 1859.

The Fifth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 14th inst., R. Wygram Crawford, Esq., M.P., in the chair.

Previous to the reading of the Paper, the Secretary called attention to the model of a new Life-boat, invented and exhibited by Mr. Ludlum, of the United States. (See page 80.)

The following candidates were balloted for and duly elected members of the Society :—

Kelk, John	Robson, James Hutchinson
Lund, William, Jun.	Rowlands, William
Nixon, Brinsley de Courcy	Simpson, Robert
Purdon, William	Wyatt, Richard Henry

The Paper read was—

ON THE "GREAT EASTERN."

By William Hawes.

In the account of the great ship which I propose to lay before you this evening, I shall avoid any allusion to the disputes existing between the contractor and the board or those between members of the board, or the charges made by shareholders against the directors.

I propose to treat the ship as a great mechanical and engineering work—fraught with great commercial and political results, the accomplishment of which may be retarded by bad management, but which will certainly be ultimately realized, however gloomy for a time the prospects may appear to the company engaged in the enterprise. My object is to endeavour to restore that confidence in the ship, which, but a few weeks back, was so perfect, and to separate from the great principles involved in the undertaking, all the petty jealousies of little minds, and the misrepresentations of ignorant and interested opponents.

Without detaining you, by reading an historical notice of ships or shipbuilding, I must, as a necessary introduction to my subject, remind you that it is only within a very recent period that ocean steam navigation has been accomplished, and within a still more recent period that iron has been used for the hulls of ships, and that the first great step in this direction was the construction of the *Great Britain*, an iron ship, of 3,500 tons burthen, by Mr. Brunel, in 1844.

Nor can I do more than notice the fact, that until the causes of the disturbance of the regular action of the compass in iron ships were understood and overcome by the researches of science and practical experience, there was very great, but, perhaps, proper unwillingness on the part of shipbuilders to adopt a new material for shipbuilding, or to appreciate, as they now do, the special advantages due to the use of iron in the construction of ships of large tonnage.

The greater strength, but less weight of properly constructed iron ships—their stiffness, or "stand-upativeness," as I once heard it called—their freedom from working, and lessened liability to leakage—their superior safety in case of accident by lightning or fire, as shown by the *Sarah Sands* and—when properly divided into compartments, by honestly constructed bulkheads—their comparative freedom from several classes of accidents to which wooden ships are liable, added to the superior facilities afforded for fixing their machinery, are some of the advantages of iron ships, but which, plain and universally admitted, as they now are, were long in receiving the assent of builders and navigators. So again, with the screw and paddle, as the means of propulsion. At first the paddle was universally adopted. The screw obtained support very slowly, and when its merits were admitted, it was for a long time used only as an auxiliary power to merchantmen and ships of war.

Experience has, however, gradually shown the peculiar advantages belonging to both modes of propulsion, and one of the most successful novelties in this great ship is the union of the powers of the screw and paddle and sail, by which she is more perfectly under control than any ship driven by one power only, or by the combination of two of them.

But I am overrunning my subject, and I must return and call your attention—

First, to the early history of the design of this ship.

Secondly, to the peculiarities of its construction—its form—its power—its longitudinal and transverse bulk-heads—its masts, rigging, and miscellaneous machinery.

Thirdly, to the consideration of its value, as a portion of our mercantile marine; and

Lastly, to the vast results we may expect to follow the success of this master-piece of shipbuilding, mechanical skill, and engineering science.

When Mr. Brunel first adopted the idea of building so large a ship I cannot say, but recollecting many conversations with him upon large ocean steamers, and looking to the progress of his public works, it is evident it had long occupied his mind, and that the exact mode of carrying it out was gradually matured as he built the *Great Western* and *Great Britain*, and other ocean steamers.

In 1835 he designed the *Great Western*—in 1842 he designed the *Great Britain*—and in 1851 he designed the *Great Eastern*.

In the *Great Western* and *Great Britain* his leading idea was to improve, by shortening and rendering more certain, the communication between America and England, the average passages by the best clipper sailing ships, at that time, being 35 or 40 days outwards, and 20 or 25 days homeward. The *Great Western* made her first outward voyage, with 7 passengers, in 15 days, burning but 400 tons of coal, returning with 87, the largest number of cabin passengers which had crossed the Atlantic in one bottom.

She was a wooden paddle steamer of 1,400 tons burthen and 400 horse-power; 236 feet long, and 35·6 broad, 50 feet longer than any steamer then afloat, and far the largest then built.

The *Great Britain* started from Liverpool, on her first voyage, Sept. 22, 1846, with 185 passengers, but was

wrecked when starting on her fourth voyage on the rocky coast of Dundrum Bay, where she remained, subject to the violence of the winter gales, till the spring of 1847, when she was got off, uninjured, as regarded the hull, the lines of which were unaltered, and she is now running regularly to Australia.

This was an iron ship, of 3,500 tons burthen, 322 feet long, 57 feet broad, and with engines of 800 horse-power. n the material of which she was built, her size and power, and in her being driven by a screw, this ship was an enormous advance on the *Great Western*, and her success led, no doubt, to the *Great Eastern*, in the construction of which the aim of Mr. Brunel was of still greater import, inasmuch as the magnitude of the interests involved in our Eastern possessions are superior to those in the Western world.

During the interval which elapsed between the building of the *Great Britain* and the *Great Eastern*, the political and commercial relations of this country with India advanced with giant strides, and the necessities of the Imperial Government, the demands of commerce, and the wants of a large passenger traffic, required that some safe and rapid means of communication should be found, entirely independent of other countries, and less troublesome to passengers than the present overland route; and I cannot help here expressing my regret that so much time has been lost in trying the great experiment for which this ship was built, any delay in realising which, is, I think, a national loss.

I have stated that the idea of a large ship, able to carry coals sufficient for a long voyage, and to attain a comparatively high speed, had assumed a tangible form in 1850-51. Early in 1852, the plans were submitted by Mr. Brunel to the Directors of the then Eastern Steam Navigation Company, when that Company was reconstituted, a new direction formed, and in July a report was published, in which it was proposed to accomplish the voyage to India *viâ* the Cape, in from 30 to 34 days, without stopping to coal, and with space enough to carry sufficient first-class passengers and freight, at moderate rates, to secure an ample remuneration to the shareholders.

In this prospectus, Mr. Brunel's acknowledged reputation as a marine engineer was fully recognised, and in a short time after this meeting, the design of the ship was completed, and the drawings, embodying the most approved forms, in combination with every mechanical appliance which could give strength to this vast structure, and by their simplicity give confidence even to those least advanced in mechanical knowledge, were submitted to the criticism and approval of the world, and these plans were not materially altered at any subsequent period.

So soon as these plans were published, Mr. Brunel became the nucleus round which concentrated every new idea, whether of the practical or theoretical shipbuilder, or of the enthusiastic schemer in the old or in the new world; and no doubt, now that a great success has been achieved, many of these correspondents, finding that plans somewhat similar to those they suggested have been adopted by Mr. Brunel, believe themselves to have been the inventors, and will hereafter claim merit accordingly.

This is the case in all great works, but the public and posterity always decide rightly in the long run, as to whom merit is due, well knowing that one of the best evidences of genius and of the possession of the highest qualities of the mind, is the power of collecting, digesting, and sifting all existing information, and then practically applying what may be good for the purpose required, filling up by its own genius what is wanting to make a perfect whole.

It is difficult to estimate the injury to the Company caused by the loss of the superintendence of the master-mind of Mr. Brunel, in the completion of this great work.

No one appears to have sufficient authority to decide what is to be done; few, I fear, of those who are now connected with the administration of the Company's affairs appreciate the vastness of the original design, and fewer still are able to carry it out in its integrity. Judging from the criticisms we have all read upon the ship of late, we might fancy that neither of the experienced engineers of the paddle and screw engines knew anything of their business, for one critic says the chimneys are too small; another, the boilers are insufficient; another, the diameter of the paddles is too great; another, the air-pump rods are too weak, and the engines themselves are in the wrong position; another finds fault with the donkey engines, and so on throughout the ship, all of which criticisms seem rather to originate in a desire to spend the money of the Company, or to obtain a false reputation by appearing to remedy evils which do not exist, than to complete in the shortest time the work that is unfinished, and to remedy, in the most economical manner, defects in her machinery and apparatus which her trials have rendered apparent.

Throughout the year 1852, Mr. Brunel's attention was very much directed to ocean steam navigation, and he was brought constantly in contact with the leading ship-builders and engineers. The first question he had to decide, and upon it many others depended, was the place of building. Was it more to the interest of the Company that so large an iron structure should be built in London than in the North, where it was alleged both iron and labour, skilled and unskilled, the two great elements of cost, were the cheapest? His decision on this point was much canvassed, but Mr. Brunel attached more importance to the facility which building in London would afford him for constant personal superintendence, and by which alone he could ensure that attention which he thought indispensable to the most minute details of its workmanship, than to any apparent economy in the cost of the transmission of the materials from the North to London. This being decided, Mr. Scott Russell was selected, as the most advanced iron ship-builder, to construct the ship and make the paddle engines; the screw engines being given to the old and eminent firm of Boulton and Watt.

Of the engines, as differences exist between the directors and the contractors, it is not desirable for me to speak, but I think it right to say that so far as they went their working was beautiful.

It was an interesting sight to watch the starting of such huge machines, and their subsequent stately movements, and I was much pleased during the trip to Portland at the ease with which, considering their size and newness, they were started and regulated.

So soon as Mr. Russell obtained the contract to build the ship, and even at an earlier period, when, from being in communication with Mr. Brunel, respecting contracts for other ocean steamers, he became aware of the plans for this great ship, he gave Mr. Brunel all the information he possessed as to the best form of entrance calculated to offer the least resistance in passing through the water; and the time he had devoted to the study of the wave-line or hollow bow for ships gave great weight to his opinion, but this was solely as to the exact curve to be adopted, and not upon the principle whether a hollow or a bluff bow was best for such, or indeed for any, steam ship. All the leading and most important questions, as to size, form, and construction were settled early in 1852, if not in 1851. The cellular hull and main-deck, the position of the longitudinal and transverse bulk-heads, were then finally determined, and so arranged as to place the accommodation for the first-class passengers in the centre of the ship—in the place of least motion, instead of quite aft, or in that of the maximum motion, as is now universally adopted; the number of masts and their material, the size, power, and situation of the engines, and the position and size of the coal bunkers were also arranged, leaving nothing for future consideration but the exact appropriation of the large spaces between the bulk-heads and above the main-deck to first, second, and third-class passengers, the accommodation of the crew, and for general cargo.

To carry out these leading ideas, and to ensure the speed required, Mr. Brunel adopted the following dimensions

and arrangements as most likely to accomplish the results he desired, viz.:—

The length of 680 feet; the length of upper deck, 692 feet; breadth of beam, 83 feet; depth, 58 feet. engines of 2,600 horse nominal power; a midship section of 1,600 square feet, with a capacity of carrying 12,000 tons of coals, a large number of passengers, and 10,000 tons of cargo.

I shall not now enter into any minute description of the measurement of the various parts of the ship, for they have been so frequently published that you must be acquainted with them, but for the sake of giving completeness to the paper they will be printed in an appendix. The centre of the ship above the main-deck he appropriated to passengers, the space below the water-line to the boilers, engines, and coal bunkers.

This space is 350 feet in length, and is divided into three compartments by two substantial bulk-heads running fore and aft the entire depth of the ship.

The centre compartment, 36 feet in width, is exclusively occupied by the engines and boilers. The outer compartments are filled with coals.

The boiler-rooms are arched over with an iron roof, to prevent the radiation of heat from them into the ship, and also to prevent the escape of smoke, and other unpleasant smells into the cabins above them.

This complete isolation of the boiler department from the rest of the ship is quite novel, and is a great security to the passengers against injury from any accident which may happen to them.

The remaining 332 feet of the ship is about equally divided fore and aft, and is appropriated to cargo and stores.

So much for the basement of the ship.

The space immediately above the 350 feet we have thus described, is divided into two parts by the paddle engine room, which occupies, including the engineers' and the stokers' berths, a space of 40 feet in length and the entire breadth of the ship, thus separating the first from the second and third class passengers; the first being in the forward compartment, and therefore subject to less inconvenience from smoke or dust, as also from any vibratory motion arising from the working of the screw. With this exception there is no real difference, so far as the ship is concerned, in the accommodation of the third, second, and first class passengers. Of course, the fittings of the cabins, the number of berths in them, and the dietary, would be different in the first, second, and third classes.

This is not the place to enter upon a minute description of the gorgeous and expensive fittings of the principal saloon, particularly as I believe the interests of the shareholders and good taste would both have been better consulted, if the utmost simplicity in ornamentation had been adhered to, and more attention paid to the introduction of comforts we are accustomed to ashore, and which the steadiness of, and the space at command in, this ship would have enabled the directors to realise, to the infinitely greater satisfaction of passengers than any pleasure the sitting in a gaudy saloon can afford them.

I may here notice a remark which has been made respecting the absence of means to warm the state room and other saloons in a ship going to America. This ship was never intended to go to a cold climate; she was built for the Indian trade; she is not calculated for a voyage to America, and I think it is to be very much regretted that the concession to other interests than those of the shareholders, and perhaps the desire of exhibiting this great work to our transatlantic friends, should have been allowed for one hour to delay her departure on the voyage for which she was designed, for which she is fitted, and from which alone commercial results to the Company can be realised. The ship has been looked upon too much as a sight, and far too little as a great commercial machine by the proper use of which alone can profits be made.

It is clear that one great element of commercial success is to be found in not allowing this great capital to be idle in port—another in avoiding, as much as possible, the dangers of passing to and from any coast, whereas by sending her to America, the delays in port must be tenfold her time in the voyage; indeed so long, that smaller steamers will fill with passengers and cargo, and make the passage, while she is loading, if indeed she ever will be loaded there; the whole object of the enterprise will thus be defeated, capital will be uselessly lying idle, and wages and expenses will be as uselessly paid. Then, again, as to the risks incidental to the voyage. We all know how comparatively small they are in a well-found ship, when once at sea, and most are equally well aware of the risk in approaching the English and American coasts, of the fogs and ice incidental to the vicinity of the one, and the dangers of our rocky shores and narrow seas; but to those who have not a clear idea of this risk, an inspection of the Wreck Chart on the walls will soon satisfy them.

I never have been able to understand why the directors determined to send this ship even one voyage to America, or to spend the large sum they have done in fittings, before the ship and machinery had been tried, and the speed of 15 or 16 knots per hour, which none doubt will be accomplished, had been proved to the satisfaction of the world.

I have always maintained that, as soon as she was launched, and the machinery completed, by which I mean everything required for her safe navigation, sufficient ballast and coal should have been shipped, and a voyage of 1,000 or 2,000 miles performed, with or without her masts. If that trial had been successful, money would have been easily raised to finish her in any style the builder or directors might have chosen; if a failure, the shareholders would have saved the £100,000 spent in fittings and ornament.

We must now examine those points of construction in which this ship differs from any other yet built. At first sight, it may be said, and I have no doubt you all have heard it said, that she is but so much longer, and so much broader, and so much deeper than such and such a ship, built by this firm at one place, and that firm at another; that all these efforts of marine architecture were outdone in olden time, if we consider size only, by Noah's Ark, which is said to have been 680 feet long; and by Ptolemy Philopater, a Græco-Egyptian, who is said to have built a ship 426 feet long, carrying 400 sailors, 400 rowers, and 3,000 fighting men.

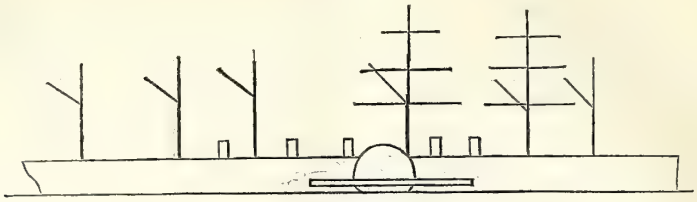
If, then, according to such authority, we are merely to test this work by its size, it is no novelty; surprising, then, is it not, that it should excite so much attention in all parts of the world; that France, our great rival in ships, should send one of her most distinguished admirals to the trial trip, and that every shipbuilder and engineer should be watching each step in her career with the utmost curiosity.

I should hardly have noticed this foolish argument, had I not heard it fall from those to whom many have been accustomed to look for reliable information; though it affords me, perhaps, the best opportunity for illustrating the great advance which has recently been made in practical ship building, for although almost up to this time, every large ship has been looked upon with doubt as to its strength and safety, it is now admitted by all that, whatever may be its other faults, this ship is the strongest ship ever built.

How, then, let us inquire, has this confidence in her strength been gained, not because of her size, for so many large wooden and iron ships have been lamentable failures from the great *White Ship* built by Henry I., which was lost with her builder, the king's son, and all the crew, on the first-voyage, to the *Great Merchant* built by order of James I., of Scotland, of 1,000 tons, lost on her trial voyage, and the *Henri Grace de Dieu*, of 1,500 tons burthen, built by Henry VIII., in 1520, which being found quite unmanageable, was laid up after one trial and went to decay.

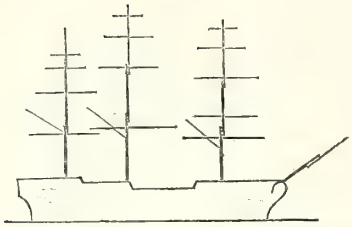
From this time to 1637, above 100 years, we only hear of one large ship, the *Royal Sovereign*, the first three-decker built, of 1,861 tons burthen, and 128 feet long

Fig. 1.



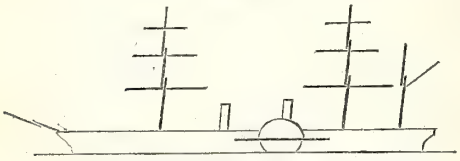
The *Great Eastern.*—Length 680 feet. Breadth 83 feet.

Fig. 2.



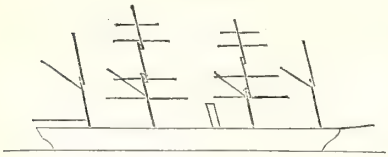
The *Duke of Wellington.*—Length 240 feet. Breadth 60 feet.

Fig. 3.



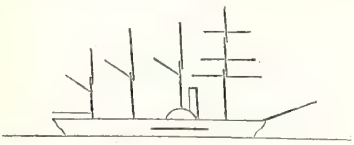
The *Persia.*—Length 390 feet. Breadth 45 feet.

Fig. 4.

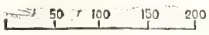


The *Great Britain.*—Length 322 feet. Breadth 51 feet.

Fig. 5.



The *Great Western.*—Length 236 feet. Breadth 35 feet 6 inches.



Figs. 1, 2, 3, 4, and 5 show the relative size of the *Great Eastern* as compared with some other vessels.

We again await another century, till in 1756, when the *Royal George*, of 2,046 tons burthen was built. The next 50 years produced the *Hibernia*, of 2,500 tons, and 201 feet long, in 1804. This was the first 110-gun ship launched. From this time the size and number of our large ships of war has steadily increased, but at a cost for labour and material to ensure safety, quite unapproachable by private owners, whose experience in wooden ships, as exhibited in the fate of the *President*, which has never been heard of, and of the *British Queen*, her sister ship, which like the *Henri Grace de Dieu*, is laid up to rot, and in iron ships by that of the *Birkenhead* and others, led them until recently to avoid rather than to build large ships.

These results naturally lead to the inquiry in what respect the construction of the *Great Eastern* so differs from them, that as soon as it was known and understood, confidence in her strength could not be withheld. In all ships previously built size was the great element of weakness. To the *Great Eastern* it was a source of strength, for only in a very large ship could all the elements of strength she possesses be combined.

The first and most important addition of strength is gained by the cellular construction of the hull and deck.

In fact it is a double ship to 3 feet above the water-line, held together by ribs of immense strength, at intervals of 6 feet each, which are united to transverse plates, dividing the entire surface of the ship into spaces of 6 feet square. The next element of strength we find in the two longitudinal bulk-heads, the entire depth of the ship, firmly fastened to the transverse bulk-heads, and thus forming two bars of iron 60 feet high, 350 feet long, and ½ inch thick. The force required to tear these asunder, as well as to rend the double cellular hull, is more easily imagined than described, and is certainly very far beyond any strain which, under known conditions of ocean navigation, can possibly arise.

The strength obtained by this arrangement was tested during the launch, when unexpectedly, and for the long period of two months, the ship was supported on two cradles, each 120 feet in length, leaving above 150 feet at each end, and about 100 feet in the centre of the ship without support, and the most careful observation could not detect the slightest change of form.

So much for its length. Next, as to its breadth.

The cellular construction of the hull is also a source of strength against a transverse strain, but this is more particularly provided for by the cellular upper-deck, and by the twelve transverse bulk-heads, each forming a plate or bar of iron 58 feet deep, 80 feet long, and half-an-inch thick.

These transverse bulk-heads, stiffened by their fastenings to those running longitudinally, and the cellular construction of the hull and deck of the ship, give to the whole a uniform strength which has never before been attained.

The strength of the general structure, and its power to resist a transverse strain, was tested in an unexpected manner by the accident which happened during her voyage to Portland.

Here was the explosion of a boiler at very high pressure, 30 feet long and 6 feet in diameter, the force of which lifted the entire chimney, weighing 8 to 10 tons, many feet high, carrying away and overcoming the resistance of all its fastenings, without doing the least injury to the frame of the ship; and it is equally remarkable that the heavy funnel being lifted from the bottom of the ship to several feet above the deck, should fall upon it, and cause but the most trifling damage, so that not only was the general structure or hull tested by the resistance it offered to

the lateral force of the explosion, but the strength of the deck was tried in a manner never calculated upon, and both bore these tests to the admiration of everyone who has since examined the ship, but especially of those on board, none of whom could, without such experience, have believed it to be possible that a ship exposed to such an explosion could afterwards have carried them, without a moment's delay, safely to their journey's end.

These, then, are the peculiarities of construction which have given to this large ship such strength and safety as not only to forbid the idea of increased danger from its great size, but to convey to the mind a sense of security greater than can be afforded by any ordinary mode of shipbuilding, and, form the practical engineering improvements over any other large ship yet built.

Next let us consider the motive power. Here, taking advantage of experience—appreciating the advantages of the paddle, which are great, and those of the screw which are equally so, both having drawbacks under special circumstances, and each also possessing advantages calculated to overcome the deficiencies of the other—Mr. Brunel determined to apply both, giving the preponderating power to the screw, and singular it was that the advantages of this combination should have been exhibited while the ship was riding at anchor at Holyhead, during the late storm, when the screw, fouled by floating timber, was freed by the gentle action of the paddle, and injury to the paddle floats prevented by stopping the paddle engines and propelling the ship by the screw, thus alternately using first one and then the other, the safety of both being secured by the alternate action and rest of each.

It is perhaps fortunate that, in so short a time, the ship should have undergone three unexpected tests of her efficiency—of her longitudinal strength in the launch, of her lateral strength by the explosion, and of the utility and safety arising from the double motive power at Holyhead, in each case the success being complete.

The steadiness of the ship at sea may be, to some extent, attributed to this double motive power, each shortening the interval which would elapse when, by the natural action of the waves, the other would be inefficient. In pitching — if she will ever meet a sea to make her pitch in the ordinary sense of the term—the paddles will be in full action, and so propel the ship when the screw has least power, and in rolling, when the paddles are least effective, the screw will be most efficient.

I have not time to notice many minor points of great interest to the engineer and shipbuilder. The absence of external keel—the flatness of her floor—her iron and wooden masts—the application of steam power to aid in many of the ordinary duties of the ship—the situation and adjustment of her compasses, &c., &c., I cannot do more than thus briefly refer to, passing on to the inquiry as to the effect of her great size on the facility and certainty with which she can be navigated.

The first difficulty suggested was that of steering.—To accomplish this efficiently it is necessary that the captain should be in a position to command a full view of the ship's course, and to communicate at once with the officer at the helm.

The post always assumed by the captain in steamers is the bridge near the centre of the ship, but in this ship it is more than 300 feet from the helm, and, without some mechanical aid, it would be impossible to ensure that immediate obedience to his orders which is indispensable. This aid is afforded by two dials, properly marked, and two indicators, one moved by the man on the bridge close to the captain, awaiting his orders, and the other answering thereto from the helm.

The captain directs the man on the bridge to put the helm "hard a-port," and he immediately brings the indicator before him to the proper mark on the dial, moving, at the same time, a corresponding finger on the dial immediately before the officer at the helm. As soon as the finger begins to move, the officer orders the men under him to move the tiller in the same direction, and this action moves the dial on the bridge, showing that the order is in course of being obeyed, almost before it is fully expressed.

By this contrivance, the orders of the captain are conveyed 350 feet to the officer of the helm, and are obeyed quickly, quietly, and accurately, thus overcoming the inconvenience of distance, and obviating one of the anticipated difficulties of navigating this large ship.

At night these dials are illuminated, so that the facility of communication is fully equal to that by day.

On either side of this steering apparatus are the paddle and screw engine telegraphs. Here, by turning a handle with an indicator, working on a marked dial-plate, a similar indicator is moved in the engine-room, every movement being preceded by the sound of a large bell, which can be distinctly heard over the noise of the machinery, and by these arrangements the rudder and engines, although out of sight of the captain, are as immediately under his command as though he could speak to the engineers and helmsman. I am not sailor enough to describe the arrangements for working the sails and rigging, but it is easy to conceive that, with an officer and gang of men to each mast, orders may be conveyed by signal with certainty and precision, and the experience gained at sea, so far, is favourable to the practical efficiency of these arrangements, for the ship invariably answered the helm as certainly and as quickly as any small craft.

The next, but, perhaps, the most important subject for consideration, as regards the safe navigation of the ship, was how to secure, as far as possible, the accuracy of the compass in so large an iron ship, but experience and science have overcome all difficulties, for although the weight of iron in this ship is by several thousand tons greater than that in any other, yet it is so large that the effect of the iron of the ship on the compass can be as easily, and perhaps more easily counteracted, than in ships of war, or in smaller ships where the compass is more closely surrounded by the iron-work and the armament. Ample means have been taken, by careful adjustment, and in the selection of the positions where the compasses are placed, to prevent if possible any disturbance of the magnetic action, and, if any should occur, to afford facilities for watching and noting such disturbance, so as to prevent any deviation from the intended course.

We have so far looked at this ship without reference to the interests of the shareholders, or to the effect she must produce on our commerce with India. Unless she be a success in both respects, while she will always be looked upon as a beautiful specimen of naval architecture, and of the boldness and originality of the engineer, she will be pointed at as a striking illustration of the folly of the shareholders, and as another instance of the extraordinary absurdities into which the public of this country are periodically led.

If, however, she accomplish what is promised, then the nation will owe a debt of gratitude to the engineer and shareholders, and there can be little doubt that a fleet of such ships will soon be built, and a visit to India, *viâ* the Cape, will become one of our holiday trips, the passage being performed in a luxurious hotel, in the midst of some of nature's grandest scenes, instead of by the overland route, which concentrates in a journey of six weeks as much discomfort as it appears possible to experience in so short a time.

The cost of a passage to Calcutta is now £102, and, excepting to servants, is limited to 1st class.

If the Great Ship Company, relying on her size and economical arrangements, boldly meets the wants of the time, and charges but £60 for a 1st class, £40 for a 2nd class, and £25 for a 3rd class passage, and freight at proportionately low rates, its annual earnings and expenditure —so soon as her speed is proved, and making two voyages only—may be estimated thus:—

Income Outwards.			
400	....at	£60	£24,000
500	....at	40	20,000
3,000	....at	25	75,000
10,000	tons of cargo at	3	30,000
Income Homewards.			
300	....at	£60	£18,000
300	....at	40	12,000
2,000	....at	25	50,000
10,000	tons of cargo at	3	30,000
			259,000
Two voyages—annually			518,000

Expenditure.	
2 Voyages—Coals	£80,000
Officers, Engineers, Crew, &c., wages	20,000
Dietary for Crew & Passengers	60,000
Engines, oil, &c.,	5,000
Working Expenses	50,000
Wear and Tear	50,000
Depreciation	50,000
Insurance	50,000
	365,000
Balance or Profit	153,000
	£518,000

No estimate is made of the receipts likely to be derived from mails, parcels, or specie.

But exclusive of these sources of income there can hardly fail to be, if this amount be even near to correctness, an ample return to the shareholders, and if the wear and tear be estimated at the cost of the ship to the present company, the result will be much more favourable, but I have estimated them upon what I assume would be the cost of a second or sister ship.

I will not detain you to prove that there will be no difficulty in obtaining a sufficient number of passengers or tons of freight to fill the ship, for so long as we are annually exporting to and importing from India £15,000,000 to £20,000,000 value of manufactures and merchandise, and employing hundreds of thousands of tons of shipping, no doubt can exist on this head, especially when we recollect that the line by these ships will be a trunk or feeding line to the whole of our Indian empire and the Eastern world.

The cargo of 10,000 tons at high rates will consist of the first-class goods required at every port to which we trade, and the advantage to merchants on either side, whose intelligence and good information enables them to foresee a coming demand before it actually arrives, of receiving goods by a conveyance as quick and regular as that which conveys the orders, cannot be overrated.

At present orders are received by the overland mail to be forwarded by sea, the shipment of which is notified to every one by our Customs' reports, and frequently in time to enable merchants having no similar orders of their own, to make shipments on the faith of the known intelligence of others, which goods may arrive as soon, or perhaps sooner than those shipped by the parties by whom, in anticipation of a demand, orders were first transmitted to England by the overland route.

To ensure the earliest possible arrival of goods after the receipt of orders, will command an amount of freight which this ship, capacious as she is, will hardly be able to carry. Commercially then the establishment of a trunk route which shall combine speed and comparative cheapness, must command as large a share of business as can be undertaken by a fleet of such ships to sail monthly from either terminus. But having thus shown the results to be anticipated if this ship attained a speed of but 15 knots, let us contemplate for a moment what will be the effect of a similar ship with 4,000 horse power in lieu of 2,600—a proportion of power to tonnage still much smaller than is ordinarily used in our large passenger ships. Every expense will be the same but the engine work and fuel; the space allotted to cargo must be nearly filled with coal, as in our existing large passenger ships; the speed would be 20 knots instead of 15, and we should reach Calcutta in 600 hours instead of 800, or in 25 days instead of 33. At such speed we should omit cargo to make room for coal, but we should at once take all the first-class passengers at the highest rates now charged, which would very much increase the receipts under this head. The same fuel, or perhaps rather more, would be used in the 600 hours as in 750, the cost of which would be covered by the saving in the dietary of so large a number of persons for eight days; but commerce would not be benefited by the change.

It appears to me almost impossible to appreciate, much less to estimate, the effect of thus reducing the distance between England and India; even the effect produced upon the home trade, by the introduction of railways, or the increased facilities for our correspondence by the joint effects of penny postage and railway conveniences, invaluable and startling as they are, or the daily increasing traffic between England and America, since 1838, when the first passage was made, to the present time when steam-boats are running almost daily, offer but poor means of estimating the advantages to be derived from bringing several hundred millions of people and their wants within a few days of our shores. Surely support ought not to be wanting to aid in overcoming the difficulties attending the commencement of so vast an undertaking, for when once the fact is established, means will soon be found to develop it more fully.

We must now, having hastily described the construction and the internal arrangements of this ship, and the effect it will probably produce on the commerce of the country, proceed to consider the results which the engineer anticipated would follow this combination of size and power, and compare them, as we are now in some measure able to do, with those obtained during the trial trips, from London to Portland, from Portland to Holyhead, and from Holyhead to Southampton.

Mr. Brunel, when placing his views before competent persons, in 1851, inquired whether, if he could build a ship that should be safer than any ship afloat, that could perform the voyage to Calcutta in 30 or 33 days, and could carry a large number of passengers in comfort hitherto unknown at sea, and 5,000 or 10,000 tons of cargo, at clipper rates, sufficient passengers and cargo would be found to make it a remunerative undertaking.

The answer to these questions was prepared by Mr. Campbell, the present energetic chairman of the Company, and so conclusive were the facts he collected, that a Company was formed, and the ship has been built.

Public opinion, scientific and popular, has acknowledged the unparalleled strength and safety of this ship, almost without a dissentient voice.

The power to perform the voyage to Calcutta in 30 or 33 days has yet to be tested, but there are facts enough collected to enable us to form a tolerably accurate opinion as to the probability of her success in this respect.

Much misconception, owing no doubt to a vague idea of the real distance to Calcutta, to the great length of time occupied by clipper ships and auxiliary steam-ships in the voyage, and the apparently, as compared with them, very short time given to this ship, has got possession of the public mind as to the speed per hour necessary to accomplish the duty undertaken.

To give a popular illustration of the speed required, let me compare the time occupied by an express train and an ordinary railway train. It is not that the express engine goes so much faster than that of the common train, but that all stoppages are avoided. So with this ship; it is her power to run the distance without stopping, or going out of her course to coal, that enables her to accomplish the object in view.

The speed proposed by Mr. Brunel in the first-published prospectus, in 1852, was that "which experience proves

such vessels to be capable of, and which will perform the voyage easily in 32 days."

To do this, he determined to employ engines of 2,600 horse power, consuming from 250 to 300 tons of fuel per day, and, in the report just referred to, 15 knots per hour is stated as the required speed.

Let us then inquire if this rate is likely to be realised. The trials prove, as far as they go, (the engines never having been worked to full speed), that after a little working, when everything is in order, this rate will be attained.

The Distance to Calcutta is 11,819 geographical miles or knots.

The time to Calcutta by Peninsular and Oriental ships, 38 to 40 days.

Time to Calcutta *via* Marseilles, 34 to 36 days.

Time to Calcutta by *Great Eastern*, at per hour :—16 knots, 31 days ; 15 knots, 33 days ; 14 knots, 35 days ; 13 knots, 38 days.

Cost of first-class passage by Peninsular and Oriental boats and rail, £102.

Do. per *Great Eastern*, £60.

Luggage for each passenger (free), 336lbs. per Peninsular and Oriental.

Do., 40 cubic feet per *Great Eastern*.

Charge for extra luggage per Peninsular and Oriental boats at the rate of £36 per ton.

Do., per *Great Eastern*, say £12 per ton.

Trade to India—Tonnage cleared to Calcutta, Madras, and Ceylon (1858), 294,162 tons.

Estimated annual value of trade to India, per annum, £15,000,000 to £20,000,000.

Now from 12 to 15½ knots have been done with a maximum rate of 12½ revolutions of the paddle and 40 of the screw engines per minute. Give them 16 and 48 respectively, and more than the anticipated duty will be done.

Indeed, so accurately has the speed attained agreed with the printed table of rates prepared by Mr. Russell, that with it in your hand and knowing the number of revolutions of the engines, you could almost with certainty declare her speed without reference to the log, and this under adverse circumstances, for she has not yet been tried in calm weather and with a fair wind.

In comparing her speed with that of our large ocean passenger ships supported by large government subsidies, it must not be forgotten that while by this ship it was proposed to accomplish a higher average ocean speed than has yet been attained, it was also calculated to carry so many passengers and so much freight, that it should be worked profitably without subsidy, the sum annually paid by government to mail steamers being £982,000, of which

£167,125	is paid	for the Indian route.
204,000	,,	for the Australian.
172,840	,,	for the American.
And 244,000	,,	for the West Indian.

In every other fast passenger ship the coals and engines, even for a short voyage, occupy so much of the ship that but little freight can be carried, and only a limited number of passengers in proportion to the size of the ship, and these mainly of the first class. They occupy the same relative position in ocean travelling to other steamers that the fast coach or the mail did, to the six insider of former days. The one quick, used only by the rich, the other slow, but paid for by the public.

Railways have abolished this distinction ashore; rich and poor travel at nearly the same speed, though at varying rates; and this great ship is the first step in the same direction afloat. Mail coaches required subsidies—by rail the mail is carried at rates scarcely equal to the actual cost of transit. So the mail steamers now built cannot run without subsidies; and as the rail has beaten the coach, so we hope in this ship to beat the subsidised mail steamers in speed and economy, and thus to secure large public support, which is of infinitely more value than a government subsidy. The one tends to check progress so long as a contract continues; the other stimulates and encourages it, because it rewards every improvement.

Now at 15 knots per hour this ship will reach Calcutta in 32 days, and at 16 knots in 30 days and 12 hours., with a consumption of fuel, when the aid of trade winds and favourable monsoons is allowed for, not exceeding 280 tons per diem.

I believe, then, we may fairly expect, from what has already been done, that when everything is in order, and all hands, from the captain to the stoker, are up to their work, and the engines do the duty assigned to them, this speed will be attained, and the distance accomplished in the time originally contemplated.

There can be no doubt but that if she had more power her speed would be greater; but extra speed can only be attained by the displacement of passengers and cargo; and it is the skill with which the space allotted to machinery, the source of expenditure, and that allotted to passengers and cargo, the sources of income, have been determined, that forms the best ground of our hope that this ship, when the first difficulties of starting so novel an undertaking are overcome, will be a great commercial success. Disturb the one, and the rates for the other two must be increased and our surest element of prosperity destroyed.

These facts can be strikingly illustrated by comparing some of our largest passenger ships with the *Great Eastern*.

Great Eastern compared with Atrato, Shannon, and Persia.

Ships.	Tonnage.	Horse Power.	Coals per Day.	Speed per Hour.	Cost.	Store of Coals for.	Carrying Power for Passengers and Cargo.	
								Tons.
Great Eastern.	22,500	2,600	300	14 kts.	650,000	40 days.	4,000	10,000
Atrato	2,720	800	95	11½	105,000	15 days.	194	300
Shannon...	3,092	800	92	11½	120,000	15 days.	268	450
Persia	3,585	1,000	140	11⅔	140,000	14 days.	356	400

Or, as compared with the Average of these Three Ships.

The *Great Eastern*	has cost ...	5 times as much.
,, ,, ,,	is	7 times larger.
,, ,, ,,	has	3 times the power.
,, ,, ,,	has at 14knots	1·22 times the speed.
,, ,, ,,	carries 40 days' fuel against 15.	
,, ,, ,,	has carrying or commercial power for passengers	15 times greater.
,, ,, ,,	for cargo	26 times greater.

In all these ships—and they fairly represent the subsidised mail and passenger ships—it will be seen that the quantity of cargo carried is trifling in proportion to their size, and that the expenditure of coals in proportion to size and speed is enormous, and whilst, with a horse-power of 1 to 3 or 4 tons of burthen, they give an average speed of only 11 knots per hour, the *Great Eastern*, to run 15 knots, has but 1 horse-power to 8½ tons burthen.

This then is the measure of the advantage gained by her beautiful form, great size, but comparatively small steam-power. We have a higher speed by a vessel 7 or 8 times larger than any afloat, than has yet been attained—capable of carrying from 5,000 to 10,000 passengers, or 4,000 passengers and 10,000 tons of cargo; burning per hour but 3 times the quantity of coals now used by ships one-eighth her size, and carrying fuel for 40 days steaming instead of for 15 days—can anyone doubt this being a great advance in ocean steam navigation? Railway speed was never the object of the engineer, but large carrying power with great safety, at a speed to accomplish the distance to India in the same or in less time than by the overland mail route, with the economy of ordinary clipper ships, *was his object*, and, as far as we can see, it appears likely to be fully realised.

I have now endeavoured to show that the passengers will

be carried in greater comfort than has ever yet been found at sea.

Everyone who has been on board during her trial trips testifies to her steadiness. It has been assumed by some, without any reason, that she would neither pitch nor roll, an assumption displaying a want of knowledge of dynamics, and of what is required for the safety of the ship. This opinion, however, was held by many when the idea of so large a ship was first announced, and would, were it the fact, be, as they asserted, a source of danger, for were she so stiff as some fancied she would be, she would receive the full shock of every wave passing her, which, notwithstanding her great strength, would sorely try her.

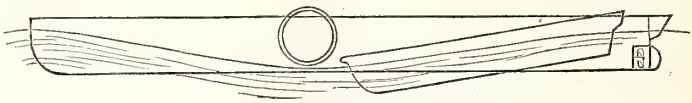
The rate with which waves are driven along during severe storms has been very accurately determined by Dr. Scoresby not to exceed 34 knots per hour.

The highest rate he registered during a severe storm in the Atlantic Ocean, in 1847, was 32.67, and in one still more severe in the Southern Ocean, in 1855, 33.9 knots per hour.

The time occupied by a wave in passing the *Royal Charter* during the storm in 1855 was nine seconds, the ship running forward, during the same time, 180 feet, by which you can form an idea of ample time for that ship to rise and fall as the waves alternately overtook and passed her, whilst their rate, which, in the case of the *Royal Charter*, was nearly three times that of the ship, would be only a little more than double that of the *Great Eastern*, but, whatever these double proportions may be, her motion in the water will be governed by the same laws which regulate that of smaller ships, with this difference in the effect, that as she is larger and more powerful, the waves which would make a Dover packet pitch and roll, as most of us have experieneed in crossing the Channel, will produce no effect upon her. Let, however, waves be formed which bear the same proportion to this ship as the waves in the Channel do to a Dover packet, and the pitching and rolling will be equal; but as this, so far as our knowledge goes, cannot be, so will this ship be easier than any other.

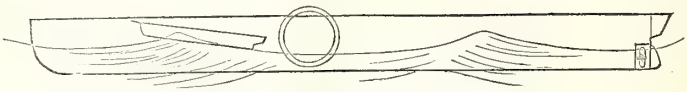
Thus we find, during the late rough weather, as she came round the Land's End, with a westerly gale driving in the Atlantic rollers, she rolled only to 8 degrees, whereas, Dr. Scoresby, running round the same course to Plymouth in 1855 in the *Royal Charter*, states that off the Lizard the rolling varied from 20 to 30 degrees, and that in a gale of wind in the Southern Ocean, when the ship was running 14 knots, she rolled 28 degrees to port and 19 degrees to starboard; and that her rolling on the return voyage from Australia viâ Cape Horn was much greater, the clinometer indicating, on several occasions, an inclination of 33 degrees to port and 28 degrees to starboard, and on one occasion the time occupied by each oscillation was 50 seconds.

Fig. 6.



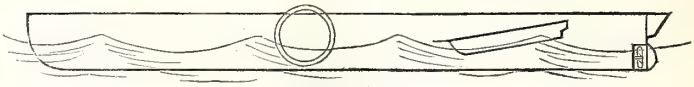
40 feet wave.

Fig. 7.



20 feet wave.

Fig. 8.



10 feet wave.

Fig 6 represents the *Great Eastern* and *Royal Charter*.
Figs. 7 and 8 represent the *Great Eastern* and an ordinary Channel-steamer.

It can hardly be doubted, then, that with almost an absence of pitching, and rolling so much reduced as in bad weather not to exceed 8 to 10 degrees, this must be a comfortable ship, and we have a right to regard the superiority of comfort in this over that of any other ship as satisfactorily proved; but while on this part of the subject, I will quote a few remarks of Dr. Scoresby, relating to the pitching of the *Royal Charter*, during very severe weather, and when the waves of Cape Horn were at the maximum height he ever witnessed.

The *Royal Charter* was a ship of 2,000 tons burden—326 feet long, 41.6ft beam, and 26.6ft in depth—or rather less than half the length and depth of the *Great Eastern*, and just half the beam.

Dr. Scoresby, a very experienced sailor, as well as a distinguished man of science, describes her as the easiest ship he had ever sailed in. He says that in a violent gale, when the ship made 12 and 14 knots per hour, and when the waves were at their maximum height of 40 and 42 feet, the prevailing seas being above 30 feet, and 650 feet in length from crest to crest, that there were intervals in which the ship was perfectly steady, and found an even berth.

If that be so with a length of 326 feet, how much more perfect will be the berthing on the waves of a ship 682 feet long

The height of the waves here referred to was from 40 to 42 feet—20 or 21 feet above the mean level of the water—a height sufficient to wash over even a larger ship, if she did not rise to the waves, but which would hardly reach the *Great Eastern*, the tops of whose bulwarks are more than 30 feet above her load water line.

I cannot resist quoting a paragraph from Dr. Scoresby's journal, referring to the motion of the *Royal Charter* in this very severe storm.—He says:—

"Now, as to the action of the *Royal Charter* under this hard gale and mighty disturbance of the waters.

"The experience we derived was very astonishing, and, compared with all my previous experience, what I should have deemed impossible. * * * A minute or two would often pass whilst these mighty waves were rolling harmlessly forward, and but just raising in a slight degree the stern and alternately depressing it, when we might have seemed to be sailing in a sea of extreme calmness in the finest weather.

"I noticed intervals of from 7 to 8, 10 to 11, and

sometimes of from 20 to 24 seconds, when there was not motion sufficient to break the silence of repose like that of a dock or harbour. Thus when the waves were the highest, when elevations of 40 feet and upwards were rolling around and beneath the ship, Mrs. Scoresby accompanied me on deck for exercise, and to view in an instant of bright sunshine the sublime scenes around.

"Again in regard to pitching, the action of the ship was equally remarkable. A 40-feet wave, on its entrance below the stern, whilst the bow was exactly in the most depressed position, betwixt east and west, should raise the stern, so as to give an inclination to the keel of 7°, but no such measure of pitching was ever observed, probably not more than half so much. In no instance of scudding did I observe the stern rise to anything like the position due to the elevation of the passing wave.

"The action was obviously of this nature. From the admirable line of construction forward and aft, the loftiest wave, on its reaching the stern post below, exerts its lifting force not abruptly or suddenly, as when the quarters were heavy and the run thick, but very gradually, so that the disturbing force passing rapidly beyond the place of greatest influence before its due action is realised, becomes modified and reduced."

We now come to the last division of our subject—the national importance of this great undertaking.

At present, the most rapid means of intercourse with our eastern possessions is through France, across the Mediterranean and through Egypt by the Red Sea to the Persian Gulf. This route can be stopped at any moment by the Emperor of the French.

The next in shortness, is by sea to Alexandria, which can be very much endangered by French fleets, and thereby deprived of all its certainty and safety, besides the risk attending the transit through Egypt.

Such are the difficulties and expense of this route, that it can only be maintained by aid of an enormous subsidy from the Government, and even then with very high charges for the conveyance of passengers and small parcels; to commerce it is entirely inaccessible. The charge by the Peninsular and Oriental Company is, by sea to Calcutta, £102, and the ordinary time required to reach Calcutta is 38 days, or four days less at an extra charge, *viâ* Marseilles.

The *Great Eastern*, therefore, will forestall the arrival of the Peninsular and Oriental boats, by several days, at Calcutta, and this without subjecting either letters or passengers to the risks and inconveniences of three times passing through foreign countries, or to being transferred from one conveyance to another, or to being interfered with from political disagreements between France and ourselves; for until France build a *Great Eastern* with higher speed than ours, she cannot be impeded in her voyages, and whatever speed France can attain, if she build a *Great Eastern*, it is evident we can equal, if not surpass it.

By such means, then, may our Eastern possessions be brought not only so many days nearer to us, but the communication be rendered more safe and equally certain as by the existing routes.

It is unnecessary to enlarge on this part of the subject. Every one must at once see the importance of thus reducing the distance as measured by time between India and this country, especially if at the same time we afford infinitely superior means than now exist for transporting an almost unlimited number of troops and material or merchandise to and from any part of our distant possessions.

One *Great Eastern* will not suffice, either for Commerce or for the Government, when her power and speed are fully proved. The objection made by many that it would not be prudent to put 5,000 or 10,000 troops in one bottom is most futile. Let it be proved that this conveyance is the safest, the quickest, and most certain, and the objection fails at once. The safety depends on the construction of the vessel. In this respect our ship has been built under the gaze of the world, and no one from the new or old world has challenged her wonderful strength. Her speed at once relieves her from a large portion of risk in passing from distant places by sea, for not only will it enable her to pass more rapidly through bad weather, but it reduces, in proportion as time is saved on the voyage, her chance of being caught in bad weather. Her strength and speed, the result of the union of size and beautiful form with her economically applied motive power, give certainty to her rate, and, therefore, to the duration of her voyages, and, as we now find by experience the increased punctuality attained by large as compared with small ships, few can doubt that she will, in proportion to her size, be more regular and more certain in her arrival than our largest ships now are.

Then, as to the idea of risk in conveying so large a number in one bottom; that, as in the case of railways, will soon yield to the practical test of regularity and safety, just as, a few years back, objections were taken to 700 or 800 passengers, besides the crew, being carried in one bottom, now a matter of common occurrence, or to 3,000 troops being carried in one ship, as was done by the *Himalaya* during the late war. Experience has fully proved that large ships are safer than small ones, and no one ever thinks of refusing to take a passage in a good ship because she carries a large number of passengers.

What power, then, will a fleet of such ships give to our country—troops and material, ammunition or manufactures, the elements of war or peace, carried in safety nearly 400 miles per day to our Eastern possessions and colonies. What an element of offence and defence, what new sources of wealth may it not open to us. Who can estimate the importance of such an increased command over the elements, wind and water, which a fleet of such ships will give to us? And to whom do we owe this prospect of so vast an addition to our political and commercial power—to whose bold and original genius we are indebted for this great combination of practical, theoretical, and mechanical knowledge—this triumph of human intellect—to one whom I grieve to say is now no more—to one taken from us at the moment of the success of this his greatest achievement—to one whose mind, from early youth directed to shipbuilding, stored up as it gained power every accession to knowledge which experience afforded him, and who, as a man of true genius, cautiously advancing step by step—each step surpassing that which preceded it each in its day being in advance of his time, having, led the way by steam to America, has now constructed a ship which will do for India and Australia that which the *Great Western* in 1838 did for America—viz., reduce the distance between these great colonies and dependencies and England, to the increased security of the empire, to the promotion of Arts, Manufactures, and Commerce, and to the advancement of civilisation and good government all over the world. And may we not look at this great step as another link in the chain of success, by which the Great Disposer of events is leading our country to still further greatness—is enabling her to maintain her superiority over all her rivals, and is permitting her to enjoy the natural fruit of her free institutions, civil and religious, which admit no retrograde movement, but which must not tempt us to forget that we have many social evils to remove, many political institutions to improve, many duties owing to the stalwart arms, without whose help these national works could not be achieved, before we can point with as much pride to our moral greatness as we now can safely do to our triumphs over physical difficulties.

APPENDIX.

DIMENSIONS OF THE GREAT EASTERN.

Length over all, 692 feet; breadth, 83 feet; depth from deck to keel, 60 feet; number of water-tight compartments, 12; partial ditto, 7; longitudinal bulkheads, running fore and aft, from keel to upper deck, at a distance apart of 36 feet, and 350 feet long, 2; space between the two skins of ship, 2 feet 10 inches; thickness of floor plates or keel, 1 inch; thickness of inner and outer skins and bulkheads, ½ inch.

Engines. Paddle:—4 cylinders, 74 inches diameter, 14 feet stroke, 4 boilers, 40 furnaces, 1,000 horse-power, paddle-wheels 50 feet in diameter, but capable of reduction by reefing. Screw:—Cylinders, 4; diameter, 80 inches; stroke, 4 feet; boilers, 6; furnaces, 72; diameter of screw, 24 feet; blades to screw, 4; horse-power, 1,600.

Weight of ship and machinery at launch, 12,000 tons immersing 15 feet 6 inches; ordinary light draught, 20 feet; full load, 30 feet; space for fuel, &c., 12,000 tons.

DISCUSSION.

Mr. Andrew Henderson begged to express the opinion which he had always entertained—that the *Great Eastern* was altogether too large for practical purposes, and what had been stated that evening gave him no reason to alter that opinion. He considered that for all mercantile purposes vessels of 360 or 380 feet in length were sufficiently large. He believed that experience would prove that the *Great Eastern* was too large to be managed, and there would be difficulties in harbour which could not be overcome except with great loss of time. They had no experience of what the behaviour of a vessel a furlong in length would be in a heavy sea; but his opinion as an old sailor was that she would not rise with the sea as a ship of half the length would do. There was an instance of that kind in the *San Francisco*, a large American steamer, which, on her passage to California, got into the Gulf stream with a north-west gale, carried away her air-pump rod, and in less than half an hour became perfectly unmanageable. The decks were stove in, and 150 men washed overboard; and a proportionably greater effect would have been produced upon a larger vessel. It was all very well to say that the passengers would experience very little annoyance from the motion of the vessel, but the great question was as to her sea-going qualities. As an old sailor he looked with some dread upon the *Great Eastern* encountering a heavy sea, as, in case of accident to her machinery, she would get into the trough of the sea and become unmanageable.

Mr. J. G. Frith could not go the entire length of Mr. Hawes's anticipations with regard to the commercial success of this great undertaking; he had his doubts upon it. In the first place, the cost of the vessel hitherto had been very great, and the expenditure for its complete equipment would, doubtless, be a very large addition. He had been told that the main paddle-wheel shaft of the *Great Eastern* was so low, that when she was loaded the paddle floats would have to be reefed, thereby diminishing the leverage of the paddle-wheels to a certain extent, and that therefore a speed of fifteen knots an hour could not be calculated upon through the whole voyage. As the ship lightened from the consumption of coals the paddle-wheels would come out of the water, but the consumption of coals could not be confined to one bunker, but to keep the vessel in trim they must equal the discharge of coals from all the bunkers, and water would have to be supplied to take the place of the ballast in the shape of coals. The next point was with regard to the collection of the cargo. It was impossible to collect cargo for so large a ship within a reasonable period, and to that was to be added the question of insurance. Assuming that the vessel had a full cargo of valuable metals and piece goods, they would never be able to get an insurance office, Lloyd's or any other office in the kingdom, to effect the insurance. Going to the East Indies, Calcutta was a port from which the *Great Eastern* would be shut out. She could not pass the sand bank, and could never go beyond Kedjeree, and therefore lighters would have to be employed to carry the cargo up to Calcutta, which would add materially to the cost of the freight. Then again upon the question of passengers, he had no doubt that the voyage could be accomplished in from 33 to 38 days; but for commercial pursoses he questioned the applicability of the system. They must bear in mind that those voyages were not undertaken by 3,000 or 4,000 people for Calcutta only. Some might have business in the ports of the Red Sea, the destination of others might be the Cape, so that they could hardly calculate upon the great number of passengers mentioned on each voyage through to Calcutta. No doubt the theory which Mr. Hawes had advanced was a very beautiful one, if they could secure all the conditions, but there were contingencies which had not yet been shadowed forth, and which, perhaps, could only be realised as they occurred. He expressed his unqualified approbation of Mr. Hawes's paper, and of the genius of the man by whom the undertaking had been designed. He considered the *Great Eastern* was the finest ship that had ever been constructed, but he wished she had a keel.

Mr. Topham would offer a few remaks upon this, as he regarded it, national undertaking; and, first, with respect to the point of the vessel getting upon two waves—one astern and another at the bows. The waves always followed one another in the same direction. If the wind was ahead, and the waves met the ship in her course, the wave at the stern would pass away while the other was lifting her up. If the waves were in the same direction as the vessel's course, the two waves would lift her together—but she was so strongly built that, if she was supported in that position, there would be no danger, and two waves would help her rather than otherwise. Then as to the steam efficacy of the *Great Eastern*. As a proof of the probability of her being economically worked, it might be mentioned that the *Great Britain* was originally fitted with engines of 1,000 horse-power, which were replaced by engines of 400 horse-power, the result of which was that the speed was increased, and the working expenses, as far as the machinery was concerned, were reduced more than 50 per cent. In the case of the *Valetta*, a vessel built by the Peninsular and Oriental Company, for the rapid transmission of the mails from Marseilles to Alexandria, she was fitted with engines of 400 horse power; but the directors found, from representations made to them, that the engines were too large for the vessel and sank her so deep that she was almost buried. They then built the *Delta*, and placed in her the engines that were taken from the *Valetta*. The *Delta* was more than twice the size of the *Valetta*, and it was found that with the 400 horse power engines the former vessel attained nearly double the speed of the latter. Engines of 200-horse power were put into the *Valetta*, and the result was a much greater rate of speed with the 200-horse power than with the 400. They might, therefore, expect in the case of the *Great Eastern*, economical working of her machinery and a high rate of speed, in comparison with the effective horse power of her engines.

Mr. P. L. Simmonds said he had listened with deep attention and a great deal of interest, to the valuable details which had been submitted to that very full meeting of members and visitors upon this important subject. He was glad to see that Mr. Hawes entertained the same views that he did, that the Indian line was the proper and commercially paying one for the *Great Eastern*, for this was the opinion that he had enunciated several months ago. Although the *Great Eastern* had, up to the present time, many difficulties to contend with, yet where was there a great and novel undertaking that did not meet some checks and disasters? That she would pass successfully through all these stages of pecuniary and other difficulties he fully believed. As for the objections which had been started by the two previous speakers, he did not think they were at all tenable. The same objections, doubts, and unfavourable opinions had been advanced in every stage of steam progress and enlarged ship building, from the time when the *Thames* Margate steam yacht, nearly half a century ago, crossed the Irish channel, to that when the *Great Western*, *Great Britain*, and other successive steam vessels, of larger size and improved build, put to sea. The manageability and sea capabilities of the *Great Eastern* had been clearly shown by her channel trips, and

had been fully explained in detail by Mr. Hawes. Looking at the large amount of the trade with the Eastern countries, not only with India, to which Mr. Hawes had confined his attenion, but with Ceylon and Mauritius, the Straits' Settlements, the Eastern Archipelago, China, and Australia, he thought there was good ground for looking to commercial success for the enterprise, both as to cargo and passengers, on a moderate scale of charges. The Peninsular and Oriental Steam Company was, with their monopoly and high rate of charges. unable to accommodate the present traffic, for their vessels were frequently booked several months in advance. It was not contemplated that the *Great Eastern* should approach the Hooghly, but a magnificent harbour like Trincomalee, or some similar port, would offer a safe and commodious depot for the receipt and delivery of goods, for the large merchandise and passenger traffic which might advantageously be collected and distributed by branch lines. As for the difficulty urged in loading or unloading so many thousand tons, considering the vessel was built in compartments, had much available horse-power, and a very extended length, he thought this would not be found important. But these and other objections urged were matters which Mr. Hawes would, no doubt, ably and fully reply to. Let but the ship be got well out of hand, placed under efficient management, and the necessary preliminary arrangements and announcements made in the various Indian ports, and he had perfect faith in her performances, and doubted not a large share of passengers and cargo could be obtained for her.

Mr. Robert Scott said, with regard to the *Great Eastern*, there was one thing that had not been yet touched upon, which he thought stood very much in the way of her success. As a first step it was necessary that a private Act of Parliament should be obtained, to be applicable to this vessel as well as to all others over a certain tonnage. At the present time shipowners, particularly of iron vessels, were bound, by the regulations of the Board of Trade, to have their vessels docked every six months, so that their bottoms might be inspected, besides other matters involving considerable expense. Unless that was done, the Board of Trade certificate was not granted to the vessel. As the law now stood the *Great Eastern* could not get her certificate unless a special Act of Parliament were passed to meet the exigencies of the case. There was no doubt that Mr. Brunel, with his great mind, had taken a seven-league stride ahead of the general ideas of his day. He (Mr. Scott) believed that, before the *Great Eastern* became a great favourite, other vessels would be built of a medium size—say about 5,500 tons—and, eventually, no doubt the *Great Eastern* would come into her place—but not immediately—as a paying vessel. But a special Act of Parliament was required in the first place, as to the Board of Trade certificate, without which she could not carry passengers, or be allowed to clear from the port. Supposing she carried 7,000 passengers, it would be beyond the population of a village, it would be that of a small town, and with a mixed assembly of that number they would require an effective police department. It would be impossible for the captain to attend to those matters as well as the conduct of the ship. They would require two police magistrates at least on board. All that could be done in the present state of the law with regard to offences committed on board ship was to inflict the trivial punishment of either confining the offender below decks or stopping his ordinary rations of food; but when he got ashore he might go to the nearest magistrate and lodge a complaint against the captain, which would have the effect of detaining the ship during the time the case was being investigated. When they took out 7,000 or 8,000 persons and recollected the many little things that might be brought against the captain, some such provision as he had suggested was absolutely necessary, by which all offences committed on board the ship could be disposed of in the same manner as if they occurred within the limits of the United Kingdom. They had not yet arrived at anything like an adequate idea of all that the *Great Eastern* really was. In proportion to her dimensions, every department was magnified in more than a direct ratio. He did not think this vessel would arrive at a commercial success until great minds took up the whole question, and worked it out in all its details. He thought that a Parliamentary Committee of Inquiry, with a view to special legislation, should be appointed, and the blue book would open the eyes of the public so much that ultimately the full benefits to be derived from such a ship as the *Great Eastern* would be obtained.

Mr. L. S. Magnus said one objection which had been urged against the great ship was relative to the discharge of the cargo. He could assure the present meeting that the whole cargo of the ship might be easily discharged in four days: that there would be no more difficulty in delivering any merchant's goods when called for than there would be out of a ship of 700 or 800 tons—not even the ordinary difficulties. The idea of something being stowed away at the bottom of the hold, could scarcely have arisen in the mind of any person who had seen how easily the cargo might be discharged from the 500 different divisions or compartments on the several decks. In reply to what had fallen from the last speaker, he would state that a bill had either been already lodged, or was prepared to be lodged, for a special Act of Parliament for the *Great Eastern*. It certainly did not provide for police magistrates, but it did provide for some of those deficiencies which existed in the present laws, which had not contemplated the existence of so large a vessel; and he believed Parliament would allow them to be provided for in a simple manner, by giving the Board of Trade power to supersede those Acts, whenever they thought it necessary, for a limited period.

Mr. R. F. Davis, as a member of the Society, felt most grateful to Mr. Hawes for the able paper he had read; and he was doubly grateful to him for the terms in which he had spoken of a man whose loss they must all deeply lament—whose genius was something transcendent—who was too early snatched away, but who, had he lived to continue in the full control of this great undertaking, would, no doubt, in spite of all the difficulties with which it was surrounded, have brought it to a successful issue. But he was gone, and it was for those who were left behind—although he feared there was no one capable of bearing his mantle—to do the best they could. As one of the public, he would say to the shareholders of the *Great Eastern*—despite the mercantile and nautical opinions they had heard that evening that it would not be a success—persevere. The late George Stephenson—the colliery boy—the humble engine-wright of Killingworth, was told by the great authorities of the country that he could never make a railway across Chat Moss, but he did make it. When scientific authority was brought to prove that he could not construct a locomotive to travel above a certain rate of speed, George Stephenson persevered, and his efforts were crowned with complete success. In like manner he would say to the shareholders of the *Great Eastern*—"You have made the railway across Chat Moss—you have now only to run the engine over it." Perseverance he believed would do it; but it must be a perseverance not encumbered by the difficulties of divided councils. It was satisfactory to find that in anything connected with this great undertaking, in which the late Mr. Brunel had unrestricted control, perfect success had been achieved; and he (Mr. Davis) was one of those who believed that had he lived to complete it, the great work would have been as perfect a success as every right-minded man must hope it would yet be.

Mr. Hawes claimed the privilege of saying a few words in reply to the observations of his friends, as to the difficulty of managing the ship, and as to the probabilities of its ultimate success. It had been the universal language of every seafaring man, and almost every elderly merchant, that ships of a certain size only could be profitably worked, but

if they turned to the tabular statement before them, they would find that when the *Great Western* was built, in 1838, being 50 feet longer than any other ship, she was threatened with destruction, by what was called breaking her back, for she was a wooden ship. Every prediction of misfortune was applied to that vessel. But, in 1844, the *Great Britain*, a ship double her size was built, and, in 1853, the *Himalaya*, a still larger one. In 1856, the *Persia*, of nearly 4,000 tons, a vessel belonging to the celebrated Cunard line, went still beyond that, and, in 1857, they had the *Great Eastern*, which eclipsed them all. It was clear that, as regarded the loading and unloading of the cargo, they could apply to a ship 700 feet long many more appliances for receiving and discharging than to a smaller ship; and just in proportion as they could use that space, they could use power which it was impossible to apply to the old-fashioned ships. They could bring the steam-engine and other mechanical appliances to bear, and discharge more hundreds of tons of cargo per day than other vessels could do in a week. Then they must bear in mind that this cargo was not to be received and discharged at one spot. This ship and the sister ships which would probably follow, were to be the trunk lines of communication between England and our Eastern possessions. They would be the great trunk from which the Eastern world would be supplied with the manufactures of England, whilst we should receive from them, collected into one great focus, the products and manufactures of those eastern climes. No doubt if they proved the safety and speed of this ship, and the appliances for loading and unloading were all that was anticipated, other difficulties would speedily vanish. He advised them not to confine themselves to perseverance only, but let them adopt the motto of Mr Brunel, which was "en avant," or "go ahead." That was the motto which would enable them to overcome the difficulties which surrounded the undertaking, and which certainly would be overcome in some way or another, for he felt convinced that this country would not abandon this great project until success was entirely achieved. One other observation of moment was that which had reference to the paddle-shaft being placed too low, so that when the ship was heavy or light the action of the paddle-wheels would be impeded or lessened, so as to affect the calculated speed. To that he would reply that this ship had one peculiarity which was not possessed by any other vessel. There was the power of reefing her paddles, so as to suit them to the load line of the ship. There was also the power of filling the skin with water, so as to preserve one line of flotation for the greater part of the voyage. Put those appliances together, and they would be able to maintain, under any circumstances, that equal exertion of power which would secure an uniformity of speed under the varying load caused by her consumption of a large quantity of fuel. His friend, Mr. Frith, had expressed his regret that this ship had been constructed without a keel. Now a keel in a wooden ship was a certain thickness of timber placed below the outer-planking of the ship, by which she was made to draw so much more water, and it would, therefore, cause her to strike the ground in two feet deeper water than she would do without the keel. They had heard of the keel being knocked away; but it was not a part of the ship. A keel was necessary in a short bluff ship, but the long thin easy run of the great ship not only did the duty of a keel, but did it better than a keel could do. It was like the weather-board which hung on the side of a flat-bottomed barge; but in this case they had the lee-board in the deep narrow surface at the stem and stern of the ship. To be of any value at all the keel to this ship must be from 3 to 4 feet deep, and that would increase the risk of striking the ground, and would exclude the ship from many ports which were now accessible. It was an old-fashioned ship-building notion, which could be entirely dispensed with in ships of this extreme length.

The Chairman said it was now his gratifying duty to propose that they should express their acknowledgments to Mr. Hawes, for the able and interesting paper with which he had favoured them. They lived in an age of wonders, and in no respect did they see them manifested more than in the intercommunications between man and man, and between one part of this world and another, which had followed the application of the advanced science of the day. Amidst all these wonders—whether it was the great bridges of Mr. Stephenson, or the telegraph across the Atlantic, which he hoped yet to see accomplished, or whether it was any other great achievement of like character—he was satisfied that in a future day none would be regarded with more wonder than this invention, if he might so term it, of the late Mr. Brunel. Into the merits of this question in a mechanical point of view he did not propose to enter. He would simply say, having watched the construction of this ship with great interest, that he had always looked forward with a large amount of faith to its success in an engineering point of view, principally because he had great faith in Mr. Brunel. He regarded the opinion of that gentleman as the best that could be obtained in a matter of this kind, and he had great faith in the influence of that authority; and as a mechanical production he had never doubted of its success. With regard to the commercial results, he would say, having considered the subject with care, that he was inclined to the opinion expressed this evening, and he was unable to see his way to the successful accomplishment of the objects stated by Mr. Simmonds. He could not see how it was possible that a vessel like the *Great Eastern* could be economically employed in the conveying a large quantity of produce from a central port in our possessions to this country. He was satisfied that those who had produce to send would do so more economically by shipping it at the port nearest the locality where it was produced. A vast deal of money must be expended in bringing the goods from the localities where they were produced to one central port of shipment, as would be necessary with this vessel—time being one of the most important elements in commercial considerations. Although he had no great hopes of the success of the *Great Eastern* as a commercial speculation, he hoped that in this respect he might be mistaken, and no one would be more gratified than he should be to find that he had been mistaken.

A vote of thanks was then unanimously passed to Mr. Hawes.

The Secretary announced that on Wednesday evening next, the 21st inst., a paper by Mr. F. Crace Calvert, F.R.S., "On Starches; the purposes for which they are employed, and the improvements in their manufacture," would be read. On this evening John Dillon, Esq., Vice-President of the Society, will preside.

NEW LIFE BOAT.

The following is a brief description of the boat, of which a model was laid on the table on Wednesday evening:—

It provides life and other boats with hollow adjustable floats along their outer sides, and water-tight compartments within. The floats are made of a conical or egg form, in their transverse section, and so fitted to the boat, as to secure their greater buoyancy when first touching the water. They are constructed of ten (more or less) canisters, of copper, India-rubber, (in case of gunboats) galvanized iron, or other material, arranged in a series, and terminating in elevated prows. Between the canisters are placed braces of wood or other material, of any desirable thickness, thus securing the floats from injury. The canisters are covered with wood, and are of such a shape as to be well protected by the gunwales. The floats are made adjustable, by their hinging or looping, from their upper edge, to the sides of the boat. They

are fastened close under the boat's sides, or are turned outward and upward, by chains or ropes from their inner and outward sides, to hooks above the boats; and should the boat be placed bottom upwards, she will, by a safe and simple contrivance, fold her "fins" or floats, from their extended position, close under her sides, right herself, and immediately extend them as before. A boat thus "winged," or "finned," it is said, will never swamp or capsize. The floats may be varied to suit the different style of boats to which they are attached. The boat, in case of a self-righting and relieving one, is constructed after the general principles of such boats; with a sufficiency of shear from stem to stern, with high bulk heads, and with a deck over the bottom of the boat, so high that water within, pressing upon valves, will run through tubes, passing through the boat's bottom. These valves are balanced into place by a lever turning upon a pivot, and are opened downwards by pressure of water from above. The deck, from the buoyancy of the floats, may be placed much lower than ordinarily, thus avoiding a "top heavy boat," when loaded. The high bulk heads may be of special service, by placing in their bottoms water tanks, opening through faucets, into the boats, and filling through tubes, from above. Into the bulk heads, above the tanks, are inserted valvular water-tight doors, thus creating lockers, for the stowage of provisions, instruments, &c. They consist of an outer lid, hung, and acting by a spring, upon an inner lid, covered on its inner side with India-rubber, which is pressed against a rim around the edge of the door. These doors may also open to lockers along the sides of the boat.

LIGHT WOODS AND UNSINKABLE SHIPS.

(From the *Mechanics' Magazine.*)

The following letter, from Captain J. H. Selwyn, R.N., is accompanied by a specimen of extremely light wood. It is in the form of a short cylinder, 3½ins. in diameter, of a mean thickness of 3-16ths in., and weighs 323 grains. It would no doubt absorb a considerable weight of water (as Captain Selwyn suggests), but as we purpose sending the specimen to the Society of Arts, we will not venture to test its absorbing qualities:—

Gentlemen,—I send you a specimen of light wood, which may afterwards, if you please, go to the Society of Arts. It is probably the same as that sent by Mr. Cunningham. I brought it from Brazil; it is the stem of the great flowering South American aloe, not a cactus. I do not think any of the cacti have any such wood. But light woods approaching this specific gravity, but of large size, are well known both in America and Africa, and are in America used for making Balsas or navigable rafts, while in Africa they are principally used for floating the heavier woods down the rivers. I do not, however, think that any such means can ever be useful for making unsinkable ships, for the space occupied must always be so comparatively great as to exclude any useful cargo, and all such bodies have the fault of rapidly absorbing water, and then of course losing their floatative qualities until again dried. Balsas or catamarans are always hauled up on the beach to dry after their short voyages. I think that more than anything else *speed* and bottom, *i.e.*, economy of fuel, will decide the future naval engagements, at least as regards the material, and invulnerability or unsinkability are alike opposed to both of these, the one by increasing the weight, the other by decreasing the space available for fuel. J. H. SELWYN.

[The specimen alluded to is now at the Society's house, for the inspection of members.—Ed. *J. S. A.*]

Home Correspondence.

ACCIDENTS IN COAL PITS.

Sir,—I drew attention, in my remarks upon Mr. Holland's paper, to the unprotected state of numerous worked-out coal-pit shafts. The enclosed cutting from a Wolverhampton paper bears on the question, and if inserted in the *Journal* may direct further attention to the subject. Last winter, near Wigan, a gentleman hunting lost his horse down an old coal-pit shaft, and by the nearest possible escape saved his own life. There are at this moment hundreds of such dangerous traps.—I am, &c.,

ROBERT RAWLINSON.

The following is the extract referred to:—

Many of the worked-out pits, together with those abandoned for other reasons in the mining districts, are very insufficiently fenced—so much so, that a late Government Inspector has been heard to say that, in his opinion, many persons supposed to have left the country, are, on the contrary,—at least their remains—at the bottom of some of the numerous disused shafts which dot the face of the country so thickly. Last week, a poor fellow, at Wolverhampton, in going home, fell into one. His direct road lay across a coal field, and one part leads within a few feet of a shaft sunk for coal and ironstone, to the depth of about eight feet, but abandoned on account of the influx of water, which now fills it to within a foot of the surface. It had been covered merely with half inch planking, a part of which was off. Nobody appears to have known of the pit, so close to the footpath; but on passing it footmarks and indications of some one having fallen in were perceived and on examination the body of the unfortunate man was found heels upward in it. Another accident occurred at Bloxwich, in which a boy was passing with a horse and cart, and the animal shied at the shaft of a pit and jerked the boy over into the abyss, and killed him. There was no fencing round, and the pit was close to the road. A verdict of "Manslaughter" was returned against both the pit proprietor and the ground bailiff, and they were committed to the Assizes.

THE AGRICULTURAL LABOURER.

Sir,—I had the pleasure of listening to the paper read by Mr. Morton on Wednesday evening last, on "The Forces used in Agriculture"—which, for the comprehensiveness of its sound and practical information, is, I think, one of the ablest of the "papers" with which for some time the Society has been favoured. I was pleased, in the discussion which followed, to hear Professor John Wilson draw attention to an important point in the consideration of the question, namely, the necessity of paying as much attention to the condition of the labourer as to the steam-engine, or to the horse, in order to make him a proportionally economical and efficient "medium" through which force can be communicated. Now while we, as a general rule, endeavour to develop to the utmost the efficiencies of our steam-engines and horses, it is painfully notorious that we do comparatively little in this way so far as our labourers are concerned. The "British labourer," says some one, "is the best living tool in the world." If so, and taking up considerations of policy only, and ignoring for the present all higher and purer motives, it is certainly but a business-like, common-sense mode of procedure, to see that these same tools of ours are kept in the best possible working order—capable of doing work not only quickly, but well. If we kept our shears or our chisels in a sadly rusty condition, with broken teeth and blunted edges, we should be showing small wisdom if we complained of the little work they did, and of that little, that it was bad. Bad tools cannot by any possibility do good work, and are not, if we thought wisely on the subject, worth having at any price where good work is desired. Just so with the agricultural labourer, the "best living tool" in the world, as we have seen him called. We have for a long time—how long, let the weary annals of wrong and wretchedness in our own national and social history tell—acted towards him as if, to use the graphic expression of Mr. Sidney, he was some "noxious weed," of which the sooner we were rid the better. We have sadly underpaid him; we have forced him—for that is precisely the truthful expression—to grovel out a species of living death in huts and hovels, where the maintenance not only of physical, but mental and moral health, was simply

an impossibility; we have done all this in the way of wrong, and have omitted to do much in the way of right, towards our labourers in field and farmyard; and we are finding—nay have already found—to our own cost, that he is not so efficient a workman as our necessities and daily growing wants require him to be; and, now that other channels of occupation are being opened up to him, that he is fleeing whenever opportunity offers from the rural district, as one does from a doomed city. While none at all acquainted with the subject can deny the truth of this, there are many who complacently assure us that we are changing, if we have not already changed it all. But the truth is that, so far from having changed it all, we have changed very little of it indeed. A cursory survey of the state of matters at present existing throughout our rural districts will suffice to show the immense proportions in which the social evils of the condition of our agricultural labourer exist. Compared with the vast swamp, so to speak, which we have yet to drain of its death-dealing waters, the little we have extracted from it is but as a drop in the bucket. We have as yet but few "sea margins" to show us how high at one time the waters were, and how much we have now exhausted them. We are certainly doing something towards getting rid of the evil which thinking men amongst us so heartily deplore, but we are doing it slowly, not at all quickly, as some seem to think. Let us only hope that it is being surely done. In order, however, to do the work surely, and to enable us to keep our "living tools" up to the mark, as the phrase goes, many points are involved, which do not come into consideration when talking of mechanisms of a lower order. For in our living tools we have two powers to deal with, intellectual as well as physical, and unless we give full development to both, we obtain an imperfect machine, one capable of doing only half work, and that, in all likelihood, anything but good. Both these powers must be dealt with carefully and well; where one is neglected it will be found of detriment to both. The maintenance, then, of efficient "working" men depends upon provisions of two kinds being secured, the provisions for the body and for the mind; and, so far as the first is concerned, let it not be supposed that all that is included is what is generally meant by the term, namely, meat or victuals. It is not so, no more than that provision for the mind means simply one thing, as reading, writing, or the like. Provision for the body in the sense we—in common with many who are instructed on this subject—mean it, involves, amongst other things, arrangements by which every attention can be paid to the development of the health and strength of the labourer—and this to be secured by well arranged and healthy houses. The question of the first of these points, namely, improved cottages or houses, is, indeed, one of the most important with which agriculturists can concern themselves, underlying as it does, and greatly influencing, many points connected with the pecuniary position of agriculture. There can be little question but that, just as sure as it is a losing concern to put valuable animals, as horses or cows, into badly-arranged and ill-ventilated apartments, where disease most readily takes hold of them, and quickly does its work, it is as surely a losing concern, where the labourer is placed in circumstances where his physical strength is sapped out of him, where disease is easily engendered and unrestrained in virulence. It is a truism, but a truism which cannot be too often repeated, that the healthier and stronger a labourer is, the more likely is he to become of paying service to his master. Now neither health nor strength is possible to be created or maintained in the circumstances in which the labourer is too generally placed as regards his home accommodation. Men are now beginning to see the truth of this, and are becoming convinced that it is really a paying investment to improve the condition of their labourers in this respect. And it is just because that self-interest is being exerted—which self-interest, as Mr. Morton says, is always intelligent—that with those who have long wearily waited to see the institution of a better order of things in our rural districts, hope is beginning to dawn brightly and cheerily. For, humbling as the consideration may be, it is, we fear, none the less sure that more will be done practically from "paying" than from other and higher motives. Men have long been convinced of the truth of the argument in favour of improved cottage accommodation, but have, nevertheless, done marvellously little in helping on its practical realisation; but now that the question is proved to have a close bearing upon their pockets, a livelier interest is likely to be taken by them. In saying this, far be it from me to ignore the vast deal which has been done by many men, from higher and nobler considerations than mere pecuniary ones. The "paying point" is, however, after all a justifiable one to be considered, and one great advantage attendant upon it is that it is likely to take the question out of the hands of the purely psuedo-philanthropical and sentimentalising, and place it upon that basis which will best and quickest bring about its practical settlement.

But the advantages derivable from the securing of good and healthy cottage accommodation are not simply of a physical kind. They have a close connection with the "provision" for the mind or intellectual power, of which we have already spoken. Certain it is, that if we simply provide for out door or school education, and take no care for the education of the home, or the influence of the lessons given daily around its hearth, we run a great risk that much of the efficiency and soundness of the out-door education will be lost. Now the quiet order, the decent observances, and the sound morality which best dignify the family hearth, cannot be observed in hovels where all the arrangements are subversive of decency and antagonistic to all regularity and order. It is for this reason, and justly, that those who have well studied the matter in all its bearings, insist upon the necessity of good cottage accommodation being provided in the first place; that this, in fact, must precede or at least proceed *pari passu* with, all other movements having for their object the raising of the standard, physical and mental, of the agricultural labourer. Intellectual and moral elevation cannot result with certainty from any plan of aggressive educational operations, however well and persistently carried out, when at their homes and around their hearths everything nearly is calculated to degrade. Certain laws have been instituted by a beneficent Providence, the which, if we observe, we shall maintain a due amount of physical and mental health, which will fit us better for the reception of important truths than when we have the dulness and disease resulting from the breaking of those laws; and it certainly seems the most reasonable plan, if not our clearest duty, to maintain that condition in which we are best fitted to receive and retain important truths, than to keep up adverse circumstances, lessening their force and obstructing their influence. It is from considerations such as these that the question of improved cottage accommodation for our agricultural labourers is considered an all important one, second to none, in fact; that if we want to get the utmost efficiency of working capability; nay, more than this, a higher degree of mental capacity than has yet been obtained, as a general rule, from the labourer, we must pay attention to this point. I have, as you are aware, for a long time devoted my attention to this subject, and have extended my observations over a wide range of locality, from the remote islands of Shetland to the more favoured districts of the South of England, and on the Continent, and in the United States, and all I have seen, with every fresh inquiry I make, has convinced and does further convince me of the paramount importance of this same question of improved cottage accommodation, an importance which daily increases from the peculiar position in which the farmer is now placed with reference to the labour question.

This improved cottage accommodation must be carried out for the labourer. It is one of those things which can neither be initiated nor realised by him. I have no sympathy with that class of philanthropic sentimentalists who are perpetually expecting us to do all for the labourer, and

who think, or seem to think, that he should do nothing for himself. The labourer, however, has his duties to perform, not less to his master than to himself, and while he is told to be a faithful servant, the same law tells him that he is to provide things honest in the sight of all men, thus involving on his part the exercise of self-denial, of prudence, and of a constant warring with the temptations which, if given way to, lead him into habits of body and of mind as disgusting as they are degrading, and which, if followed, must necessarily prevent him from being an efficient and worthy workman. He is bound to do his best to maintain himself by the exercise of habits of sobriety and well-doing, habits over which the master can possibly have no control, in good working order; but, at the same time, the master is equally bound to do all he can to aid the labourer in the maintenance of this efficiency, and not to place him under circumstances in which neither health of body nor purity of mind can be maintained. The question, I repeat, of improved cottage accommodation is one which must be worked out fully and completely by the master and landlord. Under the present system there is and can be no other alternative. Apologising for the length to which my remarks have reached, my only excuse for which is the importance of the subject, I am, &c.,

ROBERT SCOTT BURN.

December 10th, 1859.

THE FORCES USED IN AGRICULTURE.

Sir,—The valuable paper read by Mr. Morton last week on the Forces used in Agriculture, will, I hope, be studied as it deserves to be by all interested in the soil, whether landlords, tenants, or labourers. It embraces so many points of detail and of calculation, that it was difficult to offer any comments upon it at the time, and I now ask permission to explain, more clearly than I was able to do at the meeting, the points that appeared to me to claim our general attention.

The question of comparative cost of power, as exerted by steam, by horse, or by man, was never a doubtful one, and is now fairly and clearly reduced, by Mr. Morton, to its money value, viz:—that while steam can meet a certain *continuous* force at a cost of 3d. per hour, the same, if supplied by horses, would cost 10d.; and if supplied by manual labour, no less than 15s. per hour; while the two latter could not continue it longer than 8 hours out of the 24. This great difference is readily understood when we consider the nature of the machinery we have to deal with. In the one the body is made of iron, and is fed with coals and water; in the others we have organized structures, supported by oats and hay, and by beef and bread. In the latter the cost of maintenance and of wear and tear are obviously far greater than the former, and the cost of their results—force—proportionably increased. In other countries these conditions do not bear the same relations to each other: animal power is generally cheaper and steam power dearer than with us. In this, however, it is quite clear that where power alone is required, neither horses nor man can compete with steam. The man, however, as a source of power, does not bear the same relation to the other two as they do to each other; he is endowed with duplicate sources of power, in the shape of mental as well as muscular force, the absence of which in the others reduces their intrinsic value, and, unless added to them would neutralize it altogether; the horse and the engine equally needing the skilled labour of the man to direct their energies and control their powers.

The competition therefore, is between the power of steam and of horses, rather than between steam and the man. To the labouring man steam has been, and always will be, a friend: it relieves him from the hardest and worst period of his duties, and raises the value of his higher (mental) power—skilled labour. The industrial history of the country teems with evidence of the benefits conferred by steam machinery on the working classes—not less in increased employment than in increased wages for it, and few departments of industry offer greater opportunities for its development, than in that connected with the productive powers of the soil.

If we are right in our estimation of the immense value to us of steam and other machinery, we clearly are wrong in paying so little attention as we do to the directing power—the labourer—by which the efficiency of the machinery is so largely influenced.

We have for years past devoted our attention to the education (if I may so use the term) of our mechanical forces,—the improvement of our machines, and application of steam power; let Chester and Warwick testify to our success. Tens, nay hundreds of thousands are each year invested in their purchase, but no equivalent attention is paid to the education of our human power—our labourers—either as regards their physical or their mental forces.

The machine, to be complete, needs the directing skill of the man; he is essentially one of its working parts, and as in mechanics it is an axiom that the strength of the whole is only equal to its weakest part, it is clear that the efficiency of the machinery we use materially depends upon the knowledge and skill with which it is directed. We should think it a folly to give the labourer a boo-before he had been taught to read and understand it, ank yet we are surprised that he should look upon our labourd saving machines as his enemies, and either oppose their introduction or fail in rendering them as efficient as we see them to be in the hands of competent workmen. Surely this is a matter that calls for our serious consideration. It appeals to our breeches pockets as well as to our brains and our hearts. Our system of farming has undergone a complete revolution within the last 10 or 15 years, but our system of hired labour remains well nigh the same—the same neglect and want of confidence on both sides; at one season the employer takes advantage of the labourer, and at another the latter retaliates severely on the employer. The last two or three harvests have read us a lesson that no thinking man can neglect.

The increased and increasing scarcity of labour throughout the country, and the price it costs, must advance the use of machinery in the field as well as the farmstead; and I cannot refrain from expressing a very strong opinion that our farmers will find it to be greatly to their interests in a pecuniary point of view, to say nothing of higher motives, to endeavour at once to improve the condition, both moral and physical, of their labourers, and prepare them for the new duties they will be expected to perform.

Why, in the face of the mighty progress of the last few years, should the agricultural labourer still be at the bottom of the social scale? I believe he deserves a better position. I believe that the farm can afford to pay for skilled labour as well as the factory; but unless we follow Mr. Muir's sound advice and advance his regular wages, make his house more comfortable, and strengthen—by a more friendly intercourse—the natural ties between his employer and himself, we shall continue to find that the best and most intelligent of our young men will leave us, and seek a better remunerated employment elsewhere.

Power machinery becomes each day more necessary to a farmer's well-doing, indeed to the welfare of the community at large; and if we wish to derive the full benefits it offers to us, the first thing we ought to do is to prepare the labourers by education, and by improving their general social condition, for the important part they have to perform in its successful application.—I am, &c.,

JOHN WILSON.

University of Edinburgh, Dec. 12, 1859.

EXHIBITION IN 1862.

Sir,—It is somewhat remarkable that the project put forward by the Council of the Society of Arts for another Great Exhibition, which, in spite of the declarations to the contrary contained in the resolutions published by them last year, is still believed by the public to be a contemplated resuscitation of the glories of 1851, should

have met with little or no opposition from that which is supposed partly to represent and partly to guide public opinion—the Press. I cannot suppose that even the warmest supporters of the project would have been surprised if, at such a moment as this, the proposal had been received not only without sympathy but even with contempt. The position of that brilliant but childish race whose proximity to this country has been so much increased by the marvellous facilities of locomotion created within the last few years, is such that, differing widely in opinion as to form of government, unstable in their political creed, and uncertain in their political acts, they appear, if report speaks truly, to be constant and united in one thing only,—inextinguishable jealousy of England. And though, after the repeated assurances given by their great ruler of his friendly intentions towards this country, it would be worse than an insult to imagine that the military and naval resources which he is now developing are really intended to be used against us, the extent of these preparations has nevertheless convinced us, though with much difficulty, of the folly of allowing our country any longer to remain at the mercy of the first invader. Our literature teems with treatises on the art of war; and many whose ordinary habits and tastes are peaceful are trying, not in vain, to acquire skill in the use of arms, and familiarity with the details of military life.

To men accustomed to regard things merely on the surface, the attempt to enlist the commercial men of Europe in a peaceful contest at such a time as this may seem almost hopeless. But to another class of men, to those, indeed, who try, difficult as the task often is, to look somewhat below the surface; who endeavour to find in the lessons of the past, some useful guidance for the future, the present may not, after all, appear so very inopportune a moment for venturing into the field with the weapons of peace, and seeking to gather under its banner all those who have courage enough to volunteer in the cause of order, progress, and civilisation.

If we carry back our thoughts, and recollect the enthusiasm produced by the last Great Exhibition, we shall also remember, that not the meanest element in that feeling, was a glorious, though mistaken hope, that this congress of the promoters of Arts, Manufactures, and Commerce, would produce union and harmony throughout Europe; and even the least sanguine amongst us ventured to anticipate that many years, at least, must elapse, before the sounds of strife should again be heard. It is needless to say, how bitterly these hopes have been disappointed. How many an ardent philanthropist, who regarded this great gathering as the harbinger of brighter and happier days; how many an earnest lover of liberty, who thought that now, at least, his fondest dreams must be realised, and a death-blow struck at despotism and tyranny; how many a thoughtful philosopher and man of science, who believed that the pursuit of knowledge would henceforth be uninterrupted—how have all these seen their buoyant hopes entirely crushed, many of them, perhaps, having been led into an opposite extreme—a state of mind much more to be dreaded—that of despair for the future, and want of faith in the progress of mankind. Who would venture to speak harshly of such errors? who would blame this wholesome tendency to look at human events in their brightest aspect? but may we not derive a lesson from these most pardonable mistakes, which may guide us a little in looking to the future—which may prevent us from being altogether diverted from our work in the cause of peace, by the vague and indistinct murmurs of war. If the Council of the Society of Arts were now to draw back from the enterprise in which I understand them to be engaged, they would commit an error—of a different character, it is true, but still a serious error. They would be taking an inadequate view of the power of industry and perseverance to overcome obstacles, great indeed, but by no means insurmountable. Little good is done by ignoring the difficulties of the undertaking, and though I see no reason to doubt of its success, I cannot but think that those who would represent the task as an easy one are no true friends to the Exhibition. One great reason why I anticipate a favourable result from the proceedings of the Council of the Society of Arts is, that they have not taken this course; they have not attempted to gloss over the unfavourable aspect of public affairs; on the contrary, their chairman, in his opening address, which I heard with so much pleasure, frankly says, "notwithstanding the present aspect of Continental affairs, which they do not regard as the most favourable to Arts, Manufactures, or Commerce, it is nevertheless the intention of the Council, interpreting aright, as they believe, the feelings of their countrymen, to originate measures for carrying into effect an International Exhibition of Art and Industry, to be holden in 1862."

I cannot venture to doubt that they do "interpret aright the feelings of their countrymen." I cannot believe that an Exhibition, acknowledged by all to be so essential to steady and active progress in industry and art, will be indefinitely postponed. For, it must be remembered, this is the alternative. However favourably we may regard "the present aspect of Continental affairs," and however sanguine may be our hopes that our own country may remain at peace, we can hardly venture to anticipate that the allowing another year, or even a longer period, to elapse, would be at all likely to afford a more favourable moment for setting about this great enterprise. But if we should unhappily be involved in war, if the two greatest nations of Europe should engage in hostilities, the war will, in all probability, be one of unusual duration, and it may be many years before we can again hope to see closed the gates of the temple of Janus. I will not here state the reasons which may be adduced in support of this view—the deadly hatred which would be excited, and which would be so difficult to allay, the immense power and resources of both nations, and the obstinacy and perseverance of one of them; these, and many other reasons, might be adduced, why such a war would be one of extraordinary length; and are the arts of peace to be stationary during all this period? Is the Society of Arts, an association especially organised for the promotion of Industry and Art, and whose past efforts have met with such signal and brilliant success, to remain idle at such a moment as this? On the contrary, I believe the support which their proposal has already met with, the favour with which it appears to have been received, are greatly owing to the admiration so generally felt at the boldness with which they have come forward, undeterred by present difficulties, though fully alive to their existence. It was universally acknowledged, when a similar scheme was put forward last year, that such an Exhibition was wanted; of this there did not seem to be the slightest doubt, but the Council of the Society seemed then for a moment startled by the disturbed state of Europe, and they paused for a moment before proceeding with the work they had undertaken. Now, however, they seem to be as earnest as ever in carrying it forward, and I cannot doubt that they will have the support—not only of all those to whom such an Exhibition will bring pleasure and profit—not only of all those who by their position, either in the commercial or manufacturing community, are personally interested in the success of such an undertaking—not only of all the lovers of Art, whose number is happily increasing so rapidly, but of all who admire that unflinching perseverance, and that indomitable determination, in the very face of difficulty, which were once supposed to be, and which I venture to hope still are, the leading characteristics of Englishmen. Small credit, comparatively, would have been due to the Council had they merely embarked upon such an enterprise when there was nought but fair wea-

ther and plain sailing before them. Let it be remembered that in forwarding this Exhibition, they are doing what is strictly their duty; they are doing all that in them lies to divert men's minds from strife, and direct them to nobler objects; and it is gratifying to find that their efforts appear to be appreciated. Even if war should unhappily break out, it may be hoped that the energy developed in the character of the nation, by being forced to put forth all its powers for its defence, and the stimulus thus given to all the manly qualities of the people, will not be lost, but will make us strive all the more not to be outstripped in the race of progress. While we strain every nerve to maintain the national honour unsullied, while a military spirit is awakened in all ranks that will make our island impregnable, and while all classes vie with each other in sacrificing of their comforts and indulgencies to meet the inevitable expenses of such a war, let us not be behindhand in cultivating the industrial arts, but let us be equally anxious to maintain the supremacy of our country in the workshop as on the sea, in the studio as on the battle-field.

I am, &c.,

OPIFEX.

BELL CASTING.

Sir,—It need scarcely be observed that the very scientific views on this subject, as expressed by your correspondent "F. E. W." in your *Journal* of December 2nd, are of a visionary character, as very large bells have been cast for many centuries with perfect success, without any of the appliances suggested by that gentleman.

It is no "waste of research" to endeavour to obtain pure metals, for no expedients can by any possibility produce a good bell from bad materials; neither does "F. E. W." seem to be aware that the products from a pit-coal fire are notoriously injurious to the quality of every metal or mixture of metals exposed to their influence; and as the flame from wood is perfectly free from that inconvenience, why should coal be used in so exceptional a case as that of the casting of large bells, known to be able to endure the strokes of the hammer for centuries.

In regard to his suggestions upon "co-temporaneous" cooling and "metal-cases," or casting boxes, "F. E. W." quite ignores the established bellfounders' mould, which entirely prevents any imperfection of crystallisation or unequal cooling. It is not at all necessary, on this occasion, to go into the details of manipulation well known to all bellfounders, but I may briefly state that the entire mould mainly consists of three parts, the core, the false bell or model, and the jacket.

The core is a hollow shaft, or furnace, in brick and loam, of the shape of, but smaller than, the intended bell, and is coated with loam applied under the first trammel guide; the said loam being rendered so weak with horse-dung as to be destroyed by a red heat, though very solid and firm at a lower temperature.

When the core is complete, and coated with a tallow composition, the model or false bell is put on, of the same materials, under the second trammel guide, and finished with all its ornaments and inscriptions in a wax composition.

Then the jacket or cover is formed, still of the same materials, under the third trammel, but during the whole of these operations a charcoal fire is kept up in the interior furnace, so that the successive coats dry almost as soon as laid on.

The entire mould being now complete, thoroughly baked and dried, and the wax and tallow compositions melted out, the jacket is raised by a purchase tackle, and, after removing the false bell by dividing it on two sides, replaced.

The whole of these operations are conducted in the casting pit, which is deeper than the bell, and when completed the hole is filled up with carefully rammed earth, in order that the mould may be able to resist the hydraulic pressure of fluid metal. But the materials of the mould are such as to become perfectly rotten at or near the actual congelation of the metal, and no failure in bellfounding, when conducted with knowledge and skill, can or ever does take place through imperfect "crystallisation and contraction."

I am, &c.,

HENRY W. REVELEY.

December 8th.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Prof. Tyndall, "On the Radiation and Absorption of Heat."
Brit. Architects. 8. Mr. G. G. Scott, "Gleanings from Westminster Abbey."
Medical, 8½. Dr. H. Hyde Salter, "On some points in the clinical history of Asthma, founded on an analysis of fifty cases."

Tues. .. ...Statistical, 1. Mr. David Chadwick, "On the Rate of Wages in the Cotton District during the last Ten Years."
Pathological, 8.

Wed. .....London Inst., 7. Conversazione.
Society of Arts, 8. Mr. F. Crace Calvert, "On Starches; the purposes for which they are employed, and the improvements in their manufacture."
Ethnological, 8½.

Thurs. ....Philosophical Club, 6.
Royal, 8.
Antiquaries, 8.
Philological, 8.

Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principless of Vegetable and Animal Chemistry, and their application to the Arts and Purposes of Life."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 9th*, 1859.]

Dated 18th October, 1859.

2376. J. Darlington, 36, Cannon-street, London—Imp. in glass furnaces.

Dated 31st October, 1859.

2486. J. T. Pitman, 67, Gracechurch-street, London—Imp. in the construction of forges. (A com.)

Dated 7th November, 1859.

2534. H. Grafton, Chancery-lane—Imp. in bell and other signal apparatus to dwelling houses and other places, which improvements are also applicable to knobs or handles and fastenings of doors, and the like.

Dated 12th November, 1859.

2572. R. Howson, York—Imp. in bells and gongs, and in their manufacture.

Dated 21st November, 1859.

2629. J. Webster, Birmingham—An imp. or imps. in pressure and vacuum gauges.

2631. W. Whittle, Smethwick, Birmingham—Imp. in the manufacture of nails, and in machinery to be used in the said manufacture.

2633. W. E. Newton, 66, Chancery-lane—An improved machine for moulding bricks. (A com.)

2635. G. W. Lenox, Billiter-square, London—Imp. in the manufacture of ships' blocks.

Dated 22nd November, 1859.

2639. B. Amsden, Hertfordshire—Imp. in the manufacture of straw and other descriptions of hats and bonnets.

2641. G. White, 34, Dowgate-hill, Cannon-street, London—Imp. in gloves. (A com.)

2643. T. B. Daft, Tottenham, Middlesex—An imp. in coating sheathing metal.

2645. C. G. Hill, Commerce-square, High-pavement, Nottingham—An improved goffering machine, together with the apparatus connected therewith.

Dated 23rd November, 1859.

2647. W. H. Ward, Auburn, New York, U. S.—A system of signal flags.

2649. E. T. Hughes, 123, Chancery-lane—Imp. in the manufacture of a certain substance to supersede blasting powder. (A com.)

2651. E. T. Hughes, 123, Chancery-lane—An improved chemical combination to supersede blasting powder. (A com.)

2652. J. T. Smith, Birmingham—An imp. or imps. in heating, puddling, and other reverberatory furnaces used in the manufacture of iron.

2653. B. Bagster, King's-road, Gray's-inn, London—Imp. in means or apparatus for giving surface finish to paper, which improvements are applicable to copper-plate and other printing, as also to embossing.

2654. T. Eastman, Southsea, Hants—Improved means of raising the blades of screws employed to propel ships, and apparatus for getting at such screws, and for performing other operations under water.

2655. T. Lister, Chesterfield, Derbyshire—Imp. in the construction of sanatory privies and water-closets, part of which improvements is applicable as a tap for drawing off liquids.

2656. J. Knowles, junior, Saint Helen's, Lancashire—An improved apparatus for the prevention of accidents in winding from mines, which apparatus is also applicable for other similar purposes.

Dated 24th November, 1859.

2657. F. Preston, Manchester, and H. W. Garrett, Salford—Imp. in the construction of cartridges.

2658. J. Langford, Birmingham—Imp. in inkstands, and in combining with inkstands instruments for holding and damping stamps, labels, and other articles.

2659. W. C. Maniece, Manchester—Imp. in cop tubes used in machinery for spinning fibrous substances.

2660. F. Prince, Hove, Sussex—Improved apparatus for reducing the resistance of the atmosphere to the progress of railway trains.

2661. J. Fyfe, Greenock—Imp. in apparatus for regulating and adjusting the flow and pressure of liquids.

2662. W. Eassie, High-Orchard, Gloucester—An improved joint for boarding and planking of all kinds.

2663. A. Hubart and V. Cantillon, Liege, Belgium—Imp. in the manufacture of casks, barrels, and other like vessels of glass, and in machinery or apparatus employed therein.

2664. W. S. Losh, Wreay Syke, Cumberland—Imp. in the manufacture of paper, and in the preparation of a substance to be employed therein.

2665. W. S. Collins, junr., Bristol, and F. J. Chard, Warwick-street, Pimlico—Imp. in apparatus for propelling vessels.

Dated 25th November, 1859.

2667. C. Smith, I. Smith, and J. Smith, Hopwood, near Heywood, Lancashire—Certain imp. in looms for weaving, and in apparatus for cutting the loops to form pile fabrics.

2668. T. Carr, Bebington, Chester—Imp. in arrangements and mechanism for drying glue, moulded clay, sugar, white lead, and various other substances and articles of manufacture.

2669. J. Sim, Aberdeen, N.B.—Imp. in measuring and registering the flow or discharge of liquids.

2670. I. A. Read, Smethwick, near Birmingham, and W. Rennie, Birmingham—An imp. or imps. in connecting brooms with their sticks or handles.

2671. H. Lindon, Plymouth—Machinery or apparatus for raising and forcing fluids, which is also applicable for other useful purposes.

2672. M. Tildesley, Willenhall, Staffordshire—Imp. in locks and latches. (Partly a com.)

2673. G. E. Donisthorpe, Leeds—Imp. in apparatus for hackling, dressing, and combing silk waste and other fibres.

Dated 26th November, 1859.

2674. A. S. Lukin, Swansea—Imp. in apparatus for drawing window blinds.

2675. F. Scheithauer, 4, South-street, Finsbury—An improved machine for printing woollen and other fabrics.

2677. C. Bedells, Leicester—Imp. in the manufacture of shoes and boots, and in fabrics suitable for use in this manufacture.

2678. W. Moseley, 17 and 18, New-street, Covent-garden—Imp. in fountain pens.

2679. M. Auerbach, London—Improved apparatus to be applied to cabs, hackney carriages, and other similar vehicles, to indicate the number of persons carried, the distance travelled, and the amount of fares. (A com.)

2682. W. MacNaught, Manchester, and J. L. Taylor, Bolton, Lancashire—An improved method of increasing the temperature of water for feeding steam boilers or vessels for generating steam, and in apparatus connected therewith.

Dated 28th November, 1859.

2683. J. Eastwood, Railway Iron Works, Litchurch, Derbyshire—Imp. in steam hammers, and in valves to be used therewith.

2684. J. Eastwood, Railway Iron Works, Litchurch, Derbyshire—Imp. in lathes.

2685. E. Toney, Perth, N.B.—Imp. in apparatus for insulating telegraphic wires or conductors.

2686. A. W. Williamson, University College, and L. Perkins, Francis-street, Gray's-inn road—Imp. in machinery for propelling vessels.

2687. T. Luck, Spalding, Lincolnshire—Imp. in apparatus for removing straw from thrashing machines.

2688. P. R. Hodge, 16, Chalcot-crescent, Primrose-hill, Middlesex—The treatment and use of a new material in making of paper or other compounds of vegetable pulp.

2689. E. H. Bentall, Heybridge, near Maldon, Essex—Imp. in machinery for cutting vegetable substances.

2690. E. H. Bentall, Heybridge, near Maldon, Essex—Imp. in apparatus for crushing or grinding grain or seeds.

2691. J. Bower, Hunslet, Yorkshire—An improved method of preparing clay for the manufacture of crucibles, pots, and earthenware.

2692. C. Snells, Stockwell, Surrey—Imp. in steam engines.

2693. R. A. Brooman, 166, Fleet-street—An improved poultry waggon. (A com.)

2694. R. A. Brooman, 166, Fleet-street—Imp. in the preparation of red colouring matters or dyes. (A com.)

Dated 29th November, 1859.

2695. F. H. Wenham, Brixton, Surrey—Certain imp. in steam engines.

2696. H. Sharpe, 26, Broad-street-buildings—Imp. in the mode of preparing wool for the purpose of carding or combing it, with a view to it's being afterwards wove into thread. (A com.)

2697. J. King and J. Sutcliffe, Rochdale, Lancashire—Certain imp. in and applicable to mules for spinning.

2698. H. O. Robinson, 16, Park-street, Westminster—Imp. in machinery and apparatus for the manufacture of sugar.

2692. J. B. Berger, Upper John-street, Fitzroy-square, Middlesex—An improved mode of and apparatus for facilitating the calculations required for navigating ships or vessels.

2700. L. N. Dejean, Paris—Imp. in hydraulic motive power.

2701. C. Colwell, Belvidere-place, Southwark—An improved means of propelling sea going vessels without the use of either paddle wheel or screw propeller now adopted.

2702. T. Richardson, Newcastle-on-Tyne—Imp. in the manufacture of certain compounds of soda and potash.

2703. M. L. J. Lavater, Strand—Imp. in vulcanised india rubber bands.

Dated 30th November, 1859.

2705. T. Fitton, Manchester—Imp. in the slide-valves of steam engines.

2707. S. Mortimer and G. Swain, Bradford, Yorkshire—Imp. in machinery or apparatus for spinning and doubling wool or other fibrous substances.

2709. J. M. Wilson, Manchester—Imp. in finishing woven fabrics, called Arabian stripes or scarfs.

2711. J. B. Teil, Bordeaux, France—Imp. in the construction of umbrellas and parasols.

2713. G. J. Firman, Atlas Chemical Works, Borough-road, Southwark—Imp. in the manufacture of tartaric and citric acids, and certain salts in connection therewith.

Dated 1st December, 1859.

2717. C. A. Fournier, No. 60, Boulevart de Strasbourg, Paris—A process and apparatuses intended to find out the escapes of lighting gas from the conveying pipes, and to determine the precise leaking places of the said pipes.

2719. T. Silver, Philadelphia, U.S.—Imp. in apparatus for governing or regulating the speed of steam and other engines.

2721. T. Till, Birmingham-heath, Warwickshire—Imp. in machinery for the manufacture of horse-nails and other wrought-nails.

2723. J. Paton, Glasgow—Imp. in valves.

2725. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for preserving and cooking food. (A com.)

Inventions with Complete Specifications Filed.

2731. G. F. Smith, 15, Golden-square, Middlesex—Imp. in smelting and purifying iron and other ores. (A com.)—2nd December, 1859.

2740. J. Anderson and J. Bradshaw, Liverpool—Imp. in the construction of the furnaces of bakers' ovens for the purpose of consuming smoke, which improvements are also applicable to the consumption of smoke in other furnaces.

Patents Sealed.

[*From Gazette, December 9th*, 1859.]

December 9th.

1414. W. Donbavand.
1417. T. F. Henley.
1433. J. Cowan.
1442. J. Luis.
1444. L. Barroux.
1458. H. Evette.
1534. D. J. Fleetwood.
2013. W. Neilson.

[*From Gazette, December 13th*, 1859.]

December 13th.

1422. B. Baugh.
1426. C. N. Kottula.
1435. A. MacDonald.
1436. E. J. Maumené and V. Rogelet.
1441. E. T. Hughes.
1443. J. Luis.
1449. T. E. Tallent.
1451. M. A. F. Mennons.
1459. E. T. Hughes.
1493. C. F. Vasserot.
1466. J. Combe and R. Smalpage.
1467. J. Luis.
1468. J. Cox.
1480. R. Laming.
1509. C. F. Varley and C. J. Varley.
1543. G. Hall, jun.
1548. I. Tirebuck.
1596. A. Beaulieu.
1607. L. Schwartzkopff and F. C. Philippson.
1618. J. H. Johnson.
1664. R. Mushet.
1665. R. Mushet.
1674. R. Mushet.
1707. Earl of Caithness.
2069. E. J. Mallett.
2251. J. Thompson & J. Thompson, jun.
2411. T. S. Prideaux.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, December 9th*, 1859.]

December 5th.

2892. H. Ogden and H. Hibbert.
2902. J. Leslie.

December 7th.

2905. R. Eaton.
2950. J. T. Wright and E. P. Wright.

[*From Gazette, December 13th*, 1859.]

December 8th.

2915. T. Vicars, senr., T. Vicars, jun., T. Ashmore, and J. Smith.
2916. T. Peake.
2936. T. Wheatley and W. Wheatley.

December 9th.

2926. W. Storey and T. Storey.
2977. E. Heywood.

December 10th.

2957. H. Pease & T. Richardson.
3004. F. Donny.
3059. C. F. Varley.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, December 9th*, 1859.]

December 5th.

1013. G. Collier.

[*From Gazette, December 13th*, 1859.]

December 10th.

219. J. S. Russell.

Journal of the Society of Arts.

FRIDAY, DECEMBER 23, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS.

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded immediately to the Secretary of the Society of Arts.

SIXTH ORDINARY MEETING.

Wednesday, December 21, 1859.

The Sixth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 21st inst., John Dillon, Esq., Vice-Pres., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bertram, William	Grew, Nathaniel
Blackie, George	Hutton, Thomas
Braby, Frederick	McCurdy, John

Matthews, Henry.

The Paper read was—

ON STARCHES, THE PURPOSES TO WHICH THEY ARE APPLIED, AND IMPROVEMENTS IN THEIR MANUFACTURE.

By Dr. F. Crace Calvert, F.R.S.

I have undertaken to lay before you, this evening, an outline of our present knowledge respecting starches and their commercial applicability, but it is impossible, in the brief space of an hour, to enter into the details of either their manufacture or their application, owing to the great increase of trade in Europe, and to the rapid progress of chemistry, which has applied those materials to a variety of purposes, and caused their manufacture to be increased to an enormous extent.

At the beginning of this century, starch was used only in the laundry, for the toilet, and, to a limited extent, as diet, whilst now a great variety of starches have been introduced into commerce, and, by certain processes, which I shall hereafter describe, converted into gum or sugar, and thus have become used in manufactures; and, to give an idea of the immense quantities used in Lancashire, especially at print and bleach works, I may mention that at one single print works, in Manchester, above 300 tons of these products are used annually. One of the great chemists of the day has made the curious remark that this most important diet of man is often associated in plants with acrid or poisonous substances; thus, for example, in the wild chestnut, the starch is mixed with an acrid substance. In the roots of the *arum*, starch exists conjointly with an acrid and venomous substance; and in the root of the manioc it is mixed with prussic acid. But the Deity has given to man an intuition which enables him to separate the starch with facility from its poisonous accompaniments. Thus the natives of Guiana and of the West Indies have found out that by heating the roots of the manioc, the prussic acid was dissipated and the tapioca obtained.

A most interesting fact is, that although the globules of these starches vary in size from the thousandth of an inch to the three-hundredth, as in the case of potato starch, and the outer part or shell has a different molecular arrangement from the internal part, still they have been proved by analysis to have all the same ultimate composition when pure and dried at 220° Fahr., viz., $C_{12} H_9 O_9$ or 72 parts of carbon, and 81 of water. All starches except Inuline give a blue colour with iodine, and if the compound be mixed with water and heated, the colour disappears, though, strange to say, it returns when the solution cools. M. Payen has recently discovered a method of rendering this splendid colour comparatively permanent, and, as this discovery may result in some useful applications, I think it right to state that the best way to produce it is to leave some potato starch in contact with ammonio-oxide of copper for several hours, washing the excess of the latter away, boiling the green precipitate which remains, and adding to it a solution of iodine, when a splendid purple precipitate will be formed.*

The globules of starch, when heated in water, swell, burst, and are then found to be composed of successive concentric layers, but the outer layer has a different molecular arrangement from the internal ones; for M. Payen has found that these parts have different degrees of solubility in ammonio-oxide of copper, and has further observed that the outer envelope will swell to 1,000 times its original size when placed in contact with the above fluid. Starches are highly hygrometric; thus ordinary potato starch can combine with 3, 5, 11, and 16 equivalents of water. The starch, as extracted from the potato, contains 45 per cent., 25 per cent. when kept in a damp atmosphere, and 18 per cent. when stored in a dry place; and it is easy to distinguish starch which contains (say) 18 per cent. from that which contains 35 per cent., by placing a small quantity on a metallic plate heated to 212 degrees, when the starch with 18 per cent. will fly about, whilst that with 35 will agglomerate and form hard lumps; in fact it is by means of this property of potato starch that large quantities of artificial tapioca are made on the continent.

Although I shall refer, further on, to the curious transformation of starch into sugar by the action of acids, I may here state that M. Fremy has demonstrated that the sweetening of fruits is due to the action of the acids converting the starch existing in them into sugar, and that M. Nièpce de St. Victor has recently made the curious observation that when paper is impregnated with starch, and exposed to the rays of the sun, the starch is slowly converted into sugar. Diastase, or an albuminous ferment, which exists in all grains, but especially in malt, possesses also the same property to a high degree, more particularly at a temperature of 150° Fahr., as proved in the mash-tub of the brewer; and, I am gratified to find that the suggestion which I made thirteen years ago, viz., that this temperature should not be exceeded, is now generally acted upon by brewers, who find that a higher temperature annihilates the converting power of diastase and thereby causes serious loss.

One of the greatest triumphs of chemistry applied to physiology has been the discovery of diastase in the saliva and pancreatic juice in the human system, by which the starch taken as food is converted into an isomeric sub-

* See Comptes Rendus de l'Académie des Sciences, 1859.

stance called glycogene, stored by the liver and there converted, according to the requirements of vitality, into sugar, and carried by the circulation of the blood into the capillaries, where it is converted into water and carbonic acid, producing the heat necessary for the maintenance of life. Chemists have also discovered the presence of starch or a substance isomeric to it in the skeletons of many of the invertebrata, such, for example, as the crustacea, the arachnida, and insects, and the envelope of certain tunicate mollusca; and Messrs. Berthelot and Piligot have recently placed this interesting fact beyond doubt.

Starch presents not only a great similarity of composition to the fibres of plants, such as flax and cotton, but, when treated with concentrated nitric acid, it is also transformed into a fulminating substance, called Xyloidine, similar to gun cotton.

Although time will not allow me to enumerate all the various starches known, I think it advisable to mention the principal kinds used in commerce. They are:—

Arrowroot, obtained from the roots of the *Maranta arundinacea*, in the East and West Indies, by pounding in mortars, and elutriation through sieves.

Sago, obtained from the pith of the sago palm, which grows in the Molucca and Phillippine islands.

Tapioca, obtained as above stated from the manioc root (*Jatropha Manihot*).

Inuline, or starch obtained from the dahlia root.

Millet starch, obtained from the *Paniacum Miliaceum*.

Rice starch.

Wheaten starch.

Fecula or potato starch.

Sago.—The tree which yields this starch, and which often grows to a height of 30 feet, is cut down, cleft longitudinally, and deprived of its pith, which is washed upon a sieve, the water carrying through the sieve the starch, which is allowed to deposit, and when intended for manufacturing purposes, is made into lumps, and dried in the sun, which lumps are reduced to a coarse powder, and in that state sent to this country, where it is extensively used as a substitute for potato starch, either in the form of a gum,* or when bleached with a little bleaching powder, for the sizing of warps, or for mixing with other farinaceous substances to reduce their price. For these purposes the quantity annually imported is very considerable.

Tapioca.—This starch can be considered under two different aspects. When reduced to a pulp by means of a rasp or grater, and then placed in bags, and submitted to a heavy pressure, it parts with a fluid containing a large quantity of deadly poison (prussic acid); what remains in the pulp is driven off by drying it on iron plates, when hard friable masses are formed, which are called cassava cakes. But when the whole of the pulp is evaporated to a thick pasty mass, which converts the starch into a more soluble state, and it is dried on heated iron plates, it forms small lumps, which are called tapioca.

Inuline.—Although this starch has not yet been applied to arts or manufactures, it is one which deserves attention, as, when boiled in water, it does not form a gelatinous mass on cooling, like other starches.

Rice Starch.—Mr. Jones patented, in 1840, a process for obtaining rice starch by the action of alkalies and their carbonates on ground rice, which dissolved the azotized substances, and liberated the rice starch.

Wheaten Starch.—The starch in wheat is associated with a most curious elastic and azotised substance, called gluten, the quantity and quality of which in the wheat determine the nutritive and commercial value of its flour, and it is only very recently that this substance, which has generally been considered as a waste product, has received a valuable application in calico printing. An eminent chemist and calico printer of Glasgow, Mr. Walter Crum, has discovered that under certain circumstances, gluten is soluble in weak alkali, and thus has applied it as a substitute for albumen for fixing on muslins a beautiful purple mauve colour, called French purple. Thus the two principal ingredients of wheat, gluten and starch, are used in calico printing, the gluten for some colours, and the starch for others.

The usual mode of obtaining starch from wheaten flour is to place some flour or crushed wheat, with water, in large tubs or vats, allowing it to enter into fermentation, and to continue fermenting for several weeks, according to temperature. In well-conducted establishments this operation is carried on in rooms heated in winter, so as to allow the fermentation to proceed without interruption. The fermentation of the grain produces a foul acid water, called *sour water*, and the putrefaction of the azotised substance of the grain gives rise to a very offensive odour. The sour water contains alcohol, acetate of ammonia, acetic and lactic acids, biphosphate of lime, and decomposed gluten. The fermentation which first occurs is the vinous, at the expense of the sugar and a certain portion of the starch; carbonic acid and alcohol are thus formed. The former is evolved, and the latter remains in the liquor. The alcohol is rapidly transformed, under the influence of the oxygen of the air and the gluten, into acetic acid, and it is by this acid thus formed, conjointly with lactic acid, that the complete separation of the starch and gluten is effected. The ammonia comes from the decomposition of the gluten, and the lactic acid is a secondary product arising from that of the starch. But still the fermentation and the acids are not sufficient to remove or destroy the whole of the gluten, which forms a layer on the top of the starch; this mass, called *slimes* or *flummery*, was formerly used for feeding pigs, but is now employed by calico printers in their *resist pastes*, and by the patent gum manufacturers in the preparation of certain of their products. The slimes and the other results of decomposition above enumerated are removed by washing and by sieves from the starch, when this is allowed to settle in clear water for several days so as to acquire a sufficient consistency. If the starch is to have a blue tint, called Poland, fine ultramarine must be mixed in the liquor of the last sieve, in the proportion of about 2 per cent. It is then either placed on cloths to drain, or put in wooden chests, the bottoms of which are lined with cloth; this operation is called *boxing*. When sufficiently drained it is dried by various means, and then the masses are broken into lumps of about six cubic inches, wrapped in paper, and placed in carefully heated stoves, when, strange to say, these masses split up into thousands of irregular pieces, well known to consumers. Potato starch and all those similar to it cannot assume this peculiar form.

The above fermentation process is not only objectionable from the length of time it requires, and the noxious products which arise from it, but also from its serious destruction of valuable materials, which amounts to between 30 and 40 per cent. Mr. Martin, of Paris, succeeded some twenty years ago in doing away with the above inconveniences, by kneading the flour into dough, and introducing it into a wooden cylinder, working on its axis and armed with cutters, and having its openings covered with a fine copper gauze. By this means Mr. Martin obtained a larger yield of starch, and saved the valuable substance called gluten, which he turned to good account by drying it, pulverising it, and selling it as granulated gluten; it is now sold in London under the fictitious name of *semolina*. He also, by adding gluten to flour, brought the latter into a state to be easily manufactured into macaroni and similar pastes. To separate the small amount of gluten which the starch still contains, Mr. Martin allows it to ferment for several days, or treats it with chemical agents, which separate the gluten from the starch. Wheaten starch is not only employed for domestic purposes, but is also used extensively by calico printers, especially for thickening colours into the composition of which free acids enter. A similar class of starch can be obtained from rye, barley, oats, buckwheat, millet, and maize.

* See paragraph on gum substances, next page.

I cannot complete this important part of my subject, without giving a complete analysis of wheat flour.

Analysis of Wheat Flours.

	Starch.	Gluten.	Sugar.	Dextrine or Gum.	Water.	Bran.	Fatty Matter.
Odessa Flour, Hard Grain	56·5	14·6	8·5	4·9	12·0	2·0	—
Odessa Flour, Soft Grain	62·0	12·0	7·5	5·3	10·0	1·2	—
English Flour	75·5	11·0	4·7	3·3	10·0	—	—
Bakers' Flour	72·8	10·0	4·2	2·3	10·0	—	—
Recent Analysis of Dried Flour	73·2	13·4	5·6	0·2	11·1	—	2·2

Gluten is composed of glutine, fibrine, albumen.

100 parts of wheat grain give—

Flour for making white bread 58 } 72, sometimes 80 to 85.
" " brown " 14 }

		100 parts wheat—	
Bran	26	Straw ...	62
Loss	2	Grain ...	38
	100		100

Potato Starch or Farina.—This starch is chiefly manufactured on the Continent, and the following table will show that different varieties of potatoes yield very different quantities of starch.

	Starch.	Fibrous parenchyma.	Vegetable Albumen.	Gum, Sugar, and Salts.	Water.
Red potato	15·0	7·0	1·4	9·2	75·0
Germinating potatoes	15·0	6·8	1·3	3·7	73·0
Kidney potatoes	9·1	8·8	0·8	—	81·3
Large red potatoes	12·9	6·0	0·7	—	78·0
Sweet Potatoes	15·1	8·2	0·8	—	74·3
Peruvian potatoes	15·0	5·2	1·9	1·9	76·0
English potatoes	12·9	6·8	1·1	1·7	77·5
Parisian potatoes	13·3	6·8	0·9	4·8	73·1

The following is an accurate analysis of the potato:—

Water		74
Starch		20
Epidermis, cellular tissue, pectose, pectine, pectates of lime, soda, and potash		1·65
Albumen	1·50	4·35
Asparamide	0.12	
Fatty matter	0·10	
Sugar, resin, essential oil	1·07	
Citrate of potash, phosphates of potash, lime, magnesia, silica, and alumina, oxides of iron and manganese	1·56	
		100·00

To obtain their starch, potatoes are washed in a suitable machine, to remove all dirt; they are then reduced to pulp by rasping, and the pulp is elutriated upon a fine wire sieve, and, by successive similar operations, the starch is separated from the pulp. After having been drained in boxes, lined with felt, it is then placed on dried floors, made of plaster of Paris, which absorbs the greatest part of the water, and, to complete its desiccation, it is further dried in the air and in stoves. The farina so prepared, although suitable for manufacturing purposes, has still a peculiar rank taste, which renders it disagreeable as food. To remove this nauseous odour and taste which it possesses, Mr. Martin washes the starch with a weak solution of carbonate of soda, which renders it perfectly sweet.

Besides its application as above in the manufacture of artificial tapioca, and as a substitute for arrowroot, it is also used in large quantities in print works for thickening colours, and finishing goods, and also as a substitute for wheaten flour in laundry purposes. The Glenfield Company, as I believe, were the first to introduce a preparation of farina which has the advantage, when boiled with water, of forming a clear fluid, which gives to net and other fine fabrics a transparent appearance, instead of an opaque one. This the company effects by mixing with the starch a trace of sulphuric acid, which still is sufficient to convert the insoluble starch into a soluble substance, called *dextrine*. A process has lately been patented to effect the same change by means of oxalic acid.

Recently Mr. Sorel has published a most interesting application of starch, which consists in producing an artificial substance, capable of replacing, in many instances, ivory, horn, gutta percha, &c. He obtains his new plastic and translucent matter by adding farina to a solution of chloride of zinc, of such a strength as to swell it out without dissolving it. This mass becomes hard and tenacious, and to modify these properties various substances, such as oxide of zinc and sulphate of baryta, are added in a powdered state; and what is curious is that, whilst oxide of zinc renders the mass opaque, sulphate of baryta does not affect its translucent appearance.

The extension which took place in calico printing, some 20 or 30 years ago, called into consumption such large quantities of gum arabic, that farina heated to a temperature of 250 to 300 degrees, and thus rendered soluble as a gum, became extensively employed as a substitute, and of late years it has assumed an important place in the list of materials used by calico printers. To effect this curious change at the present day, farina is heated to the above temperature, either in a revolving cylinder or in iron troughs placed in a stove for several hours, when it acquires an umber colour and becomes soluble in water. This change is entirely a molecular one, as the raw and calcined farina have the same composition, notwithstanding which farina gives a blue colour with iodine, and when calcined a purple. As the colour of calcined farina is an objection to its employment in many instances, it was a great desideratum to find a process for its conversion, at such a low temperature, as to leave the converted farina nearly colourless. This was first effected, in 1838, by M. Payen, who found that if to 400 parts of dry farina one part of nitric acid at 1·40 was added, after having been diluted with sufficient water to form with the farina a hard paste, and this then dried slowly and heated in a close chamber for 20 hours, at a temperature of 200 deg. Fahr., a nearly white farina was obtained. It is interesting to observe how so small a quantity as a few thousandths of acid can effect this great molecular change. Since that time, many processes have been devised to attain the same end, and you will remember that, in a paper which I had the honour to read here some years ago, I adverted to a method discovered by Mr. Edward Hunt, and I have now the satisfaction of calling your attention to a very interesting process discovered also by one of my late assistants, Mr. Charles O'Neil, and which is valuable as it enables him to convert insoluble farina into soluble farina, or *dextrine*, without any change of colour. This he effects by subjecting starch, farina and other amylaceous substances to the chemical action of muriatic acid gas, or other acid gas or vapour in a cylinder, the exterior of which is surrounded by an atmosphere of steam. This beautiful preparation will extend the employment of soluble farina as a substitute for gum arabic, the colour which was inseparable from farina previous to this discovery excluding its use in many instances. As calico printing in its present extraordinary development requires thousands of tons of soluble materials for thickening the mordants and colours used, a great variety of this class of artificial gums are prepared so as to meet these requirements. Thus, besides farina, sago, rice,

slimes and wheaten flour are used; the latter when heated generally bears the name of British gum, which differs from calcined farina in being soluble in water only at a boiling temperature.

If, instead of employing minute quantities of acids, a larger quantity be used, farina and other starches are not only first transformed into gums, but are further converted into sugar, similar to that which exists in grapes and fruits generally. But, in this case, starch undergoes not a mere molecular change, but a complete chemical transformation, by fixing two equivalents of water. On the Continent, where large quantities of this peculiar sugar are employed in the preparation of beer and other beverages, the following process is now adopted. By adding farina gradually to one part of vitriol diluted with 33 parts of water, and carrying the whole to the boil for 30 or 40 minutes, it is converted into sugar, and this is easily ascertained, as that solution yields no colour with iodine. To the solution is then added carbonate of lime or chalk, which forms an insoluble sulphate of lime. It is then sufficient to pour off the saccharine solution, and evaporate it to a proper consistency to obtain, after cooling and standing several days, solid masses of sugar, very similar in appearance to honey.

If, instead of continuing the action of sulphuric or other acids upon starch until it is converted into sugar, the operation is stopped as soon as the solution gives a purple colour with iodine, then, by removing the acid, and evaporating the solution, a translucent soluble matter is obtained, having the greatest resemblance to gum, called *Dextrine*. Although the conversion of starch into sugar has been known for a long period, still it is only since 1833 that chemists have been aware how this curious conversion was effected. In that year, Messrs. Payen and Persoz succeeded in extracting, by means of alcohol, from a solution of malt, the curious ferment which caused that change, and they gave to it the name of *diastase*. To leave no doubt that this is the agent which converts starch into sugar, they found that by mixing one part of this azotised substance with 2,000 parts of farina and a sufficient quantity of water, these were completely converted, first into dextrine and then into sugar, at a temperature of 150°Fahr. And, as I observed at the commencement of this paper, this conversion was completely prevented if the temperature was raised to 200° or 212°.

DISCUSSION.

Mr. P. L. Simmonds said he was glad to find that Dr. Crace Calvert had been induced to take up the subject he was so competent to discuss, and which had been so ably treated that evening. Indeed, the immense importance of the subject could scarcely be overrated. Whether we looked at it in an industrial and agricultural point of view, or in a dietetic or manufacturing light, it was fraught with great and important interests to society at large. Four years ago, in the columns of the Society's *Journal*, he (Mr. Simmonds) had drawn attention to this matter, and the wide field open for investigation and the development of new sources of supply. At his suggestion, among other desiderata, the following had been placed on the Society's Premium List:—"For an account of the processes employed in the manufacture of starch, the sources from which it is obtained, and the purposes to which it is applied." "For the largest and best sample of starch produced from a non-edible substance cheaper than any at present in use, and obtainable in large quantities." No person could have been found better qualified to discuss this subject than Dr. Calvert, both from his chemical knowledge and his local opportunities of acquiring practical and useful information in the great seat of the manufacturing districts. Few were aware of the large consumption of starch of different kinds for dietetic use, laundry purposes, and manufactures. Although it was somewhat difficult to get at the statistics of production and consumption, yet Dr. Calvert had furnished them with some data of the enormous consumption of gum substitutes in the factories; and in a paper he (Mr. Simmonds) read before the Society on "Gums and Resins," he had pointed out how dextrine was taking the place of the more expensive gum arabic for stiffening purposes and for labels of various kinds—such as postage and receipt stamps, adhesive labels and envelopes. In 1852 Mr. Braithwaite Poole, in his work on the Statistics of British Commerce, had estimated the manufacture of starch in the United Kingdom at about 20,000 tons, which, at an average of £23 per ton, would give a total value of £460,000 per annum. But this scarcely took into account at all the dextrines or gum-substitutes which had mainly grown into importance with the progress of textile manufactures, and were certainy 4,000 to 5,000 tons a year. As Dr. Calvert had chiefly confined his attention to the chemical and manufacturing view of the question, which, from the time at his disposal, he was necessarily obliged to do, he Mr. Simmonds, would touch briefly upon the commercial and statistical points. It was greatly to be regretted that we were obliged to trench so largely upon food plants for the production of starch for manufacturing purposes, by which a heavy loss was entailed and prices advanced. He believed much might be done to remedy this evil, and prevent that immense destruction of valuable food, such as wheat, rice, potato, and sago, which now occured. It only required attention to be drawn to the matter, and investigation and enquiry would soon find ample substitutes. In Belgium not long since, a premium of £400 was offered for any substitute suitable for the production of starch, other than a food product. In France, the horse chestnut, which was to be had in abundance, was now converted into excellent starch and vermicelli. Many neglected tropical roots and seeds might be turned into starch; there were hundreds available to be met with in various quarters, and it only resolved itself into a matter of cost of manufacture and price to be obtained to cover shipment, &c. Besides the *cassava* or *mandioca*, alluded to by Dr. Calvert, there were numbers of coarse yams, which, if fit for little else, could at least be converted into starch. The yield, per acre, of all these roots in the tropics was something enormous. There was abundance of cheap land, and the cost of culture and manufacture was comparatively trivial. He had dozens of starches of different kinds in his collection, many from new and little-known sources, but which were certainly deserving of attention. There were the Curcuma arrowroots of the East, which formed a large source of food in Travancore. The Zamias, again, seemed to offer a profitable field for research, as they had been utilized in St. Domingo and Western Australia. His friend, Sir Robert Schomburgk, a few years ago when British Consul at St. Domingo, had called attention to the Guellaga starch obtained there from the root of the *Zamia media*, a plant which covered immense tracts along the coast and interior. It was made there on a small scale; and 494 barrels were shipped in 1856 at the price of £1 13s. 4d. per barrels. If the starch were extracted by machinery, in lieu of employing human hands, it might be obtained at a much less cost than at present, and become available for calico printing and for other manufacturing purposes. The production of starch in our colonies was, he was happy to perceive, occupying an increased degree of attention. Singapore was the great entrepot of the sago trade, of which article we now received 7,000 or 8,000 tons a year. He was not aware, until that evening, that it was so large a source of dextrine, although he knew that it was a considerable source of starch for laundry use. In Penang, Ceylon, and other parts of the east, starch manufacture was advancing. In the last Ceylon papers, he saw it mentioned that the production had increased, in 1856, to 66,000 lbs., so that while they formerly imported from Southern India, they now exported largely. But although the plants were used as common fences, it had been found difficult to get them cultivated for their roots. The so-called arrowroots of commerce were of a very varied character, and were obtained not only from many sources, but from

very different plants; indeed it was impossible to state what were the sources of many of the African and Indian arrowroots of the present day. The *canna*, or arrowroot tribe, yielded the best, from the West Indies; but the *arums*, *curcumas*, and *cassavas*, and the sago, and other palms, yielded starches, which were, no doubt, bleached and rendered more saleable. He questioned, however, whether the *semolas* and *semolinas* of commerce were so largely made from potato flour as Dr. Calvert had stated. Most of those of London commerce were certainly the fine hard parts of wheat, rounded by attrition in the millstones, and imported chiefly from Italy—but the imports of these had been declining lately. Dr. Calvert had pointed out, besides wheat and potatoes, that rice and sago were now much used for starch-making; what the quantity of these substances employed might be for the purpose he could not say, but he had thrown together collectively the imports of all the foreign substances which might be used for this purpose, or those which approximated to them in character and composition—including few of the farinas, &c. The table applied to 1857—the official returns for 1858 for many of the articles, not being yet published. In the United States, maize—the great grain crop of the country—formed also the source of starch production, and the Oswego starch had even some repute in this country. The demands for manufacturing purposes were there also on the increase. In the town of Lowell alone there were used by manufacturers, in 1855, 13,115 cwt. of starch and 1,545 barrels of flour. The last Australian advices reported that, owing to the low price of potatoes in Tasmania—an article for the production of which the colonists had been famous, the farmers had been compelled to fatten their pigs upon them, not being able to dispose of them. In many instances crops had been allowed to rot in the ground, simply because they would not realise a sufficient price to cover the expense of gathering them in. Some of the farmers, however, had bethought themselves of making starch from the potato, and had found a ready sale for the product. The more information, therefore, chemical, practical, and commercial, could be diffused throughout the colonies, by means of the Society's *Journal* and the Institutions with which it was in union and correspondence, the better for the cultivators there, and the manufacturers and traders here. He (Mr. Simmonds) desired merely to throw out these few practical hints and facts in furtherance of this great object, and hoped that benefit might result therefrom.

Import and Value of Starches, &c., in 1857.

	Quantity. Cwt.	Value. £
Arrowroot	17,631	49,984
Tapioca	9,528	30,250
Sago	149,416	166,848
Potatoe Flour	12,736	11,462
Manioc Flour	26	19
Indian Corn Meal ...	1,092	510
Semolina	385	771
Starch	9,085	9,540
Starch, Gum, or Dextrine	233	279
Rice Meal	3,526	1,763
Manna Croup	1,495	2,653
Cassava Powder	1,152	1,075
Maccaroni and Vermicelli	7,543	18,482
	213,848	293,636

Mr. Evill, as a manufacturer of starch, would offer one or two remarks of a practical nature upon the branch in which he was more particularly engaged. He wished to bear his humble testimony to the great value and importance of the very interesting and able paper they had heard that evening. There was very much in it which should suggest thought to the manufacturers, and stimulate them to improvement and progress,. As Dr. Calvert had well said, it was for scientific men to make discoveries, and for manufacturers to carry them out to practical results. As regarded the general question of the chemistry of starches, he attended rather as a learner and a listener, than as one competent to communicate any valuable information; but as the particular branch of starch manufacture in which he was himself engaged—viz., the manufacture of rice-starch—had been cursorily alluded to by Dr. Calvert, he would venture to make a few remarks upon that subject. Dr. Calvert, in the opening part of his address, alluded to the impetus which had been given to the manufacture of starch of late years, in consequence of the great increase of trade and the progress which had been made in chemical science. It was quite true that trade had largely increased, and in a corresponding degree the demand for starches had increased. It was also true that great progress had taken place in chemical science, and as they increased in chemical knowledge, so was that knowledge brought to bear upon manufactures. But there was one other cause which had not been alluded to, and which should have its due place. He believed it was not generally known that, up to the year 1833, there was an excise duty on starch. Every pound of starch manufactured paid a duty of 3½d. to the government, amounting to nearly 75 per cent. upon the present market price of that article. Every packet of starch was stamped by the Excise officer before it went into the stove, and, as might be imagined, that was a great hindrance to the progress of the manufacture, which languished under such restrictions. It was a very important fact that, since the year 1833, when those restrictions were removed, there had been no fewer than 40 different patents taken out for improvements in the manufacture of starch. That was a fact which should go forth to strengthen the hands and enforce the arguments of those who urged the removal of all fiscal restrictions upon home manufactures, and it was a fact which was especially worthy of notice, in a meeting of the Society for the Encouragement of Arts, Manufactures, and Commerce. It was an illustration of the same principle as that afforded by the manufacture of glass. Since the restrictions were removed, they knew how greatly that manufacture had improved. It was the same with bricks, soap, and vinegar, and he trusted the time was not far distant when the great principle established by the late Sir Robert Peel, with regard to the fiscal duties upon articles of food, would be recognised as regarded paper and other home manufactures. With respect to the manufacture of rice starch, it had been stated by Dr. Calvert that it was 30 years since rice was first applied to the purpose of making starch. He (Mr. Evill) believed it was nearly 100 years, for he found that, in 1768, William Prince patented a process by which he extracted starch from rice. The process was described in the patent to consist of the mixing calcined oyster-shells with boiling water, or, in other words, treating the rice with lime water. The next patent was taken out by Wickham, in 1821, which was a process of treating the rice with caustic potash previous to the grinding of the grain. He believed that was an imperfect process, owing to the solvent used not being strong enough to dissolve all the gluten. Then, in 1833, the fiscal restrictions were removed, and shortly after that some very important patents were taken out. Orlando Jones made a very great step in advance of Wickham, by the application of a caustic alkali in the maceration of the starch, before and after the grinding of the rice, as well as in the steeping of the grain. This dissolved all the gluten and produced a pure rice starch. At the same time Mr. Colman was engaged in a process similar to that employed in wheat starch, and to facilitate the solution of the gluten of the rice, he added a certain quantity of woody fibre, and afterwards treated it in the same manner as was done with wheat starch. Subsequently Mr. Colman took out another patent, reverting to Wickham's process; but treating the rice after grinding with a solution of borax and lime. Mr. Berger patented a process similar to that of Orlando Jones, except that, in-

stead of caustic alkali, he used a solution of carbonate of soda. Subsequently Mr. Berger took out another patent, using caustic alkali in the maceration of the rice and also introducing spirit of turpentine in the process. The Messrs. Colman afterwards patented a process by which they extracted starch from rice by means of chloride of sodium. The last patent he was acquainted with was taken out by Mr. Ransford for a mechanical process by which he proposed to extract the gluten from the rice by hydraulic pressure. He (Mr. Evill) did not say that the manufacture of starch had attained perfection, but a very great deal had been done of late years: and it was a remarkable fact that since these patents had expired no other process had been proposed, and all the patents taken out during the last few years had simply reference to minor details of manufacture. One patent, he might mention, was for the production of solid starch by atmospheric pressure; another for mixing starch with whey or butter-milk, whilst a third stopped short of the drying process. Another process had been proposed to mix oxalic acid with the starch in a dry state, so as to convert insoluble starch into soluble starch or dextrine, which conversion took place by submitting the combined matters to a high temperature. With regard to the peculiar characististics of rice starch he felt some delicacy in alluding to them; but he might mention one feature of interest, viz., that in ordinary starches it was necessary to boil the starch before the gelatinous consistency was obtained, whereas with rice starch it was simply necessary to pour boiling water upon it, and he believed that it was also considered to be less hygrometric. He would avail himself of Dr. Calvert's kind offer to reply to any inquiries that might be made upon this subject. There was one singular feature which he had remarked in the process of rice starch manufacture, which he found it difficult to account for. He alluded to the variation in the time which it took to deposit the starch according to the particular state of the atmosphere, not as regarded the temperature, but possibly the electrical condition of the atmosphere. In one instance, it had been proposed to introduce an electric current into the ranges, in order to regulate the deposit. If Dr. Calvert was in a position to throw any light upon that circumstance, he should feel greatly obliged by his doing so. He felt convinced that nothing could more conduce to the development of this manufacture and the progress of the arts than discussions of that kind. He rejoiced at open discussion and competition, and certainly starch manufacturers in the present day had their share of that wholesome stimulant.

Mr. Colman said, after the full explanations which had just been given by one of his competitors in the trade, it was unnecessary for him to add anything upon the subject. The manufacturers of rice starch were by no means a numerous body; he believed there were not more than about ten in the whole country. Still wholesome competition did good to them and to the public. As a manufacturer, he felt personally obliged to Dr. Crace Calvert for the paper with which he had favoured them. So far as rice starch manufacture was concerned, he believed that those engaged in it would agree that it was a difficult manufacture; at the same time he believed they could produce as good starch as could be obtained from any grain that was grown. He did not speak in depreciation of any other description of starch. There were, doubtless, many other roots and grains from which starch might be produced, of which at present they had little or no knowledge—amongst others, those enumerated by Mr. Simmonds; but there was one important thing which they must bear in mind—viz., that the public would require of the manufacturer starch of a certain quality. It was not enough to produce a starch, but it must be of a good marketable quality. Several attempted patents for the manufacture of starch had come to his knowledge, having for their object to render the fabric upon which it was used uninflammable. He begged to ask Dr. Calvert whether he could afford him any information upon that subject. At present there was very great difficulty in producing a starch possessing such an uninflammable property. He should be extremely glad if means could be devised for the production of such an article. As far as he was acquainted with the subject, whatever agent they employed to impart the uninflammable property, was carried off with the water. If Dr. Calvert could give the manufacturers some hint upon that subject, they and the public at large would be greatly benefited, and there would be no recurrence of those fearful accidents from fire which were now so frequently heard of.

Dr. Crace Calvert, in replying upon the discussion, said he had listened with much gratification to the remarks of Mr. Simmonds. It must be borne in mind that it was impossible, within the limits of an address such as he had given that evening, to enter into all the details of the subject. He had stated at the outset that many of those details to be of value, must be minutely entered into, and it was a question whether they would be interesting to the general body of the meeting; but that defect could be remedied, as he had already stated, by any person requiring further details writing to him at Manchester, when he would tell them where they could get full information, far more than he could give in treating of the subject generally. In fact wheat starch alone would form a subject for an entire paper. When he was requested to read this paper, he thought the best way was to give a general view of the properties of starches, leaving persons to make such subsequent inquiries as they wished. The remarks of Mr. Simmonds were most valuable. The main object of the paper was to induce the introduction of new articles for this manufacture, for it was a great pity that two staple articles of human food, such as wheat and rice, should be transformed and decomposed in order to get from them some 20 per cent. of this commodity of starch, whilst in other parts of the world things were produced in great abundance, which, with the employment of a little capital and labour, might form an important branch of this manufacture. It would be a great boon to society if thousands of tons of food were now thrown into the markets and their value cheapened to the consumer. He hoped that Mr. Simmonds would confer another service upon the Society, by adding to his remarks such data as would induce colonists to export to this country larger quantities of starch-yielding articles. It would be of great service if Mr. Simmonds would furnish a table of the present prices of the various starches in the market. Mr. Evill had asked him a question, which, he was sorry to admit, he was unable to answer—viz: how it was that starches deposited sooner under certain atmospheric influences than under others. He had never heard the statement made before; but at the same time it was a fact which it was interesting to know. There could be no doubt that the friction of the starchy particles might produce a certain amount of electric fluid, but beyond that he confessed he was in the dark upon the subject of Mr. Evill's enquiry. The only way of elucidating such a question, was for the manufacturers to give scientific men access to their establishments, and, by watching the process step by step, and each communicating freely his ideas to the other, they might hope for a solution of the difficulty. Mr. Colman had inquired whether there was any good process to give to starch the power of rendering fabrics incombustible. He thought that adding 1 or 1½ per cent. of sulphate of ammonia would have considerable effect. Some processes for producing that result had been patented, but it had long been known that sulphate of ammonia was the cheapest and best substance for preventing combustibility. Messrs. Versmann and Oppenheim had recently investigated this subject, and recommended the use of tungstate of soda; but whether this or any other salt, such as sulphate of ammonia, was the best, was principally a question of cost. If they took a piece of cotton wool, and dipped it into sulphate of ammonia, and then dried it, it was rendered uninflammable, and he saw no practical reason why this salt should not produce the same effect when mixed with starch.

The Chairman said he was sure the meeting would not fail to remember the handsome offer which Dr. Crace Calvert had made to answer inquiries more in detail than it was possible to do on the present occasion. It was now his pleasing duty to call upon them to express their sense of the value of the paper they had heard. It was a subject of infinite importance in the relation which it bore to the food of man, and to our own prosperity as a nation, as well as that of our colonies; and it was impossible for such a subject to be brought forward by able minds without producing important results. With that feeling, he begged to move that the thanks of the meeting be given to Dr. Crace Calvert, for the able and useful paper he had read.

Mr. Varley seconded the motion.

A vote of thanks was passed unanimously.

Dr. Crace Calvert in acknowledging the compliment paid him, expressed his readiness at all times to obey the call of the Society in any matter which would be useful or agreeable to them.

The paper was illustrated by various experiments, and a large collection of samples of various starches and artificial gums.

The Secretary announced that the next Ordinary Meeting of the Society would take place on Wednesday, the 18th January.

TRIAL OF PATENT CASES.

An action was tried in the Queen's Bench on the 5th inst., when the Lord Chief Justice Cockburn made some very important observations in reference to the inadequacy of existing tribunals for trying patent questions.

The action was brought by Messrs. Crossley, carpet manufacturers at Halifax, to recover £2,000 from Mr. Talbot, also a carpet manufacturer, at Kidderminster, as royalty for the use of their patents in connection with the Jacquard loom. The royalty was secured by a deed between the parties, and the defendant, by plea, denied that in making his carpets he had used any of the plaintiff's inventions or any part thereof.

Before the case commenced, the Lord Chief Justice said there was another patent case in to-day's paper. He really could not take up the whole time of the sittings in trying patent cases.

Mr. Atherton had not concluded the opening, when

His Lordship suggested that it was a matter which might be much better settled by some scientific person from an inspection of the machinery than by an inquiry in court, which would occupy two or three days.

Mr. Knowles said he quite concurred with his lordship. At the end of two or three days the jury would not have arrived at the knowledge necessary to commence the investigation.

The Lord Chief Justice said these patent cases were nuisances. Laymen, perfectly unacquainted with the points which they were called upon to determine, were not in such an advantageous position at the end of several days as a scientific person would be in as many minutes.

A Juryman said he could confirm his lordship's view. He had served upon a jury in the Court of Exchequer in a very similar case, and he believed that half of the jury were so confused by the conflicting testimony that they could scarcely arrive at any conclusion.

The Lord Chief Justice said it was very difficult to decide between conflicting evidence in ordinary cases, but especially so when the subject-matter was not within their cognizance.

A verdict was then taken for the plaintiff, with the damages in the declaration, subject to a reference.

Mr. Knowles said that all parties ought to be obliged to his lordship for making the suggestion. He was certain that this case could not have been as satisfactorily tried in any other way, and few patent cases could be satisfactorily disposed of by a jury.

The Lord Chief Justice.—One mind conversant with the subject is infinitely better than 12 or 13 who are not.

EMPLOYMENT OF WOMEN.

The following letter has been addressed by Mr. Harry Chester to Miss Bessie Parkes, the authoress of the paper on this subject read at the recent meeting at Bradford, of the National Association for the Promotion of Social Science:

63, Rutland-gate, London, S.W.
November 8th, 1859.

Madam,—Having been prevented from going to Bradford, I had not till yesterday the advantage of reading your paper on the education and employment of women.

You suggest that the examinations of the Universities and other public bodies should be open to women as well as to men. I fear that there may be difficulties about opening to women the examinations instituted by Oxford and Cambridge; but, if you will do me the favour to read the enclosed programme of the examinations of the Society of Arts for 1860, with the appendix, you will see that these examinations are open to women in all respects as readily as to men; and that some women obtained certificates at the examinations in May last. The same was also the case in 1858.

At page 7 of the programme you will see the subjects in which the Society of Arts examines. The following appear to me to be those of the twenty-five subjects which may be suitable to your sex. Arithmetic, book-keeping, algebra, geometry, astronomy, botany, political and social economy, geography, English history and literature, Latin and Roman history, French, German, and the theory of music.

The question which you propose to deal with, is, I think, simply a question of education, *i.e.*, if you can improve the education of females, but not otherwise, you can improve the market for female labour; and one of the great wants of female education, is I think, the want of some external standard such as the Society of Arts now supplies.

The advantages of the peculiar mode of examination adopted by the Society of Arts would be appreciated by ladies. They would not have to go to a distance; and there would be no unpleasant excitement or display before the examiners.

A woman that had obtained from the Society of Arts a certificate of the first or second class in book-keeping could scarcely fail to obtain employment as a book-keeper; and one cannot see why the wives and daughters and sisters of commercial men should not act as their book-keepers in London as well as in Paris, where they commonly act in that capacity. You are of course aware that women are employed to a considerable extent in the offices of electric telegraphs.

I doubt whether they could be well engaged in the duty of inspecting schools, as it can scarcely be discharged efficiently over a very limited area; and an extent of area sufficient to afford the requisite experience proves very fatiguing even to male inspectors. I cannot but think that many a lady would be more comfortably circumstanced if, instead of being a governess in a family, she were the mistress of a national school for girls. She would be more independent, have more time to herself, and be at least equally well employed.

The statement of the Society for the Employment of Women speaks particularly of the cases of servants, needle-workers, and governesses.

If, as is the case, female servants are too often recipients of parochial relief in old age, this result arises more frequently from their own improvidence or dishonesty, than from any essential condition of service. Those that receive very small wages do not often receive less than they are worth, while a faithful and good servant has generally no difficulty in retaining her place and in laying up money in it. It is the bad or unfaithful servant who has constantly to change her place, and who goes downwards instead of upwards in the world: and many, who, being faithful and good, save money in their places, are tempted to give them up for marriage, or to enter upon business; and then, from

their ignorance and inexperience of their new life, they become insolvent and die in the workhouse, classed there as domestic servants, though their failure has in fact come to them, not as servants, but as greengrocers, publicans, or lodging-house keepers. It should be added that servants are commonly very charitable, and spend on their destitute relations considerable sums, which, laid out at interest, might provide for themselves for life. I know of only one mode by which the condition of domestic servants can be effectually improved, and that mode is the improvement of the education of women, by which women may be made more useful, trustworthy, and provident than they are now.

As for needlewomen, their market being perfectly open, we may be sure that their work is remunerated at its real value in the market. Their employers cannot pay more for needlework than the minimum which needleworkers in general are willing to receive. There is but one way by which the price of needlework, or of any other article, can be raised, and that is by a diminution of the number of workers in proportion to the demands for the work. Much of it is as rude and as bad as possible. You may teach some of the crowd to do a better and more remunerative kind of work, and you may enable others to emigrate.

Under the head of "governesses" are included persons whose capacity and remuneration vary from the very low to the very high. A really valuable governess is generally well remunerated and well treated. A salary of from eighty pounds to one hundred pounds a year, or more, a good sitting-room and bed-room, excellent food, sufficient attendance, and considerate, often affectionate treatment, are commonly accorded to a governess of the first-class; and it is easier for her to find such an appointment, than for an employer to find such a governess. When we burn with indignation at reports of mean and unworthy remuneration offered to young ladies who wish to be governesses, we may do well, perhaps, to consider how ill-qualified some of them are for that important and sacred office.

From these observations you will infer that I think it of the gravest consequence to your society, that it should take up no views which are partial or exaggerated, or opposed to invincible economical laws; and that I regard the question which you desire to solve as simply and remarkably a question of the improved education of women.

As shall be the education of women, so shall be the remuneration of those women who labour to live.

You may think lightly of the objection taken by the *Saturday Review* that, if you increase woman's power of gaining her own livelihood, you diminish the number of marriages and so injure society, for you may reply that such a power, making her more valuable, in a pecuniary sense, as a wife, increases her opportunities of marriage; and that it is neither for her own good nor for the good of society that she should marry for hunger instead of for love and esteem.

On the other hand, when you look with regretful longings on the more abundant facilities which France affords for the light and remunerative employment of women, it is well to remember also that labour in general, and very heavy, ill-paid labour, devolves upon them there much more than here; and that this is to a considerable extent a result of that horrible military conscription which withdraws six hundred thousand males from their natural fields of labour.

Looking, then, at your object in the lights in which I have endeavoured to place it, let us see what you can do.

The education of women of every class among us is in urgent need of improvement. Much less has been done for girls' than for boys' schools. There is a great want of properly qualified schoolmistresses; and those who have charge of the schools for the poor are drawn commonly from the ranks of the poorest. Your society might suggest and promote the erection of many additional schools for female children, and of some normal schools for the preparation of governesses, of mistresses of middle schools, and of mistresses of schools for the poor. I repeat that I am strongly of opinion that ladies not qualified to take the part of governesses of the first class, had much better be mistresses of national schools, than governesses of an inferior grade. I need not point out to you how greatly the education of our girls in the national schools would be improved, if educated ladies could be placed in them, instead of more of the excellent but sadly crammed young women who are now commonly sought for as mistresses. As there is already a great demand for more mistresses, ladies could take these places without displacing other people. There needs be no loss of caste, and generally there would be a great increase of comfort. A certificated mistress might receive a salary of (say) sixty pounds a year; allowances of (say) twenty pounds a year for her certificate, and of (say) twelve pounds a year for her pupil teachers, and a comfortable house, rent free. She would have more time to herself than a governess has, and her influence with the parents of the scholars would be invaluable. To qualify her for the post, she would have to be trained at a normal school, and to be taught to teach.

A normal sohool for one hundred ladies could not be erected for less than ten thousand pounds, half of which might be looked for from the Committee of Council on Education.

I advise your society rather to stimulate others to found and maintain schools, than to attempt to found and maintain them itself. You might, however, establish classes for the special instruction of young women who have left school, with a view of qualifying them to act as book-keepers, clerks, &c. You may be sure, that well-qualified women would immediately obtain employment, as their service (if equal in quality) would be very much cheaper than men's. I should advise you to begin with classes for arithmetic and book-keeping; and to prepare your pupils for the examinations of the Society of Arts in the spring.

If anything occurs to you as within the means of the Society of Arts to do in furtherance of the object of your paper or of the Society for the Employment of Women, I am sure that the Council will gladly take into consideration any suggestion that you may be so good as to make.

I have the honour to be,
Very faithfully yours,
HARRY CHESTER.

To Miss Bessie Parkes.

EDUCATION IN SWITZERLAND.

A lecture was delivered on Friday, December 3rd. at the Middle School, High street, Peckham, by Dr. Yeats, the head of the establishment, on the Principles and Plans of Education in Switzerland. The address formed one of a course which is being delivered on the system and extent of instruction which prevail in the principal States of Europe and America. Dr. Yeats, in referring to the excellent system of national education among the Swiss population, stated that it was the cause rather than the consequence of the great material prosperity which existed in Switzerland. Their geographical position, not less than the physical characteristics of their country, had required from the hardy peasantry this close application of thought and labour, for the purpose of obtaining the necessaries and comforts of life. A population of little more than that of Yorkshire and Lancashire combined, could boast of 13 normal schools for the training of teachers. The national schools were attended by one in every five of the population. The attendance was compulsory; every child was required by the state to attend a district school until he was fourteen years of age, and was not permitted to enter into any employment until he had passed through an examination. This regulation naturally enough excited considerable discontent when first imposed upon the people; the cotton manufacturerers complained that they would not be able to get labour for their mills, and there were not a few among the parents who regarded it as a great hardship that they should be deprived of the assistance of the earnings of their children during the long probation of their school days. The lecturer, however, stated

that all complaint on the subject had now ceased. The effect of this universal education of the working classes was, in the lecturer's opinion, to be traced in the superiority of the manufactures of the country over those of almost every other nation; and in the increased amount of produce obtained from the soil. The cultivation of the land of Switzerland might be more properly described as horticulture than agriculture, and the slopes and sunny sides of the mountains yielded cereal and other crops which would compare in quantity and quality favourably with those of the most fertile of European States. Dr. Yeats concluded his lecture by an eloquent description of the varied character of the face of the country, and pointed out that this diversity in the natural scenery of Switzerland was in itself a great and valuable aid to progress. Uniformity was, he said, productive of stagnation, but diversity was ever favourable to progress and advancement.

A vote of thanks was unanimously given to the lecturer for his address.

LECTURES ON BOTANY.

A course of fourteen lectures on "Botany, as applied to the Fine Arts and Manufactures," is now in course of delivery at the South Kensington Museum, by Dr. C. Dresser, in the large theatre, on Wednesday afternoons, at 1 o'clock.

These lectures are intended to give a full insight into the science of botany, as well as into its diverse applications to the wants of mankind. The terms of admission to the course are within the reach of all, one shilling being the fee for the fourteen lectures to all engaged in teaching, or studying for that purpose; and 2s. 6d. to others.

The first lecture began with a rapid survey of science in general. The sciences which treat of objects were then separated from those which deal with phenomena; these objects were separated into animate and inanimate; and this was followed by separating, as far as modern science would permit, the vegetable from the other animate kingdoms of nature, or rather, the points which have been thought to separate these two kingdoms were reviewed, and the value of the characters discussed.

A brief examination of the chemistry of plants was given, and the nutritive matters which are of value as articles of diet were pointed out and distinguished from those which alone give heat to the animal system.

An examination of the cell—the ultimate element of all plants—was then conducted; it was received as a perfect and entire plant, capable of isolated existence, and hence of performing all the functions of life. Its varied forms were dealt with, together with its morphological changes into vessels and fibres of diversified kinds. The value of the varied fibres in the arts was considered, and an allusion was made to the fact that the Peruvian mummy cloths were formed of cotton or cellular matter, while the Egyptian were formed of linen or fibrous tissue.

The second lecture was devoted to the root and stem. The value of the root was noticed as an article of diet, and it was shown that as much as 80 per cent. of the succulent edible roots was frequently water.

The forms and habits of the stem were introduced, after the mode of its first formation had been explained, and then its internal structure. The "liber fibres" of the bark were pointed out as being the source of the fibres which are of the most value in commerce.

The third lecture was on the leaf, as the type of all vegetable leaf-like organs; and the fourth on the flower bud, &c.

SUN-SIGNAL FOR TRAVELLERS.

Mr. F. Galton read a paper, at a recent meeting of the Geographical Society, describing an invention of his own, of a sun signal for travellers. This signal, in its simplest construction, consists of a small piece of looking-glass, so arranged that it may be held steadily with one hand, and turned round with the other, the rays of the sun being directed on to the small reflector by an adjustable mirror. Mr. Galton said that the reflection of the sun's rays from a piece of looking-glass no bigger than the thumb nail may be seen at a distance exceeding six miles; and he made a calculation that with reflectors of about an inch the signals might be seen to the distance of 40 miles. With this instrument two travellers might, without much difficulty, communicate with each other at those distances, if one of them was sufficiently elevated. For instance, the direction of a distant explorer being known, the reflection of the sun's rays could be flashed towards him till they fell upon him, and he could then indicate that he had received the signal by a return flash from his instrument. The communication being thus established, a correspondence might take place between them by prearranged signals, somewhat in the manner of Morse's recording telegraph. A simple affirmative or a negative might be readily transmitted by making a single return flash signify the former, and two flashes the latter. A more complicated arrangement of the instrument was also shown by Mr. Galton, in which a telescope was employed, but that departure from the simple arrangement seems to be no advantage, for the principal merit of the instrument would be its portability, and in its original form it might be contained in the waistcoat pocket. In reply to an objection that there would be great difficulty in reflecting the rays in the right direction, so as to fall on the eye of the distant traveller, Mr. Galton said that as the rays would diverge from the reflector in the form of a cone, they would spread over so large a surface that he conceived there would be no difficulty. He had tried the experiment successfully from Hampstead Heath to Stanmore.

PORT WINE TRADE.

The following is from the circular of Messrs. Joseph James Forrester and Sons:—

"It will be recollected that in the years 1846, 1847, and 1848 the annual average production of wines in the 'Feitoria,' or privileged district (in which alone, for nearly a century, port wines exported to Great Britain have been grown), was 107,000 pipes, and that since this district was extended by decree of the 11th of October, 1852, the production, instead of increasing (as it was reasonable to suppose would have been the case, to 130,000 pipes, or even to 140,000 thousand pipes), fell, in in the years 1856 and 1857, to 16,300 pipes. In 1858 the vines appeared to rally, and produced 49,529 pipes; while this year the total registered production in the entire district is only 17,378 pipes, of which only 12,687 pipes were made in the 'Feitoria,' or original demarcation! From these figures, it is evident that the production of port wines in the years 1856 and 1857, and 1859 has not been equal to one-ninth of the quantity produced in the years 1846, 1847, and 1848; and, from observations in the Alto-Douro from the spring to the autumn of the current year, it seems certain that of the port vintage of 1859, not 6,000 pipes will be exportable to Great Britain. With regard to its quality, generally speaking, the grapes were ill grown, and gathered in an unripe state in the middle of September. It is just to some of the proprietors of vineyards in the 'Feitoria' district, however, to declare that, owing to the improved mode of cultivating their vines, and the careful manner in which they now make their wines, there is reason to believe that these proprietors have this year made a few hundreds of pipes of fair good wine, well adapted for exportation to the British market.

"The restrictions on the growth and exportation of port wines not only remain undiminished, but are maintained by armed force in the same manner as they were more than a century ago—with the declared object of

supporting the value of port wines in Great Britain and of preventing the exportation from Oporto of any other wines than those grown in the district especially licensed for that purpose, and of the quality ordained by law.

"The excessive application of sulphur, in the attempts made to eradicate the vine disease, has stimulated the vines to such an extent that they are gradually ceasing to produce fruit. The distress, too, among the vineyard proprietors is so great as to deprive them of the means of properly cultivating their estates; and no attempt has hitherto been made, either on the part of the Government or of the proprietors themselves, to provide a remedy for these united evils, which threaten the destruction of a branch of agriculture and commerce of the greatest importance."

PROSPECTS OF TRADE.

The following, on the closing prospects of the year as regards the produce-markets, is from a circular of Messrs. Joseph Travers and Sons:—

"The history of English trade could not furnish an instance of a more healthy year than that now approaching a close. The extent of business has been larger than on any former occasion, and complaints of dulness, which have occasionally been reiterated, have sprung merely from the smoothness with which everything has gone on, and the absence of feverish excitement. As the produce trade depends entirely on the activity of all the general branches of employment, it has especially benefited by this evenly-diffused prosperity, and there is every sign that in 1860 it will experience a further expansion. Bread has never, for so long a period, been more abundant; and, looking at the foreign supplies that would be certain to reach us on the least advance in price, there can be no expectation of any rise during the winter that would influence the comfort of the population. The effects of the recent strike in the building trade will now be to stimulate work in that line to make up for lost time. From Manchester, Glasgow, Birmingham, Sheffield, Leeds, and all the other principal seats of manufacture, the accounts describe a pressure of orders waiting completion. The home and foreign trades are alike healthy, and the certainty of an undiminished, if not an increased, consumption of articles of food and luxury is therefore established. Whether the disturbed state of the Dutch settlements in the Eastern Archipelago will have any considerable effect in reducing the exportation to Europe of the various products of those islands, or what may be the turn of the Chinese quarrel, are questions on which it would be idle to speculate, except to the extent of recognising that for the present, at all events, they cannot lead to increased growths. On the whole, although any continued improvement in quotations here will proportionably attract new arrivals, there is nothing to lead to an expectation that they will be in any degree beyond the average requirements of the markets, or such as to cause the existing firmness to be succeeded by renewed depression."

LAMBETH SCHOOL OF ART.

Encouraged by the success which has attended the establishment of a School of Art in the very heart of Lambeth, inhabited by artisans engaged in the potteries and building trades, the chairman of the school, the Rev. R. Gregory, of St. Mary's Parsonage, is endeavouring to raise the necessary funds for building suitable premises for the school, which has hitherto been held in the national school at great inconvenience.

With the view of obtaining the assistance of the Committee of Council on Education, Mr. W. Williams, M.P., and Mr. Roupell, M.P., with a deputation, have waited upon Earl Granville, and it is intended to form a committee of well-wishers to Art Instruction to promote the object, as the immediate district of the school is too poor to raise the necessary funds.

Home Correspondence.

THE "GREAT EASTERN."

Sir,—I attended the meeting, on the 14th, with the intention of offering a few remarks on Mr. Hawes' paper, relating to the *Great Eastern*, but from the moment that Mr. Henderson finished to the end of the evening, it seemed to me that there were so many anxious to be heard, and possibly more deeply interested in being heard, that I considered my single voice, as "one naval man against the meeting," likely to prove rather out of tune.

But it was evident to my senses, from the reception Mr. Henderson's remarks met, that the minds of the audience were not prepared to deal with experience against theory —and singly and unsupported, I did not care to reply to observations, on facts and figures, which would require more time to dissect than the brief interval for discussion admitted.

For this reason, therefore, and to prevent misconception by landsmen reporters, I prefer putting my remarks on paper.

In the first place, I am prepared to admit, in the fullest degree, not only the strength of the vessel, but also that a certain velocity, under favourable circumstances, should result. As to her form, it is evident that we must treat her, in every respect, as superior in strength to any of our "tubular structures" for bridges: all her contour lines opposed to wave forces, at and above the water line, being indeed not only segments of circles (or arches), but also well supported internally by spurs and braces, to resist wave forces better than any wooden structure.

I admit also her adaptation for taking the ground better than a keeled vessel, but I retain my own special ideas as to such a mode of construction as would have met the objection to this defect, and rendered her, if ever it should be required, more weatherly.

And lastly, as one of the old disciples of Sir Robert Seppings, as well as of the inventor of the iron diagonal braces of 1819 (then the architect of the India-house), I know that a vessel, even of the older build, could be made to bear her entire weight on her central point of balance. And at a later date we have had full experience, in the Britannia Tubular Bridge, that such iron structures bear their calculated strain when suspended at the extremities and tested with enormous weights on the centre, fully meeting the required parliamentary data.

Now, I consider myself within the category of the "forward" or "go-ahead" class, adopting, during the whole course of my life, that "but few things are impossible," and that "any reasonable proposition can always be carried out," therefore the idea of constructing so large a vessel as the *Great Eastern* presented to my mind nothing difficult to carry out, but, in truth, so far as the structure alone was involved, an operation perfectly feasible.

Some stress, however, has been laid on the selection of the banks of the Thames for her birthplace, as well as on the mode of her construction, &c.

It is free for every man to form his own estimates, and in all my views of stupendous and enormously expensive undertakings, I have rigidly turned my attention to the most economical, if not judicious mode of disbursing the money required for an undertaking—deeming that man the most competent to achieve any great enterprise, deservedly so termed, who brings to great conception the simplest, most effective, and least expensive mode of perfecting the baptism of his bantling; and, taking into consideration the means placed at his command, is willing to make success warrant a proper remuneration, due regard being had to ordinary charges.

Many, doubtless, will demand my meaning, nor will I flinch from giving it full expression.

Fully sensible of the genius of the lamented Mr. Brunel, and admiring his great and comprehensive mind, I am not about to call them in question, nor, indeed, any of

the individuals engaged in carrying out the scheme for the construction of the *Great Eastern*. But originally, and now, I am convinced that I was right; I formed my own conception as to the cheapest mode of construction, avoiding entirely the enormous waste of money in proving merely what engineering skill could be applied in moving the mountain into the Thames.

If I had possessed sufficient influence with my friends, blindly depositing their money in this "venture," I would (as indeed I did) have advised "separate contracts, under certain sectional plans, accurately defining the spaces for each separate piece of machinery; confining the builders solely to the construction of the carcass, and leaving to them the responsibility and entire expense of delivery into the water, according to custom in like cases."

At the earliest communication of this scheme I gave my opinion, that she should have been constructed afloat, or if built on shore, should have been laid in a species of dry dock, by artificial damming, close to the river side, but parallel to it, and calculating on the highest flow of tide floating the flooring. She should have been then moved into the river, and built up to her required height. Now this required height, I think, has been exceeded, and to the increase of top-hamper we are to attribute the deficiency of height demanded for the paddle beam. This top-hamper conduces, in an alarming degree, not only to render more unsafe at anchor in a gale, but must render her more liable to roll deep.

I have since heard from a friend, who communicated to him my view of building afloat, that the late Mr. Stephenson simply observed—"Why, that is just what we did with the tubes for the Britannia-bridge." But here let me ask, as it will bear on my later views of due superintendence, and the interest of the proprietors, was it prudent, after the shell of that vessel had attained to completion, adequate only for launching, to add "one feather more to break the camel's back?"

Leaving the vessel now at her cost of launching, I cannot but advert to the stress laid by landsmen on sundry adaptations, lessening to a certain degree the labour of command for steering, steaming, &c.—all, however, not novel; and I will observe that I delight in seeing every new application of science to meet exigency, and make up for the deficiency of human powers. Still, as a Naval Commander of some little experience, I cannot hear such matters lauded with undue ostentation, without feeling sensitive that we "old salts" of the last war are being unceremoniously shaved, by our "Gentlemen of England, who live at home at ease," with dull razors, and made to feel as if we were shorn of our powers. But more particularly we of the naval school, particularly of the pilot class, or surveyors, who have latterly so brought our discipline to the perfection of silence, or dumb motion, that a look, a gesture, almost the bend of a finger joint conveys our wishes, (and to a perfectly disciplined crew) commands, obeyed too almost as quickly as electricity.

Next, I am strongly of opinion that had the shareholders or first movers of the *Great Eastern* come to a decision to place some practical nautical man as the sole and chief authority over the contracts and fittings of that vessel, to meet her wants only for the sea, an enormous sum of money would have been saved. And I am warranted in coming to such a conclusion by the success, not only of many private ship builders, but also by the perfect ease with which Sir W. Symonds, or at present Sir Baldwin W. Walker, our past and present naval surveyors, control the enormous expenditure of the Royal Navy; and I firmly believe, if each of the individuals named had held still more unlimited power, great saving would have accrued to the country. If such a prime mover, possessing the full confidence of the Company, had guided the fitting of the *Great Eastern*, that vessel, under her original owners, would long ere this have brought home triumphant records of success—subject, however, to the selection of convenient seas for eliciting the powers contemplated, but which I am afraid have been rather overrated.

Fully coinciding in the remarks of my friend Mr. Henderson, as to the size of the *Great Eastern*, and of the propriety of first trying vessels of 5,000 or 10,000 tons, I may be excused, perhaps, in remarking that, although the mental capacity of man expands to works of vast and astonishing size, it has been only by the gradual extension in size and tonnage of our vessels that we have succeeded in bringing human beings (who cannot be fattened up, or expanded like prize beasts) to manage, or, to use our own comprehensive phraseology, "completely man and handle" these huge structures.

I can readily comprehend the inert mind of the landsman forging and putting together, link by link, aided, too, by powerful machinery, the huge chains for securing the *Leviathan*, or for even working the necessary gear of the sails.

But let one of the uninitiated place himself on board even of one of our small frigates coming to an anchor in rough weather at Spithead, and he will then feel how difficult a matter it is to control, with human hands, that small cable, rushing out of the hawse-holes with furious and frequently uncontrollable velocity. Let him then view the cables of the *Great Eastern*, and imagine that vessel under difficulty, such as that of the *Royal Charter*; and, without naval authority and discipline, what would be the fate of the *Great Eastern?*

Stress has been laid on her performance—thanks to the skill of her commander. But had accident—and the control of the helm is void without speed—cast the bow of the *Great Eastern* sufficiently on either side to cause her to "break her sheer" and bring her cable broad on either bow—an accident to which all steamers forced a-head to their cables (and probably that which lost the *Royal Charter*) are very liable, no seamanship can avail, the cable must part, and the vessel can then trust only to steam.

I will now advert to another remark, made by Mr. Henderson respecting the passage and height of the ocean waves, and in doing so I regret to differ with the late Dr. Scoresby, probably an older seaman, but not with more experience in heavy gales of the worst regions, and also having made more practical experiments on the positive rise and fall of the sea on land. I must explain myself very shortly. The instructions of Monsieur Arago to the captain of the *Bonite*, sometime about the year 1835-6, were also furnished to myself as my guide, and I was directed "to follow them in my voyage as far as practicable."

The proof that the sea-wave does not rise above the ordinary level is found by the high water-level on the sea coast, when the wind is along shore, not exceeding that of a calm.

That it does not rise beyond a few feet, is proved by setting the level wire of a theodolite at some floating object in a calm, and observing the same object in a gale, when the change of level at one mile is hardly perceptible.

But the fall also is barely appreciable in vessels of the corvette class, or 600 tons, as I have often anxiously watched, when riding in nearly the ship's own draught without striking.

But at sea, in latitudes where hurricanes prevail, we very often experience "heaped up seas," setting at defiance all the ordinary conceptions of seas, and to the seaman's eye rendering any attempt at diagrams perfectly ludicrous—and these seas prevail between England and America, between the 44th and 50th degrees of latitude.

Mr. Henderson did not speak at random. He was, in the year 1814, a shipmate of mine, in the old *Bellerophon*, 74, on her passage from Newfoundland to England, bearing the flag of Sir Richard Keats. At 6 a.m., one of these boiling "heaped-up seas" becalmed the ship, scudding at the rate of 12 knots, under close-reefed main topsail and foresail, broke over the stern, some 50 feet × 25 (height of tafrail), cut away the port quarter galleries, and swept the main deck fore and aft—clean! At 8 o'clock, when all were at breakfast, another sea boiled upon the starboard beam, at right angles to the direction of the wind and the course of the ship, broke high up the mainmast about

100 feet, overwhelming the ship, staving boats on the booms, cutting away iron stanchions as smoothly as by cold chisel, and giving 6 feet water in the hold! More than 200 miles ahead, at the same moments, two similar seas dismantled H.M.S. *Partridge*, 28 guns! These were both full, buoyant, good sea-boats!

What the fate of the *Great Eastern*, receiving on her capacious decks such volumes of water, would be, I leave others to imagine. I believe her decks to be capable of adequate resistance, but the shock would be terrific, and, under such circumstances, the seaman would naturally inquire whether paddles or steerage remained uninjured.

The questions of capacity, stowage, taking in and delivery of cargo, were simple matters of administration, controllable by the ability of the commander and his staff. Indeed, it would be simple, as I know from experience, to arrange compartments for each individual shipper, as has for centuries, perhaps, been practised in Chinese junks.

The "double skins" do not appear to have been constructed for the object of counterbalancing the consumption of coal, otherwise the compartments would have been fitted expressly for confining the water within bounds, so as to prevent its shifting, and becoming lee ballast!

I am not at all satisfied with the very doubtful comparisons of velocity, and the presumed mean assigned to the *Great Eastern*—particularly as regards the Cunard steamers. I have made passages in two, the *Asia* and *Africa*; I have looked narrowly also into the voyages of the *Persia*, and I observe $11\frac{3}{8}$ given as her speed. Now let us rather take the voyage performed in days and hours—a distance of 3,000 miles, impeded by pilot delays, in 10 days, sometimes less—and we have a velocity of $12\frac{1}{2}$, and for many successive hours at sea, to my knowledge, she performed 14 knots.

Assuming, therefore, the average velocity of the *Persia* at 300 miles per diem, she would cover 12,000 miles, the absolute clear distance to Calcutta, in 40 days—less every objection as to ports, or other difficulties, urged against the *Great Eastern*. But, unfortunately, the *Persia* cannot carry sufficient fuel.

Now, believing fully that the *Great Eastern* may, indeed should, accomplish 14 knots under double expenditure of coal after she attained 13—will such increased velocity, and *probable* break down of machinery compensate for possibly five days less passage if she reached Calcutta? We must throw our land friends overboard, and view the question as seamen.

If misfortune arises, her sails will not avail, and *where* and *how* is she to be refitted? Having for many years held carte-blanche under the Admiralty, and met every difficulty from my own resources, I should have been better pleased to learn that from the very inception of this contract a competent staff of engineers and workmen had been entered for two years as part of her establishment—in fact, a force competent to re-build her if demanded at any out-port in England, and assuredly to meet every requirement at foreign ports. Independent of her own wants, this force abroad might, with adequate forges and tools, execute and receive payment for repairs of immense importance—otherwise demanding either sale at immense sacrifice, or return to England. These are matters clearly within my own province, and where, with my pigmy means, I have rendered effectual assistance. To my view of the mission of the *Great Eastern*, and judging, not from mere theory, but from experience, of the practice of the Americans, 1837 to 1840, in the Pacific, she should present to the world, wherever interest may carry, partially for the conveyance of merchandise, the fact of a small manufacturing kingdom conveying, in well-fitted bazaars, every object to be found in our London shops—with workmen skilled in every important branch of the lighter trades.

In a minor degree I have seen our ships of war passing from the position of mere storehouses, issuing very inferior slops, to the present moment, when every needful supply may be obtained, excellent in quality, and at the lowest prices.

If the *Great Eastern* is to be deemed a mercantile speculation, these matters should not be lost sight of, not merely as regards the wants, amusements, &c., of the voyage, but as affording the means of pursuing useful employment, and reducing the tedium of a monotonous period.

One of the speakers had suggested the port of Trincomalee as adapted for an entrepot. If he has visited the port and knows of the facility at the present moment, either by the visits of vessels, other than Her Majesty's ships, or by lighterage, &c., I will remain silent. But I know the disadvantages as they formerly existed in every shape. I do not believe that any vessel would be allured there, to take or furnish cargo; and therefore to make a port to suit the *Great Eastern*, and to coax vessels there to load and unload, appears to my mind inapplicable, and would destroy *in toto* the less charge of freight.

Mr. Hawes, in conclusion, asserted, "that this ship had one peculiarity, which was not possessed by any other vessel. There was the power of reefing her paddles, so as to suit them to the load-line of the ship."

Now surely Mr. Hawes could not mean this. All paddle steamers have this faculty. In the year 1833, I suggested a self-acting motion for effecting this, at pleasure, but I have not yet understood that any such invention has been applied to the paddles of the *Great Eastern*, and if so, Mr. Hawes should have so worded his statement as to imply "some peculiar adaptation to reefing." But if compelled to reef them now, when unladen, what will be her condition when proceeding to sea.

I now take leave of the subject, hoping that the interests of the shareholders will be more fully carried out than has hitherto been the case, by more attention to necessary outfit to enable her to put to sea, than to the decoration and luxurious fittings calculated to entice passengers. The great object, to prove her utility as well as safety, should occupy undivided attention. After which only will any expense for decoration be reasonable.

I am, &c.,

EDWARD BELCHER.

Proceedings of Institutions.

Barnard Castle Mechanics' Institute.—The twenty-seventh Anniversary of this Institute was held on Thursday, November the 22nd. Geo. Brown, Esq., vice-president, occupied the chair. The Report was read by Mr. Clelland, and states that since the last Report the Committee feel they can congratulate the Institution on a slight increase in the number of members, a considerable increase in the number of books, and a good prospect of a large hall being built. There are 150 members, 21 of whom are working men, paying 5s.; 75 apprentices, paying 3s.; and 53 members paying 8s. a-year; which statement, compared with last year's Report, shows a diminution of 8 working men, a diminution of two 8s. members, and an accession of 13 apprentices. A revision of the Bye-laws has been effected, and a new edition of the Rules, Bye-laws, and supplemental Catalogue printed. During the winter months the following Lectures have been given;—a Lecture and Readings from Nichol and Barham, by Mr. G. Brown; a Lecture on Temperance, by Mr. Guy; a Lecture on Shakespere, by the late Dr. Noble; a Lecture on Photography, by Mr. A. Brown; a Reading of Shakespere's Merchant of Venice, by the Rev. Canon Dugard, M.A.; and a Lecture upon Japan and the Japanese, by the Rev. W. Darwent. With some exceptions these Lectures have been well attended, and the Committee are encouraged to continue the plan of monthly lectures or readings during the winter. The classes have been suspended during the summer months, and, with the exception of the Mutual Improvement Class, have not been resumed. The Mutual Improvement Class recommenced

its meetings on the 2nd Nov., with an increase in the number of its members, there being now 15 on the roll. Since the last Anniversary Meeting great exertions have been made by the Committee to obtain funds for the erection of a large hall on the vacant piece of ground which belongs to the Institute, at the back of the present building, and by co-operating with the Saving's Bank a hall 70ft. 9in. long, 38ft. wide, and 27ft. in height, inside measurement, is contracted to be built by Mr. P. Appleby, and completed by April next, under the direction and supervision of Mr. Bryson, architect.—The Meeting was afterwards addressed by Mr. W. Pinkney, Eggleston; Mr. Winpenny, the Rev. W. Darwent, the Rev. W. O. Aldom, and other gentlemen.

Chelsea Athenæum.—Mr. Horatio E. Norfolk has resigned the office of Hon. Secretary to this Institution.

Hastings Mechanics' Institution.—The first *conversazione*, held under the auspices of this Institution, took place in the Music Hall, on Monday evening, the 7th Nov., and was continued for the two succeeding evenings. A variety of choice works of art, scientific instruments, models, curiosities, and other objects of interest were exhibited. Paintings by Correggio, Berghem, Morland, Lance, &c., were on the walls, and an interesting collection of models contributed by gentlemen connected with the Brighton Railway Company. Various electrical and other experiments were shown, and short papers were read by W. Hunt, G. Linnæus Banks, Esq., of Brighton, and Mr. D. Selway. At the conclusion of the *couversazione*, a report, stating the manner in which the arrangements had been carried out, was read by the Hon. Secretary, Mr. Banks.

Macclesfield Useful Knowledge Society.—The Fourth Anniversary of this Society was held in the Town-hall, on Thursday evening, the 10th ult., and was numerously attended. John Brocklehurst, Esq., M.P., President of the Society, occupied the chair. There were also present E. C. Egerton, Esq., M.P.; Hon. Wilbraham Egerton, M.P.; Rev. J. A. Armstrong; Rev. E. Jones; S. Greg, Esq.; J. Clarke, Esq., Mayor; T. U. Brocklehurst, Esq.; C. Brocklehurst, Esq.; D. B. Curwen, Esq., Hon. Secretary, &c. Letters of apology were received from Lord Harrington and Lord Stanley of Alderley, Lord Egerton of Tatton, &c. The Chairman addressed the meeting, expressing the satisfaction he felt at seeing so large and influential a meeting. He called upon Mr. D. B. Curwen, the Hon. Secretary, who read the Twenty-fourth Annual Report, from which it appears that a variety of untoward circumstances have occurred to prevent the usual development of the Society's usefulness, and it has progressed less during the past year than hitherto. One of the first objects of the Committee's attention after their election was the providing more accommodation for the classes, which, it was stated in the last report, was much needed. With this view they procured designs and plans from Mr. Bland, of Bury, for a new building, which might serve the purposes of extra class rooms and a lecture and concert hall. These drawings were kindly and gratuitously furnished by that gentleman. Mr. Bland's design and plans having been approved by the Committee, he was requested to prepare the necessary specifications, and the Committee proceeded to canvass the town for subscriptions towards this object, and they are glad to be enabled to state that the canvass, though partial, was successful; and that about £600 was promised by those members and friends to whom the appeal was made. The canvass was, however, shortly and unfortunately interrupted, partly by the staple trade of the town being affected through the late war, and partly by the illness of the Society's late Secretary, Mr. Kelly, which deprived the Committee of his active and energetic services, and which ultimately ended in his death in August last. These latter circumstances also prevented the Committee from availing themselves of the kind permission of C. R. B. Legh, Esq. to hold a *fête* in his grounds at Adlington, and also prevented the holding of their intended and hitherto announced bazaar. The *fête* and bazaar, thus postponed, the Committee hope to hold next year; and the Committee also hope that the canvass for further subscriptions towards the intended new class-rooms, and lecture and concert-hall, will be shortly resumed. The Committee deeply regret the loss of the late Secretary, Mr. Kelly, an early member, and one of the first officers of the Society. A subscription has been raised, with the view of providing some memorial of esteem and regard to his memory. The Committee also regret the decease and consequent loss to the Society of several of their earliest members and patrons, and amongst them the late Dr. Swanwick, Wm. Brocklehurst, Esq., and one of the Vice-Presidents, Thomas Ryle Daintry, Esq. In consequence of the illness of Mr. Kelly (before alluded to), none of the pupil members became candidates at the examinations held either by the Society of Arts or at those of the Lancashire and Cheshire Institutional Association, this year; this omission, it is trusted, will be provided against next year. The classes have been numerously and diligently attended, and this, the educational portion of the Institution, has continued in full vigour. The thanks of the Committee are given to the teachers for their assiduous attention to their pupils. The Committee thank E. C. Egerton, Esq., M.P., for his annual donation of £5 5s. for prizes. In consequence of Mr. Kelly's death, Mr. William Jeffrey, one of the oldest members of the Committee, has been appointed Secretary of the Society. The receipts during the past year have been £595 18s. 4d., the expenditure has been £620 8s. 10d., leaving balance due to Treasurer £24 10s. 6d. The adoption of the report was moved by E. C. Egerton, Esq., M.P., who said the duty which devolved upon him of moving this resolution was one which he had had the honour of fulfilling on about six occasions since he had had the honour of being one of their representatives. His worthy friend, and their excellent President, had referred to the report as being rather a lugubrious one. Like many other incidents in human life, the report this year was a chequered one. They had been accustomed at all previous meetings, to hear from that platform most interesting and gratifying reports of the progress of this Society. Now, for the first time, and he hoped he might say the last, they had a report rather upon the adverse side of the question; but from what he knew of the spirit and good feeling of the people of Macclesfield, he felt confident they would not allow that reverse to be more than temporary. He then paid a feeling tribute to the memory of the late Secretary, as well as of the other gentlemen whom the Society had lost by death during the past year. In conclusion he said that he was glad to find that the pleasing duty would devolve upon him of presenting prizes to the female class. He was happy in being able to congratulate the Society upon the prosperity of this comparatively new but highly important department of the Institution. The Macclesfield Mechanics' Institution had his warmest wishes for its continued progress, and he hoped next year he should have the pleasure of congratulating them upon a more encouraging report, and a greater degree of prosperity in the Society's operations.—Mr. T. U. Brocklehurst seconded the resolution.—Mr. Greg moved a vote of thanks to the officers, which was seconded by the Rev. W. B. Arthy. The prizes, which generally consisted of books, were then presented. The meeting was afterwards addressed by the Hon. Wilbraham Egerton, M.P.; the Rev. J. Armstrong, Mr. Joseph Wright, and Mr. Potts, who promised £25 towards the fund for building new class rooms. The Mayor proposed, and Mr. Barker seconded, a vote of thanks to the Chairman, which was unanimously agreed to. A cordial vote of thanks was then passed to the honorary secretary, Mr. Curwen, for his exertions in the cause of the Society. From the teachers' reports of the classes it appears that the grammar class contains 32 members, the average attendance being 21; the mathematical and arithmetical

class contains 94 members, the average attendance being 52; in the reading and writing class the number of pupils is 69, and the average attendance 44; the reading and dictation class has 13 members, the average attendance being 10; in the stenographical class there are 20 pupils, 12 being the average attendance; the number of pupils in the class for the French language and literature is 130, males and females; in the female class, in which it appears that grammar, dictation, and arithmetic are taught, there are 49 members; in the juvenile elementary class the number on the books is 71, and the average attendance is 62. The teachers also mention that the attendance in the class for history and geography has been better than for some years past, and their reports as to the diligence and attention shown by the pupils in all the classes are most favourable.

To Correspondents.

Erratum.—In the last number of the *Journal*, p. 83, col. 1, line 53, for "Muir" read "Mechi."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 16th*, 1859.]

Dated 3rd August, 1859.

1722. T. P. Fay, Liverpool—Imp. in machinery or apparatus for obtaining and applying motive power.

Dated 22nd November, 1859.

2642. P. Marchand, E. Marchand, and J. Marchand, Dunkirk, France—Imp. in refining lamp oil made from oleaginous seed.

Dated 23rd November, 1859.

2650. W. Keates, Liverpool—An improved mode of manufacturing or forming the foundation or body of compound cylinders used for printing or embossing fabrics.

Dated 2nd December, 1859.

2727. W. Betts, Wharf-road, City-road, Middlesex—Imp. in the manufacture of capsules, and in the machinery or apparatus employed therein.
2729. T. F. Bradson, Birmingham—Imp. in door springs.
2733. A. V. Newton, 66, Chancery-lane—Certain imp. in the construction of coiled springs. (A com.)

Dated 3rd December, 1859.

2735. T. R. Russell, Liverpool—The application of a certain metal for the movements of watches and other time keepers.
2737. J. W. Wilson, Buckingham-street, Strand—Imp. in the mode of forming and constructing boxes or cases for postal and other purposes.
2739. H. E. Drayson, Bridge-street, Westminster—Imp. in the mode of extinguishing fires in ships, steam boats, vessels of every description, houses, warehouses, stores, or other buildings of whatever kind, and in the machinery connected therewith.
2741. R. Bond and W. Hayhurst, Burnley, Lancashire—Improved machinery or apparatus to be employed in the manufacture of a certain description of "temples" used in power looms for weaving.
2743. N. Clayton and J. Shuttleworth, Lincoln—Imp. in steam boiler safety valves.
2745. E. A. Curley, Richmond-street, Saint George's-road, Southwark—Improved mechanical arrangements or contrivances for measuring, registering, and regulating the flow of liquids, and likewise for measuring and regulating the passage of fluids and vapours.

Dated 5th December, 1859.

2747. E. Kelly, Erdington, near Birmingham—An improved washstand, part of which is also applicable for other useful purposes.
2749. J. Benn, Tiffield, Northamptonshire—Imp. in drills.
2751. C. Short, Westwood, T. B. Smecton, Underwood, Nottinghamshire, and W. Bowler, Butterley-park, Derbyshire—The manufacture of bricks, tiles, drain pipes, or other articles from cinder or refuse slag.
2753. A. Lancaster, Kensington, Middlesex—Imp. in breech-loading fire-arms, in projectiles, and in apparatus for charging cartridges for breech loading and other arms.
2755. E. A. L. Negretti and J. W. Zambra, Hatton-garden—Imp. in stereoscopes.

Dated 6th December, 1859.

2757. F. Coignet, 33, Boulevard St. Martin, Paris—Imp. in the manufacture of beton or composition applicable for purposes of covering, building, and construction, and for various uses as artificial stone.
2759. J. Shaw, Manchester—Imp. in the insulation and laying down conducting wires for the transmission of telegrams or telegraphic messages.
2761. E. A. Wood, Victoria-terrace, Notting-hill, West, Middlesex—Certain imp. in anchors.
2763. A. Turner, Leicester—Imp. in the manufacture of elastic fabrics.

PATENTS SEALED.

[*From Gazette, December 20th*, 1859.]

December 17th.

1461. D. Deas.
1469. A. Jeffrey.
1471. R. Harper, R. Stokes, and T. Walker.
1475. P. F. Aerts.
1481. C. L. J. Dierickx.
1495. W. C. Fuller.
1533. G. Wrigley and T. H. Wrigley.
1593. J. McIntosh.
1747. E. Hunt and H. D. Pochin.
2181. W. Airey and J. Clayton.

December 20th.

1479. J. Cox, S. Frankham, and Moses Frankham.
1485. W. Rowan.
1489. E. Gwyn.
1492. J. Meikle.
1496. E. Oliver.
1499. A. Barclay.
1606. J. Apperly and W. Glissold
1510. A. J. Dessales.
1512. G. C. Grimes.
1516. W. Lister, jun., and T. G. Garrick.
1522. P. Faure and J. Pernod.
1524. T. Howard.
1528. J. Roberts.
1537. T. Leigh and J. Line.
1542. J. Nash.
1546. T. Wight.
1562. J. A. Wilkinson.
1577. M. Bogg.
1604. C. Hagan.
1617. W. Robinson.
1629. W. H. Harfield.
1631. J. Taylor.
1636. M. Henry.
1653. C. J. Proal.
1678. W. O. Carter.
1681. J. Bernard.
1683. C. Pottinger.
1695. W. H. Harfield.
1712. G. Welch.
1726. W. H. Harfield.
2176. R. Kay.
2214. E. Sonneborn.
2392. C. Seton.
2439. E. Ellis.
2477. J. A. Turner.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, December 16th*, 1859.]

December 12th.

2968. G. Littlewood.
3015. T. White.

December 13th.

2974. A. V. Newton.
2990. F. Levick, jun., and J. James.

December 14th.

2976. C. F. Vasserot.
3084. I. Atkin and M. Miller.

[*From Gazette, December 20th*, 1859.]

December 16th.

2993. G. M. P. Swift, Viscount Carlingford.
2995. F. B. Howell.

December 17th.

3002. C. Fay.
3003. J. Brown.
3065. W. Irlam.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, December 16th*, 1859.]

December 14th.

1070. C. Dresser.

[*From Gazette, December 20th*, 1859.]

December 16th.

1094. A. Krupp.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name	Address.
4,219	Dec. 1st.	Perforated Iron or Steel Plates for Mashing Cooked Bulbous Roots	James Fairley	Stechford, Worcestershire.
4,220	„ 6th.	Rotating Harrow	John Seton	Forest-lodge, Gowran, Co., Kilkenny.
4,221	„ 20th.	A Self-acting Draught Preventer, to be affixed to doors or windows	Isaac Atkins and Arthur Maxfield	Nottingham.

Journal of the Society of Arts.

FRIDAY, DECEMBER 30, 1859.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded immediately to the Secretary of the Society of Arts.

COMMITTEES.

The following Committees of the Society have resumed their Meetings for the Session :—

The Artistic Copyright Committee.
The Uniform Musical Pitch Committee.
The Colonial Committee.
The Small Parcels Post Committee

ON RENDERING FABRICS NON-INFLAMMABLE.

By Fred. Versmann, F.C.S., and Alphons Oppenhein, Ph. D., A.C.S.

In their introductory remarks the authors say, that during the last winter some of the leading journals of London contained letters commenting upon the number of accidents which were almost daily happening, from the fact of light dresses and curtains catching fire, and earnestly calling for expedients to prevent occurrences which had but too often assumed a most dangerous character. Her Majesty, in like manner, desired the Master of the Mint to report to her on this important subject, and Professor Graham was kind enough to entrust the investigation to the authors of the present paper. The number of salts over which their investigations have extended will secure the manufacturer against adopting to-day a process likely to be superseded on the morrow, and there is no fear that the process recommended will injure either the colour or the strength of the fabrics operated upon.

All endeavours permanently to fix in cotton or linen anti-flammable expedients have hitherto proved unavailing, inasmuch as substances thus prepared are found to suffer materially; and the large quantity of oxides required for this purpose leave but little hope that the result will ever be obtained, save at the expense of the fabrics. The processes recommended need not, however, be confined to these latter; for, among other inflammable goods, paper may be instanced as one deserving in this particular great consideration.

Every attempt to impart to organic substances the property of resisting wholly the influence of fire must ever remain unsuccessful, on account of its ignoring an inherent quality of organic nature, viz., liability to decomposition by heat. But as soon as this decomposition remains confined to that point of a substance where it is in immediate contact with the flame, so that it is impossible for the latter to spread, as soon as the substance itself is non-inflammable, all danger of a conflagration ceases.

The following is the substance of a paper read before the British Association, at Aberdeen, the 15th September, 1859.

The difference between the chemical constitution of the animal and the vegetable fibre, the first containing about eighteen per cent. of nitrogen, whereas the latter consists exclusively of carbon, hydrogen, and oxygen, is of the greatest practical importance. The animal fibre, although subject to the destructive influence of heat, chars when in contact with a flame, but is not itself inflammable, because the gaseous products of its decomposition contain an amount of carbonate of ammonia sufficient to rarefy the inflammable hydro-carbons, so as to prevent them from burning. The vegetable fibre, however, if decomposed by heat, evolves gaseous hydro-carbons, mixed with oxide of carbon and little carbonic acid only, and communicates ignition by burning with a flame.

Wherever it has been possible to dispense with the vegetable fibre in arts and manufactures, it has been substituted by less dangerous materials—wood being frequently replaced by iron, stone, or brick, and paper by parchment.

But the use of cotton and linen is ever on the increase, and will most likely never give place to more solid substances. So great a number of conflagrations, and so considerable a loss of life originate yearly from the use of these inflammable substances, that the authors feel justified in attempting to direct the attention of the Association to the following questions :—

What means may be applied for the rendering of these substances non-inflammable? What is the comparative value of these means? and why have none of the means hitherto recommended been introduced into public use?

Nitrogen being, as it were, the safeguard, protecting the animal fibre against fire, the first idea offering must be to introduce nitrogen into the vegetable fibre, in the shape of a soluble animal substance, such as glue or albumen. But these do not contain more nitrogen than hair or wool, or the animal substances from which glue is made, and it is easily to be anticipated that a very considerable quantity would be required to render the vegetable fibre non-inflammable, by which its pliability would be lost. Experiments made by the authors with that view, demonstrated that neither albumen nor the most concentrated solution of isinglass can produce that effect.

In order to learn, however, whether eighteen per cent. of nitrogen were really required to protect a thin vegetable fibre, the authors applied to a piece of fine muslin a solution of the organic substance, richer in nitrogen than any other —viz., urea. By introducing not less than 28 parts of urea into 100 parts of muslin, they protected the latter from burning with a flame. 28 parts of urea correspond to 13 parts of nitrogen, or the muslin, when rendered non-inflammable, contained 10·2 per cent. of nitrogen. Although this quantity is smaller than might have been expected, still, for all practical purposes, the authors sought for an expedient amongst the inorganic salts, on account of their comparative cheapness, and all expedients hitherto proposed pertain to this class of substances.

In collecting the information on the subject, it was found that, as early as 1735, a patent "for preventing combustible substances from flaming,'" was granted to one Obadiah Wild, who applied a mixture of alum, borax, and vitriol either in solution or by mixing it with the pulp before it was made into paper.

This is most likely the process to which De Hemptine, a Belgian chemist, refers, in an essay, which appears to be the first extensive investigation of the subject in question, and which was published in the "Annales de l'Industrie," in 1821. He observes, that "the English use a kind of non-inflammable paper in the manufacture of cartridges for their navy."

The attention of many chemists of that period was ap-

parently directed towards this subject, for De Hemptine mentions three compositions, proposed with the same view in other countries—viz., silicate of potash, by Brognatelli; sulphate of iron, by Hermbstaedt; and a substance of unknown composition by Delisle.

De Hemptine mentions a great number of substances proposed by himself and others, for rendering canvas and wood non-inflammable, although he himself denies that they are applicable to wood, without offering, however, any reason. He does not sufficiently sift these different expedients, and amongst them are found a number of salts quite useless for the purpose.

In the same year, a paper by Gay-Lussac, on the same subject, appeared in the "Annales de Chimie et Physique," tome 18, succeeded by a paper by Prater, in the "Phil. Transactions, 1839," on the use of the carbonates of potash and soda; a recommendation of the water-glass, by Fuchs at Munich; a notice on the use of a precipitate of sulphate of lime in the "Mittheillungen des Gewerbe Vereins für Hannover, 1841;" a paper by Dr. R. A. Smith, in the *Phil. Magazine*, Ser. III., vol. 34; a number of notices of less import; and a large number of patents taken out for different mixtures in different years.

Gay-Lussac's dissertation on the subject is the only one which discusses the respective amount of different salts required for rendering a certain fabric non-inflammable.

He took solutions containing 25 grammes of anhydrous salt in 250 cub. centimètres, for two series of experiments, with pieces of linen weighing three grammes each.

In the first series he introduced into the pieces of linen always three c. c. of the solution, or ten per cent. by weight of the anhydrous salt. Finding no salt to answer in this proportion, he made a second series of experiments, with double the quantity of salts in solution. He then found that linen may be rendered non-inflammable by taking up 20 per cent. of either of the following salts; viz.—

Chloride of ammonium, sulphate, phosphate, borate of ammonia, and borax, or by mixtures of any two of these salts. He likewise tried solutions of the tartrates of potash and soda, and of cloride of sodium, but without obtaining a favourable result.

Now, the small number of salts tested by Gay-Lussac, as well as the limit whereby he confines his experiments to two proportions only, prevents him from forming conclusions sufficiently general respecting the action of all salts suitable for the purpose. It likewise appears that he confined his experiments to the laboratory, and he was therefore unable to forsee the difficulties arising in the practical application of some of the salts.

Reserving some remarks on other investigations of later chemists before entering more at large upon the salts recommended by them, the authors proceed to describe the method by which they compared the value of forty different salts soluble in water. The experiments include the salts hitherto proposed; certain others, the application of which the authors were the first to try; others, again, worth investigating on account of their chemical analogies only.

Instead of comparing the quantities of different salts which must be taken up by a certain fabric, the authors tried to simplify the investigation by determining how strong a solution of different salts is required for their purpose. They thus found that the differences which various salts exhibit in this particular, are more marked than the differences in the increase of weight of fabrics immersed in various solutions, but they also found that both these differences were constant, provided care was taken to remove the excess of liquid by squeezing, but without twisting, the muslin, till no drop of the liquid remained clinging to the fabric.

The muslin used was free from starch and other stiffening agents; twelve inches square weighed 33·4 grains; the degree of non-inflammability was such that the muslin was destroyed only in that part which was in immediate contact with the flame.

The failure to which this method is liable does not exceed two per cent.; and, although far from being entitled to claim absolute exactitude, it is sufficient for practical purposes, and for the explanation of the action of various salts.

Those salts which proved to be preferable on account of the small amount required, or by reason of their properties, were afterwards tested on a large scale, either in the finishing works of muslin manufacturers, or in laundries. The processes resorted to by finishers and by laundresses differ principally in this: that in the manufacturing process the muslin is finished without the application of heat, whereas in laundries the ironing with hot irons cannot be dispensed with.

We may here premise, that this circumstance explains why none of the salts hitherto recommended have found favour with the public, none of them allowing the iron to pass smoothly over the fabric, and some even destroying it under the influence of the heat of the iron.

Before proceeding with their observations, the authors felt bound to express their acknowledgments for the kind and truly liberal assistance which they received from W. Crum, Esq., of Thornliebank, Glasgow, and from Alexander Cochran, Esq., of the Kirton Bleaching Works, Glasgow, as well as for the favour which enabled them to make a large number of experiments in Her Majesty's Laundry at Richmond.

The chlorides of potassium and of sodium proving to be decidedly ineffective, even when applied in concentrated solutions (although De Hemptine repeats an assertion of M. Hassenfratz to the contrary), the carbonates of potash and soda must be considered to be the cheapest salts hitherto recommended. They have been proposed by Horatio Prater ("Phil. Mag. 1839," vol. 14), and by B. Cook ("London Journal of Arts and Manufactures," vol. 5, Ser. 1).

Solutions containing only ten per cent. of anhydrous carbonates are quite effective. Both salts, however, cannot be practically applied, because the carbonate of potash is deliquescent, and the carbonate of soda is highly efflorescent, and thereby converted into dust, which does not adhere, and injures the transparency of the fabric. If we try to explain the action of these salts, three reasons offer: The reason given by Prater, who attributes their protecting power to the carbonic acid, which, according to Gay-Lussac and Thenard, leaves the alkali at red heat under the influence of water gas. This explanation is proved to be correct by the inflated appearance of the cinder remaining. Another reason is contended for by De Hemptine, who thinks that it is the water gas as well which prevents ignition, by leaving the crystals at high temperature. Against this theory must be quoted other salts, which, like the phosphate of soda, are almost useless, although they contain a much larger amount of water. A third theory, which we beg to suggest is, that the carbonate of soda acts by firmly enveloping the fabric in a fused state, and that the carbonate of potash, which does not become liquid at a temperature when muslin would begin to burn, surrounds the fibre in its solid state, so as to prevent the contact with the air. This theory is supported by the fact that other substances, which do not give off gases, and are fusible at a high temperature only, can protect the fibre.

The paper then proceeds to give an account of the action of various salts, in effecting the desired object. The results of these observations are, however, given in a condensed form in Table I.

With regard to sulphate of ammonia, the cheapest salt of ammonia, the authors say, a solution containing seven per cent. of the crystals, or 6·2 per cent. of anhydrous salt, is a perfect anti-flammable. In 1839, the Bavarian embassy at Paris caused M. Chevalier to make experiments before them with a mixture of borax and sulphate of ammonia, as recommended by Chevalier, in preference to the sulphate alone (Bair. Kunst und Gewerbe Blatt, 1839). He thought the sulphate would lose part of its ammonia, and thereby give rise to the action of sulphuric acid upon the fabric. This opinion seems to be confirmed by the fact that a solution of sulphate of ammonia

gives off ammonia, as observed by Dr. R. A. Smith in his paper on substances which prevent fabrics from flaring; but on the other hand, this may be easily counteracted by adding a little carbonate of ammonia, and besides, the solid salt remains perfectly undecomposed. The authors say that they now have kept for six months whole pieces of muslin prepared in various ways with this salt, some having been even ironed; but cannot find that the texture was in the least degree weakened. Chevalier's mixture, on the contrary, became injurious to the fabric, not only at temperatures above 212°, but even at summer heat; and this can easily be explained, because he did not actually apply sulphate of ammonia and borax, but biborate of ammonia and sulphate of soda.

Another drawback of Chevalier's mixture is the roughness which it gives to the fabric, and which could only be overcome by calendering the pieces, while sulphate of ammonia by itself has not this effect.

The use of this salt must therefore be strongly recommended.

Every inorganic salt, if applied in solution to fabrics, diminishes their inflammability by absorbing heat and excluding the free access of the air. Even those salts, which, like saltpetre, give off oxygen and assist ignition, prevent fibrous substances from flaming, and even those salts, which, like chloride of sodium, proved not to protect the fibre, would most likely do so, if solutions concentrated enough could be obtained. More active than other salts are those which are easily fusible, such as borax; or partially or entirely volatile, such as certain ammoniacal salts, or those which, owing to their peculiar physical constitution, prevent the access of the air, such as the tungstate of soda. Of all the salts experimented upon, only four appear to be applicable for light fabrics.

These salts are the

1. Phosphate of Ammonia.
2. The mixture of Phosphate of Ammonia and Chloride of Ammonium.
3. Sulphate of Ammonia.
4. Tungstate of Soda.

The Sulphate of Ammonia is by far the cheapest and the most efficacious salt, and it was therefore tried on a large scale. Whole pieces of muslin (8 to 16 yards long) were finished, and then dipped into a solution containing 10 per cent. of the salt, and dried in the hydro-extractor. This was done with printed muslins, as well as with white ones, and none of the colour gave way, with the sole exception of madder purple, which became pale. But even this change might be avoided, if care be taken not to expose the piece while wet to a higher than ordinary temperature. Most of these experiments were made at the works of Mr. Crum and of Mr. Cochran. The pieces had a good finish, and some of them were afterwards submitted to Her Majesty for inspection, who was pleased to express her satisfaction.

Mr. Crum, who prepared some dresses with phosphate and some with sulphate of ammonia, arrives at the result, that, with the phosphate, the finish is chalky, and not transparent enough, whereas the finish with the sulphate is successful.

Other pieces, prepared with the sulphate, were exhibited in the Exhibition of Inventions of the Society of Arts, and at the Conversazione of the Pharmaceutical Society, in July last. During the space of six months none of the fabrics prepared with sulphate of ammonia have changed either in colour or in texture; it may therefore be considered an established fact that the sulphate of ammonia may be most advantagously applied in the finishing of muslins and similarhighly inflammable fabrics.

The authors felt, however, the necessity of inquiring further into the effect which ironing would have upon fabrics thus prepared; for all the above-mentioned salts, being soluble in water, require to be renewed after the prepared fabrics have been washed.

Now, the sulphate of ammonia does not interfere with the ironing so much as other salts do, because a comparatively small portion is required; but still, the difficulty is unpleasant, and sometimes a prepared piece, after being ironed, showed brown spots like iron-moulds. On covering the iron with plates of zinc or brass, these spots did not appear; but the difficulty still existed, and a white precipitate covering the plate, showed evidently that it is the volatile nature of the salt which interferes with the process. An attempt to counteract this action of the salt, by adding wax and similar substances to the starch, remained also without any result.

For all laundry purposes, the Tungstate of Soda only can be recommended. This salt offers only one difficulty, viz., the formation of a bitungstate, of little solubility, which crytallizes from the solution. To obtain a constant solution, this inconvenience must be surmounted; and it was found that not only phosphoric acid, in very small proportion, keeps the solution in its original state, but that a small percentage of phosphate of soda has the same effect.

The best way of preparing a solution of minimum strength is as follows:—A concentrated neutral solution of tungstate of soda is diluted with water to 28° Twaddle, and then mixed with 3 per cent. of phosphate of soda. This solution was found to keep and to answer well; it has been introduced into Her Majesty's laundry, where it is constantly being used.

The effects of the soluble salts having been thus compared, a few remarks are necessary respecting the means which may be adopted permanently to fix anti-flammable expedients, so that the substances prepared may be wetted without losing the property of being non-inflammable. This aim has been kept in view by a writer in the "Mittheilungen des Gewerbe Vereins für Hannover, 1843," who tried to fix sulphate of lime in the fibrous fabric without success, and also by Mr. Morin, who tried to fix oxide of zinc by glue and by tannic acid, but without success. (Journal für praktische Chemie, vol. 24, page 281). The author tried equally unsuccessfully to fix sulphate of baryta, phosphate of alumina, and some of the silicates of alkaline earths and of earths, by precipitating them by double decomposition in the fibre; they all, however, wash out, and none of them acts as a perfect anti-flammable.

Relying upon the property of alumina as a mordant, we tried the combination of oxide of zinc and alumina, obtained by mixing solutions of oxide of zinc in ammonia and of alumina in caustic soda; but although this precipitate protects the fibre, it does not adhere to it when washed.

The oxychloride of antimony, obtained by precipitation from an acid solution of chloride of antimony by water mixed with only a little ammonia, is a good anti-flammable, and it withstands the action of water, but not that of soap and soda. It was not found that the solution of this and other salts in muriatic acid injured the texture of the fabric, as long as this was dried at an ordinary temperature.

The borate and phosphate of protoxide of tin act effectually, if precipitated in the fibre from concentrated solutions of these salts in muriatic acid by ammonia; they withstand the influence of washing, but give a yellow tinge to the fabrics.

The same remarks apply to arseniate of tin. The stannates of lime and zinc protect the fabric, but do not withstand the action of soap or soda.

The oxides of tin give a favourable result, inasmuch as they really can be permanently fixed; the yellow tinge, however, which they impart to the fabrics will always confine their application to coarse substances, such as canvass, sail-cloth, or ropes. The binoxide does not act so well as the protoxide, it may be, because it cannot be applied in a sufficiently strong state, the bichloride of tin being too acid, at least when containing nitric acid, and the stannate of soda not yielding the amount of binoxide required, for a large quantity of oxide of tin is necessary. The best way to prepare sail-cloth permanently non-inflammable is as follows:—The canvass is first soaked

TABLE I.

Showing the smallest percentage of Salts required in Solution, for rendering Muslin Non-Inflammable; A, of Crystallized; B, of Anhydrous Salts. Twelve square inches of the Muslin employed weighed 33·4 grains.

Name of Salts.	Formula of Salts.	A.	B.	Remarks.
Caustic Soda	NaO, HO	8	6·2	Injurious to the fabrics.
Carbonate of Soda	$NaOCO_2, 10\ HO$	27	10	
Carbonate of Potash	$KO\ CO_2, 2\ HO$	12·6	10	
Bicarbonate of Soda	$Na\ O\ 2\ CO_2, HO$	6	5·4	Not sufficiently efficacious; too volatile.
Borax	$Na\ O\ 2\ BO_3, 10\ HO$	25	13·2	Destroys the fabrics above 212° Fahr.
Silicate of Soda	$2\ Na\ O\ 3\ SiO_3$		15·5	Injures the appearance of the fabrics.
Phosphate of Soda	$2\ NaOHO\ PO_5, 24\ HO$	80	32	Not sufficiently efficacious.
Sulphate of Soda	$NaOSO_3, 10\ HO$			A concentrated 72 p. c. solution is insufficient.
Bisulphate of Soda	$NaO\ 2\ SO_3, HO$	20	18·5	Destroys the fabrics.
Sulphite of Soda	$Na\ OSO_2, 10\ HO$	25	10·3	
Tungstate of Soda	$NaOWO_3, 2\ HO$	20	16	*Recommended on account of its being the only salt not interfering with the ironing of the fabrics.*
Stannate of Soda	$NaOSnO_2, 3\ HO$	20	15·9	Injurious.
Chloride of Sodium	$Na\ Cl.$			Concentrated solutions are insufficient.
Chloride of Potassium	$K\ Cl.$			
Cyanide of Potassium	$K\ Cy$		10	Poisonous.
Sesquicarbonate of Ammonia	$2\ NH_4\ O\ 3\ CO_2, 3\ HO$			Not available.
Oxalate of Ammonia	$2\ NH_4\ OC_4O_6, 2\ HO$			
Biborate of Ammonia	$NH_4O, 2\ BO_3, 4\ HO$	5	3·6	Destroys the fabrics above 212°.
Phosphate of Ammonia	$2\ NH_4\ O\ HO\ PO_5$		10	Efficient but expensive.
Phosph. of Ammonia and Soda	$NaO\ NH_4O\ HO\ PO_5, 8\ HO$	15	9·8	Expensive and scarcely sufficiently efficacious.
Sulphate of Ammonia	$NH_4\ O\ SO_3, HO$	7	6·2	*Very efficient, and recommended on account of its low price.*
Sulphite of Ammonia	$NH_4\ O\ SO_2, HO$	10	9	Deliquescent.
Chloride of Ammonium	$NH_4\ Cl$		25	Not sufficiently efficacious.
Iodide of Ammonium	$NH_4\ I$		5	Too expensive.
Bromide of Ammonium	$NH_4\ Br.$		5	
Urea	$C_2\ H_4\ N_2\ O_2$		40	
Thouret's Mixture	$\{3\ (NH_4\ Cl.)\ 2\ (NH_4\ OHO, PO_5)\}$		12	Efficient, but expensive.
Chloride of Barium	$Ba\ Cl.$		50	Not sufficiently efficacious.
Chloride of Calcium	$Ca\ Cl, 6\ HO$	19·7	10	Deliquescent.
Sulphate of Magnesia	$MgOSO_3, 7\ HO$	50	24·3	Not sufficiently efficacious.
Sulphate of Alumina	$Al_2O_3\ 3\ SO_3, 18\ HO$	15	7·7	Destroys the fabric.
Potash—Alum	$KOSO_3\ Al_2\ O_3\ 3\ SO_3, 24\ HO$	33	18	Not efficacious enough, and destroys the fabric.
Ammonia—Alum	$NH_4OSO_3\ Al_2\ O_3\ 3\ SO_3, 24\ HO$	25	13	
Sulphate of Iron	$FeOSO_3, 7\ HO$	54	28·8	Not sufficiently efficacious.
Sulphate of Copper	$Cu\ OSO_3, 7\ HO$	18	10	Poisonous.
Sulphate of Zinc	$Zn\ OSO_3, 7\ HO$	20	11·2	
Chloride of Zinc	$Zn\ Cl, HO$	8	5·8	Deliquescent.
Protochloride of Tin	$Sn\ Cl, HO$	5	4.6	Deliquescent.
Protochloride of Tin and Ammonium	$Sn\ Cl\ NH_4Cl\ HO$	5	4·7	Becomes yellow, when exposed to the air.
Pinksalt	$Sn\ Cl_2\ NH_4\ Cl.$		7	Injures the fabric.

for two days in a solution of protochloride of tin containing two parts of crystallized salt in one part of water, and afterwards left for one day in a concentrated solution of either stannate of soda or carbonate of soda. On making use of the latter salt, the formation of anhydrous protoxide of tin was sometimes observed; and this was always found to be the case when solutions of protochloride of tin and carbonate of soda, quite concentrated, although cold, were mixed, so that the soda was in excess. The formation of the black anhydrous protoxide sometimes occupied twelve hours' time. It could be converted into the ordinary hydrate, by boiling it with protocloride of tin, and its formation could be prevented by agitating the canvas in the solution of soda.

The canvas thus prepared must be dried and then washed, to remove the excess of precipitate. Salt-water does not remove the tin from the canvas.

A few yards of sail-cloth thus prepared have been exhibited in the Society of Arts exhibition of inventions.

A piece about 40 yards in length has been prepared by order of the storekeeper-general of the Royal Navy; but it was found to have lost in strength, and increased in weight too much, to allow of its application.

These experiments, however, being the first successful attempts permanently to fix some anti-flammable agents, may have some interest, although they leave but little hope that the result of fixing anti-flammable expedients will ever be obtained without injuring the fabrics.

In concluding their investigation, the authors trust that they may have succeeded, as far as possible, in answering the questions raised by them in the beginning of the paper.

By determining the comparative value, and ascertaining the difficulties which have prevented, till now, the general use of protecting agents, the authors were led to exclude a number of salts hitherto proposed, and to advocate the adoption of sulphate of ammonia, and of tungstate of soda, in manufactories of light fabrics, and in laundries.

They hope, therefore, that the general introduction of these salts will soon greatly reduce danger and loss of life through fire.

TABLE II.

Showing the increase in weight of Muslin prepared with various anti-flammable expedients.

Muslin (not starched) prepared with a solution of	Increased in weight about
7 per cent. of Sulphate of Ammonia	18 per cent.
10 per cent. of Tungstate of Soda .	27 per cent.
12 per cent. of Thouret's compound .	24 per cent.

In the manufacturing process the weight increases at a somewhat higher rate; a piece of starched Tarlatan, weighing about 8½ oz., took up about 2 oz. of Sulphate of Ammonia from a 10 per cent. solution.

The authors have received a certificate from Messrs. Cochran and Dewar, of the Kirkton Bleach Works, Neilston, who bear witness to the perfect success of the process for rendering muslins non-inflammable, by the application of sulphate of ammonia. They have finished many pieces of the finest muslins by this process, and the texture of the cloth is in no way injured; while neither colour nor the elasticity is ma-terially changed.

The manager of the Queen's laundry expresses entire satisfaction with the action of the solution (namely, of tungsate of soda) for rendering light fabrics, such as curtains, muslin dresses, &c., non-inflammable. After having tested various salts and solutions intended for the purpose, this is the only one found to be neither injurious to the texture or colour, nor in any degree difficult of application in the washing process. The iron passes over the material quite smoothly, as if no solution had been employed. The solution increases the stiffness of the fabric; and its protecting power against fire is perfect. The writer says that many specimens have been submitted to Her Majesty, who was highly pleased with them, and has commanded that the solution be used in the laundry for everything liable to danger from fire.

THE SOAP-BARK OF SOUTH AMERICA.

By Professor S. Bleekrode (Delft, Holland).

Several months ago, a peculiar bark was introduced into the European trade, and recommended to be employed instead of soap, for washing and cleaning printed goods, woollens, and silks, and especially for the delicate colours of ladies' dresses, etc.

This soap-bark is externally black coloured, but internally the liber consists of concentric layers of yellowish white. The bark is remarkable for its density, as it sinks in water. The cause of this is the great quantity of mineral substances in its ashes, there being 13·935 per cent. of the internal parts, dried at low temperature, and 18·50 per cent. when dried at 100° C. The ashes consist largely of carbonate of lime, which forms 2·60 per cent. of the 13·935, and appears as small crystalline needles, isolated or in groups, in the cells of the liber, not only between its concentric rings, but in every part of it. They glitter in the sun, resembling, under the microscope, the arragonite form of the crystallised carbonate of lime.

Relative to the great amount of lime, it may be remarked that this mineral is generally characteristic of plants, in which mucilaginous or pectinic substances are found abundantly. So the grains of the quince (*cydonia*) contain 10 per cent. of carbonate of lime, and are remarkable by their large quantity of jelly.

When the internal white layers of the bark are soaked and macerated in water, at the ordinary temperature, a clear solution, without any alkaline or acid reaction, is soon formed; it becomes slightly turbid by the action of the air. When shaken a heavy scum is produced. The bark loses nearly 20 or 25 per cent. in the winter. I have prepared an extract from seven grammes in half a litre of water, and one part of it was sufficient to make, with sixty-eight times its weight of of olive oil, a perfect cream-like emulsion, and this emul sion does not become separated, even after several months. By mixing equal volumes of the bark extract and of oil, the same emulsion is formed without change of volume, but in a short time the emulsion, changed into a thick, pure, white, cream-like substance, swims upon the clear water. There is, however, no separation of the constituents of the oil, as is the case by the reaction of alkaline substances. Alcohol does separate the emulsion, the oil is restored, and a white granular substance subsides.

The extract mentioned has the property of reducing gold from its chloride; the glass employed for the experiment will be beautifully gilded; the reduction is much accelerated by the influence of the direct rays of the sun. The same power of reduction is shown by mixing the extract with the alkaline copper solution, as prepared by Fahling for the quantitative sugar experiment; the reduction into the red oxyde of copper immediately follows on the application of heat. That this reduction is not produced by the presence of a sugar-like substance, or glucose, is demonstrated by the experiment of Boettger, with the basic nitrate of bismuth; when boiled with the extract of the bark it remains white, which does not happen when there is glucose present in the smallest quantity. The solution of mineral chameleon is immediately changed from green to light yellow.

I have observed that the mucilaginous extracts made with water at a low temperature, by macerating the roots of the marshmallow (*rad. altheae*), of the comfrey (*symphytum*), and of the grains of the quince, have not the same influence on chloride of gold. The extracts of the roots precipitate the gold, under the form of purple of Cassius, only at a boiling temperature; the mucilage of the grains of quince, however, likewise at ordinary temperatures, produces a precipitate having the lustre of metallic gold. The reduction of the copper, as mentioned, will not happen. These mucilages have likewise the property of forming emulsions, but weaker, and not so lasting.

The extract of the soap-bark is coloured a reddish brown by nitrate of silver, and ammonia forms a precipitate. When a proper proportion of nitrate of silver with ammonia is prepared, a silver lustre, like that of the silvering of glass, will be produced by heat.

Concentrated sulphuric and nitric acids give, by boiling, a sediment in the form of white flocks; the white flocks produced by the reaction of sulphuric acid are coloured brown by iodine.

The experiments with different chemical agents have not produced any characteristic result. The extract is not coagulated by boiling, nor precipitated by alcohol and ether. The cold prepared extract can be employed for washing, and deserves the name of "Vegetable Soap."

Indeed, long before the invention of our alkaline soaps, and even up to the present day, several roots and fruits were known by their capability of being employed as soap, and botanists have distinguished them by the name of *Saponaria* in the system of classification. Pliny gave a description of the *Struthion*—our Shrubby Gypsophila (*Gypsophila Struthion, L.*) "It is astonishing," he says, "how woollens are bleached, and made supple by it" (*Radicula lavandis lanis succum habet mirum quantum conferens candori mollitieique. L.* 19; *c.* 18)." Dioscorides

mentions that the soap-wort (*Lychnis*, our *Saponaria*) is everywhere sold in the shops for scouring and cleaning dresses. Several of the family of the caryophyllaceous plants (*Dianthus, Lychnis, Gypsophila, Silene*) are remarkable for this property in a greater or less degree. By recent chemical means there has been extracted from these roots the *Saponine* (or *Struthiine*), a special substance, and to this, notwithstanding the very small quantity contained in the roots, the singular power is attributed of making emulsions, and of being used for soap in washing. The soap-wort of the Levant (*Gypsophila*) is, to this day, employed in the East for washing and cleaning silks and shawls. It was generally used in the Mediterranean districts of France and Spain; the French called it *herbe aux foulons* (the fullers plant). The *Saponaire*, or *Savonière* of the French, is the root of a kind of *Lychnis*.

The vegetable soap-principle, or saponine, was found by Henry and Boutron Charland, in the bark of the *Quillaja saponaria*. *Le Quillay* is a tree of the family of Spiraeaceous plants, a native of Huanuco, in Peru. Ferdinand Lebeuf made special mention of this bark in 1850, (Comptes rendus de l'Académie des Sciences à Paris, xxxi. p. 652) for its richness in saponine, and recommended it for pharmaceutical use in preparing emulsions of oils, rosins, balsams, and several other medicaments. He mentions likewise the bark of the *Yallhoy* (*Monina polystachia*).

From one bark, boiled with alcohol of 40°B. (or 828 sp. gr.), according to the method followed by Lebeuf, Rochleder, and Schwarz, the saponine was extracted. This substance is characterised by its lasting irritating smell, producing sneezing by only a few particles, and in some cases a special aromatic flavour was perceived. It is remarkable how a small particle, a homœopathic dose, is sufficient to change a large quantity of oil into an emulsion. The saponine has likewise the power of reducing gold from its chloride.

The extract of the soap-bark, prepared as mentioned above, undergoes a spontaneous change, when exposed to the influence of the atmosphere for several weeks. The clear solution is transformed into a colourless, thick, but transparent jelly, with a slight acid reaction. Its property of making emulsions is not the least diminished, but it has lost the power of reducing gold and copper as before, and the reaction on the mineral chameleon proceeds very slowly. In short, to explain the change, it is sufficient to say, that by absorption of oxygen from the air, the substance, extracted by water, has been oxydised.

To conclude, it appears that the soap-bark retains two substances, saponine and pectine, both soluble in cold water, equally endowed with the faculty of making emulsions with oils and fatty substances. The large quantity of isolated pectine in the soap-bark is explained by the separation from the lime during vegetation. The spontaneous oxydation has transformed the pectine into the gelatinous acids, the pectosic acid and pectinic acid.

Several years ago, in 1832, M. Braconnot, in his inquiries as to the transformations of several vegetable substances into a new principle by the influence of concentrated nitric acid, remarked that he found the saponine in the bark of the Nicker tree (*Chicot de Canada*), or *Gymnocladus Canadensis*, Lam. (*Guilandina*). He says, that it is possible to substitute this bark (and also its leaves) for the soap-wort of the Levant, the tree being 30 or 40 feet high, able to stand our winters, and easily cultivated for the use of the bark as a vegetable soap. I have also another sample of a bark containing saponine and pectine, which, when combined, are excellent for washing purposes.

Besides this a kind of soap-bark is mentioned in the proceedings of the Boston Society of Natural History for 1850 (see also the *Edinburgh New Philosophical Journal*, vol. 51., p. 201), the bark of a tree, *Chelaria saponaria*. As there is no plant known by the name of *Chelaria saponaria*, I suppose that it is wrongly printed for the *Quillaja*, treated of in this paper. The soap-plants used for washing in California, and preferred by those who know their merits, to the best kinds of soap, are the bulbs of *Phalangium pomaridianum*. In this communication it is stated:—"All these contain considerable quantities of oleaginous and alkaline principles in their composition, on which their value depends." This opinion is highly erroneous. Not one of the vegetables known as vegetable soaps contains oil and alkali; their property is entirely derived from neutral substances as above described.

In Guiana, the bark and fruits of the soap-wood tree, (*Sapindus saponaria*) called by the natives, *Hurawassa*, is employed in the place of soap, and it is said that the fruit will clean sixteen times more goods than the same weight of common soap. A kind of sapindus, called *Rarak*, is used in the same manner at the Moluccas and at Java.

The study of vegetable substances, for their application as neutral soaps, merits the attention of modern dyers and printers, and certainly they can be recommended for delicate colours, which are liable to be injured by the alkaline soaps.

WELL-BORING.

An Artesian well, of unusually large bore, has just been completed in Birmingham, for the supply of the Woodstock-street Baths in that town. There are many wells much deeper, but in diameter of bore it is stated to exceed all others.* When the corporation advertised for tenders, the contract was taken by Mr. Greenley, a well-known metropolitan well-borer, usually employed in such works by the Admiralty and other Government departments. The diameter of the well was not specified, but as Mr. Greenley had recently commenced working some much improved machinery, he was anxious to show to what extent the old dimensions could be exceeded, and undertook the construction of the well for a sum much below what he believed it would cost him. The diameter fixed upon was 26 in. The work was commenced in November, 1858, in the belief that it would be finished in three or four months, but the difficulties encountered were so great that the well was only completed a few days ago. More than one stratum of running sand was encountered, and to pass through these iron cylinders had to be sunk and fixed. But for the nature of Mr. Greenley's machinery the well would probably have proved a failure. Mr. Greenley's machine is simply an improvement upon an instrument which has been used in China for the last two or three thousand years. It consists of a very heavy bar of cast-iron, armed at its lower end with a number of cutting chisels, and suspended by a rope, which is in connection with a steam-engine at the mouth of the well. As it is wrought up and down by the engine, the torsion of the rope gives a circular movement to the bar of iron sufficient to vary the position of the chisels at each stroke of the instrument. The apparatus of some well-borers has around the chisels a cylindrical chamber, which, by means of simple valves, receives and retains the abraded portions of the rock. This chamber, which would not hold many pints, had, of course, to be raised to the surface at short intervals for the purpose of being emptied of the *débris*, thus involving much loss of time. Mr. Greenley, however, performs this important operation in a very different way. He employs a cylinder 8 in. or 9 in. in diameter, having a piston fitted to it so as to form a pump, with one valve at the piston and another at the bottom of the cylinder. When the pump sinks to the bottom of the well, the piston, by its own gravity,

* In a discussion which took place on the reading of a paper before this Society, by Mr. Mather, on "Earth-boring Machinery," in which he describes the appliances invented by him for this purpose, it was stated by Mr. Herbert Mackworth that borings have been executed on the Continent by Kind, varying in diameter from ten inches to 4 feet and one-eighth of an inch. In the latter case the boring had been made in white chalk for 100 yards, and hard grey chalk for 163 yards. See *Journal of the Society of Arts*, Vol. 3, p. 508.—Ed. *S. of A. J.*

sinks also to the bottom, and by suddenly reversing the engine and drawing up the sucker, not only is the crushed *débris* drawn up, but also pieces of rock 6in. or 8in. in diameter. When the workmen came to the running sand, therefore, instead of bringing up a few quarts at a time, this pump enabled them to raise six or seven tons per hour. The sand, however, was not the only difficulty. Hard clays had to be cut through, and then, at a depth of 75ft., the red old sandstone was reached. It proved to be as hard as Aberdeen granite, and infinitely worse than flint, because flint would crack and split, whereas this had to be ground as in a mortar. Though the contractor did not expect his machine would have such a crust as this to bite, he persevered month after month in the tedious work, and at length, having penetrated the sandstone to the depth of 145ft., he reached the gaol specified in his contract. Numerous water fissures were met with in the formation. The height to which water rises is of course dependent on the level of its source, but at present this is within 40ft. of the surface, and will be easily reached by mechanical means. The water is beautifully pure, and far softer than any with which Birmingham housewives have yet been blessed. This well, from its great size, has been watched with the greatest interest by many scientific men, some gentlemen having come from France on purpose to inspect the working of Mr. Greenley's machinery. The machinery employed is the invention of Mr. Allison, who had the superintendence of the work under Mr. Greenley.

Home Correspondence.

THE GREAT EASTERN.

Sir,—Will you be good enough to allow me a portion of your space, to reply to the observations of Sir Edward Belcher, in last week's number.

Sir Edward admits, as fully as I could wish, the strength and fine form of the ship. He disputes the correctness of Mr. Brunel's judgment in giving the contract for building her to one contractor, and thinks several contracts for portions of the ship would have been better than one for the whole. Without disrespect to Sir Edward, I prefer to rely on Mr. Brunel's judgment—a judgment formed upon an experience, in relation to contractors and contracts, vastly superior to anything which Sir Edward can possess; and may I not retort on him that as everything, in his opinion, on board the ship would have been better done had it been under the charge of a seaman, so matters of this kind are more likely to be rightly decided by an experienced landsman and distinguished engineer, than by a seaman. But, in this special case, I have always understood that Captain Harrison, to whom the command of the ship was entrusted, was in constant communication with Mr. Brunel, gave the company the full benefit of his knowledge and experience, and would now have been in command, I have no doubt, had not Mr. Brunel's life been so unfortunately cut short before the work was completed. Here then we had the benefit of the genius and great and comprehensive mind of Mr. Brunel to design the ship, and his practical knowledge to construct her, and the large experience of a thoroughly good seaman to fit her for sea. What more would Sir Edward desire?

The comparison instituted between the mode of constructing the Britannia-bridge and the Great Eastern, is so fallacious, I only notice it to prevent its being supposed that I admit the correctness of the criticism, or am unaware of the entirely different purposes to which these great works were to be applied when finished.

Then as to the size of the ship. Sir Edward clearly does not grasp the whole of the subject. He asks why not have first built a ship of 5,000 tons, then one of 10,000 tons burthen, and thus gained experience in the management of large ships by degrees. To this I reply simply that neither a ship of 5,000 nor of 10,000 tons could have accomplished what is required of the Great Eastern, and upon the accomplishment of which those who have studied the subject rely for success.

It would, therefore, have been useless to build them, and the time occupied by such experiments would have deferred for years the only experiment likely to answer. The question of size is this, what tonnage and power is required to enable a ship to run to Calcutta in from 33 to 35 days, to carry 40 days' fuel, and passengers and cargo enough to realize a profit without a government subsidy? To realise these main but essential requirements by means of a ship of less than 20,000 tons burthen, is, I think, beyond the nautical or engineering resources, or practical business knowledge of Sir Edward Belcher. I will not enter more into this part of the subject, because it is fully treated in my paper, but I will assert that no ship yet built, but the *Great Eastern*, approaches these conditions. To talk of the *Persia* is nonsense; large as she is, she must, were she to attempt an Indian voyage, stop three times for fuel, thereby deviating from her true course, and increasing her distance to run; and then, where is her space for passengers and cargo to pay? Let her coal at St. Vincent, the Cape, and Galle; let her do her utmost, yet with these delays she will not reach India in fifty days, and then without either passengers or cargo of any moment, and having paid double price for her coals.

Then, again, as to the risk, when at anchor in a gale, of "*breaking her shear*." This, according to Sir Edward, happens to small ships. He suggests it was the cause of the loss of the *Royal Charter*.

I can but reply, that whilst I have not attempted to claim for the *Great Eastern* freedom for every source of accident or danger, I have said that, powerful as she is, strong as she is, well commanded as she is (was), and always must be to be successful, she will be liable to fewer accidents than smaller or weaker craft, and will be free almost from many to which they are subject, for no one knows better than Sir Edward that the surface she offers to the wind when riding at anchor or driving head to wind, is vastly less in proportion to her size than that offered by any man-of-war or other ship of 4,000 tons now afloat.

Then, again, as to the height of waves. I must adhere to Dr. Scoresby and his accurate observations, and the little experience I have had on the South Atlantic Ocean, in preference to the opinions only of Sir Edward.

Surely he does not pretend to say that the wave he refers to was 100 feet high. That the spray from a broken wave, and a volume of broken water is driven high up at times, no one can doubt who has been to sea; and in coming round the Land's End one sea did break over the *Great Eastern*—but that this fact proves the inaccuracy of Dr. Scoresby, an old and accomplished sailor, who has crossed the Atlantic at all seasons, and probably oftener than Sir Edward, and whose attention, for years, was devoted to this subject, I must be allowed to deny.

But surely I may admit all Sir Edward says, and ask him, if a wooden ship has borne such shocks as he describes, will not the *Great Eastern*—which he allows to the strongest ship afloat—bear them?

Then Sir Edward asks, if her machinery be disabled, and her sails be useless, what can she do? This is the old, and I thought worn-out diatribe against the use of steam power at sea. It is not for me, a landsman, to venture to reply to such a question, for it is too evident Sir Edward is no little jealous of a landsman daring to construct, and, much more, to fit out for sea such a ship as the *Great Eastern;* but suppose all her machinery disabled, what does that mean?—that her four distinct engines should be all disabled at once—for each cylinder of her paddle-engine, and each pair of cylinders in her screw engines can be worked separately—and that her six masts, with their square and fore-and-aft sails, shall also be disabled, and at the same time—and then what is to be done? I will not stop to reason on the improbability of such a state of things,

but appeal at once to an old experienced seaman and officer for a reply, and the man to whom I will appeal is Sir Edward himself, and I feel confident he will say that so long as we have a sound hull and trustworthy ship, with God's help we will bring her safe to port. But should Sir Edward's—may I say prejudices, be so strong as in this case to overpower his long established character for courage and seamanship, then I would ask him to put the question at the next examination of mates aspiring to be masters, and I have such confidence in the pluck and ability of English seamen that I feel sure he will receive from many of them ready and good answers—and that plenty will be found whose courage will not fail them in face of danger and whose resources are equal to any emergency.

The suggestion that the *Great Eastern* should be a store-ship, from which everything required by smaller ships, whether steamers or sailing vessels, that she may meet with in need of help, may be supplied, is too good to be forgotten. It proves that Sir Edward does in this respect appreciate the vast power and capacity of this ship, and I hope the directors will not lose sight of it—for, independently of the good service she would perform in this way, the sale of such stores would form a most profitable part of her freight.

I now arrive at the last paragraph in which Sir Edward notices a partial inaccuracy, not in the paper itself, but in my reply to the observations made upon it, relating to "reefing the paddles."

I certainly intended to say she had the power to reef them to a greater extent, and by a better mechanical arrangement, than any other ship, and not that no other ship could reef her paddles,—a fact which could not be within my knowledge. I am obliged to Sir Edward for this correction.

I am, &c.,

W. HAWES.

STARCH.

Sir,—In the account of the discussion on Dr. Calvert's paper on Starches, contained in the last number of your *Journal*, I find that in one or two particulars my remarks have been inaccurately reported. In it I am represented to have stated, that the employment of chloride of sodium in conjunction with a solution of lime, as a solvent for gluten in the manufacture of rice starch, was patented by Messrs. Colman, whereas I stated that this patent was taken out by Messrs. Attwood and Renton.

I am also reported to have said that the last patent with which I was acquainted was that taken out by Mr. Ransford, whereas I alluded to this as the last of any importance in connexion with rice starch that had been sealed. Since then twenty-five patents have been taken out, but they mostly have reference to unimportant details.

As a member of the firm of Orlando Jones and Co., the original patentees of rice starch, and whom I represented at the meeting, I should regret if it were thought possible for me to mis-state these well-known facts, and I will therefore thank you to insert this letter in the next number of your *Journal*.

I am, &c.,

WILLIAM EVILL, Jun.

Sir,—It is related of Beau Brummell that one of his most successful achievements was the discovery of the utility of starch in stiffening certain articles of body linen. While he retained his secret the elegant rigidity of his neck adornments was the envy and dismay of the dandiacal portion of the male world. How did he accomplish it? At length the oracle of fashion revealed the grand secret:—starch makes the man.

The statements of Mr. Calvert would lead us to infer that some of our cotton manufacturers have expanded the idea of Brummell, and it might now, with some propriety, be said, starch makes the calico.

Three hundred tons of farina per annum, nearly a ton (ten sacks) per working-day, seems an enormous quantity to be consumed by one firm in the legitimate stiffening of woven goods.

I fear the great increase in the use of starches referred to by Mr. Calvert, has some connexion with the production of cheap calico, in the manner explained to us by Mr. Warren, in his lectures at the Society's rooms, three or four years ago.

Speaking from my memory, I believe he laid great stress on this point (deception as far as consumers are concerned), that a warehouseman or factor would require a cloth to be made a farthing or some fraction per yard cheaper than the previous supply, and to meet this demand, and yet retain his profits, the manufacturer weaves his cloth with a proportionately less number of threads to the inch than before. To counteract the flimsy effect to the eye and touch which would result from this course, it was further stated that it is customary to run the cloth through a solution of starch, and until wetted the character of the fabric is not apparent; only when the article is washed, is the other side of the picture presented. Of course with farina at 2d. per lb. it must be very profitable to sell yards of starch at even a much lower price than the lowest cotton goods could be supplied. The fabric in some cases appears to be used merely as the vehicle for the starch, being woven extremely coarse or wide, and the interstices filled with starch. English manufacturers enjoy a tolerably good reputation abroad for solidity and genuineness, if not for elegance, but I hope that the "more starch and less cotton" principle may not be carried to such an excess as to injure the fair name of one of our staples. As an illustration of my meaning, and as apposite to this subject, I may briefly relate a circumstance which happened to come under my own notice.

During a portion of the time of my residence in New Zealand money payments were unknown, the reply to offered money being, "I cannot eat or wear it, or dig with it; give me some goods;" and amongst such articles of barter, plain and printed calicoes were always good trade. It was amusing to observe the criticism and test to which these articles were subjected. Judging from experience that many stuffs imported were totally unsuitable for their hard wear and wet climates, they were accustomed, before purchasing, to suck a piece of the cloth for a few minutes, rub it in their hands, and then hold it against the light. And with a contemptuous sneer would they sometimes remark, "all flour; when washed, you might shoot pigeons through this sieve, and not burn the thread."

Again, whenever a vessel arrived in port, the first question was, "Is she from England direct, or from the colonies? If the latter, an expression, translatable by the word "rotten," was the form in which their opinion of her commodities was conveyed, the idea being that as the ship came from a colony, the goods must have been made there, and English-made articles were, in their estimation, better than colonial.

The opinion as to quality was correct, but not its supposed cause, the real cause being that, at the period to which I refer the goods forwarded on to New Zealand were the refuse of the Australian markets, whereas direct shipments were to order of those who knew that good articles were appreciated, and would be adequatly remunerative.

The starch question from the point of view I have taken, does not appear to have been touched upon by the lecturer. Regarding the subject therefore as one of food, dress, and character, I may appeal to the cotton manufacturers on behalf of the poor women of our own and many other countries. Pray, gentlemen, omit the starch; spare it to us for food, and put more cotton in your calico; we shall then be warmer both within and without, and in your pro-

ductions sustaining a character for quality, you will find ample reward.

Yours, &c.,

W. STONES.

MEETINGS FOR THE ENSUING WEEK.

MON. .....London Inst., 7. Mr. Joseph Towne, "On the Organs and Phenomena of the Senses, Intellectual Powers, and Memory."
Actuaries, 7.
Entomological, 8.

TUES. .....Pathological, 8. Anniversary.
Photographic, 8.

WED. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Geological, 8. 1. Capt. T. Spratt, "On the Geology of Southern Bessarabia." 2. Messrs. T. Rupert Jones and W. K. Parker, "On the Recent and Fossil Foraminifera of the Mediterranean Area." 3. Prof. Goeppert, "On the Palæozoic Fauna." 4. Prof. J. Phillips, "On some Cretaceous Sections near Oxford."
Pharmaceutical, 8.
R. Soc. Literature, 8½.

FRI. .....Archæological Inst., 4.
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."

SAT. .....Asiatic, 2.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 23rd*, 1859.]

Dated 31st October, 1859.

2178. I. Brown, Carlisle—Imp. in the treatment of growing crops.
2482. A. Chevrier, 21, Rue du Faubourg St. Martin, Paris—Neutralizing the smell and savour of all vegetable and animal substances without their being adulterated by the use of essences of spirits and aromatical products.

Dated 8th November, 1859.

2538. A. Learch, Brussels—An improved process of manufacturing embossed sheets or stuffs, called embossed fictitious leather for hangings and household furniture. (A com.)

Dated 14th November, 1859.

2583. H. J. Daniell, Donnington-park, Leicestershire—Imp. in the construction of breech-loading fire-arms.

Dated 19th November, 1859.

2622. C. Bosc, 45, Essex-street, Strand—The manufacture of artificial marbles.
2626. J. Hollingsworth, Cecil-street, Strand—Imp. in the mode of and machinery for cutting irregular and other forms. (Partly a com.)

Dated 23rd November, 1859.

2648. W. H. Ward, Auburn, New York, U.S.—Improved signal lanterns.

Dated 25th November, 1859.

2666. W. Smith, 19, Salisbury-street, Adelphi—Imp. in applying or working propellers in boats or vessels. (A com.)

Dated 30th November, 1859.

2706. B. Samuelson and W. Manbury, Britannia Works, Banbury, Oxfordshire—Imp. in reaping and mowing machines.
2708. E. Dorsett, 76, Old Broad-street, London—A new manufacture of heavy oil.
2710. H. de Matthys, Antwerp, Belgium—Imp. in electric telegraph cables.
2712. W. E. Newton, 66, Chancery-lane—Imp. in the construction of pianofortes. (A com.)
2714. J. Lawson and S. Cotton, Leeds—Imp. in machinery for cutting and forming the teeth or cogs of wheels.

Dated 1st December, 1859.

2716. G. K. Geyelin, 462, Oxford-street—Making close folding metallic spring laths, mattresses, and bedsteads.
2718. A. Mosselman, Rue Saint Ghislain, No. 17—An aromal electrical girdle.
2720. J. Cocks, 25, Cornhill, London—Imp. in the mode of manufacturing cloths or materials for trowserings.
2722. W. E. Newton, 66, Chancery-lane—Improved apparatus applicable for beating eggs, or mixing substances or liquids. (A com.)
2724. G. Davidson, Mugie Moss, Aberdeen—Imp. in the manufacture of paper bags, and in the machinery or apparatus used therein.
2726. N. S. Dodge, 44, St. Paul's Churchyard—Imp. in the construction of lamps. (A com.)

Dated 2nd December, 1859.

2728. J. Moore, 46, New-road, Woolwich—An improved damper of chimnies and flues.
2730. D. Makinson, Bolton-le-Moors, and J. Hope, Harwood Lee, near Bolton-le-Moors, Lancashire—Certain imp. in carding engines.
2732. W. H. Aldridge, Kingsdown, Bristol—Certain imp. in paddle wheels or propellers of steam ships.
2734. A. V. Newton, 66, Chancery-lane—An improved mode of treating india rubber, gutta percha, and analogous gums. (A com.)

Dated 3rd December, 1859.

2736. T. Hall, Ancoats Grove, Manchester—Certain imp. in the construction of cartridges.
2738. F. Palling, Esher-street, Lambeth, Surrey—Imp. in the construction of lamps for burning oils and tallow.
2742. P. M. Parsons, Arthur-street West, London-bridge—Imp. in firearms and projectiles.
2744. J. Rudkin, Slate Works, Groby, near Leicester—Imp. in stoppers for bottles.

Dated 5th December, 1859.

2748. J. Hawkins, Lisle-street, London, and C. Hawkins, Walsall, Staffordshire—Certain imp. in the construction of furnaces for consuming smoke, applicable to stationary and marine boilers, and other closed fire-places.
2752. G. Feldwick, St. Martin's-court, Westminster—An imp. in roller blinds.
2754. W. Hutton, West Hartlepool, Durham—Imp. in preventing the destruction of the timbers of piers, docks, and other structures by the action of sea worms or other marine animals.

Dated 6th December, 1859.

2758. C. Sells, Stockwell, Surrey—Imp. in marine steam engines for driving screw and other propellers.
2760. J. Jones and J. Hilton, Rhodes, near Middleton, Lancashire—Imp. in apparatus to be used in dyeing, dunging, soaping, and clearing fabrics.
1764. F. Potts, Birmingham—Imp. in the mode of manufacturing or finishing tubes for certain purposes.

Dated 7th December, 1859.

2765. F. Levick, Blaina Cwm Celyn and Coalbrook Vale Iron Works, Monmouthshire—A new or improved coke oven.
2767. J. Anderson, Newton, Ayr, N.B.—Imp. in obtaining motive power.
2768. T. Bradford, Manchester—Certain imp. in machinery or apparatus for wringing and mangling textile fabrics.
2769. R. A. Brooman, 166, Fleet-street—Imp. in marine steam engines for driving screw and other propellers, and in screw propellers. (A com.)
2770. F. W. Schafer, Brewer-street, Middlesex—Imp. in cash, deed, jewel, and other boxes.
2771. R. H. Collyer, 8, Alpha-road, Saint John's-wood, Middlesex—A chemical ink-pencil or composition applicable as an instrument or means for writing, drawing, and marking.
2772. M. Jacoby, Nottingham—Imp. in the manufacture of twist lace.
2773. T. R. Harding, Leeds—Imp. in combs or hackles for combing, carding, or hackling flax, cotton, silk, or other fibrous materials (which are also applicable to raising the nap or pile of woollen or other cloths), and in the making of pins or teeth for such combs or hackles.
2775. C. C. S. de Changy, Boulogne-sur-Mer, France—Imp. in the manufacture of bread, which improvements are also applicable in the preparation of dough or paste for other purposes.
2776. J. Mabbott, 7, Sunbury-terrace, Liverpool-road, Middlesex—Imp. in wind guards for chimnies.
2777. R. T. Pattison, Daldorch-house, Ayr, Scotland—Imp. in printing and dyeing certain woven fabrics and yarns.

Dated 8th December, 1859.

2778. W. Spence, 50, Chancery-lane—Imp. in rotating harrows. (A com.)
2779. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derbyshire—Imp. in the manufacture of boilers, ships' tanks, and other hollow vessels of iron and steel.
2780. J. Harrison, Bilston, Staffordshire—A new or improved method of constructing land batteries and gun boats.
2781. J. Harrison, Bilston, Staffordshire—Imp. in the manufacture of beams or girders, and in machinery and furnaces used in the said manufacture.
2783. R. Gray and T. H. Scholfield, Sheffield—Imp. in flattening and tempering steel wire and sheet steel, and also in the tubes employed in the furnaces.
2784. T. Crook, Bolton-le-Moors, Lancashire—Imp. in machinery or apparatus for making paper bags.
2785. W. Prosser and J. Hogg, Witton-park, Darlington, Durham—An improved cooking apparatus particularly suitable for military purposes.
2786. J. Norris, jun., Birmingham, and T. Till, Birmingham Heath—Imp. in machinery to be used in manufacturing horse nails and other wrought nails.
2787. F. H. Elliott and C. A. Elliott, Strand—An improved method of preventing drawing boards and other flat wooden surfaces from warping or twisting, and of adding to the strength thereof.
2788. A. Rumpff, King-street, Cheapside—An improved fastening for portemonnaies, portfolios, bags, and other like articles, (A com.)

2789. J. Macintosh, 40, North Bank, Regent's-park—Imp. in the manufacture of waterproof and other fabrics, and of moulded or formed articles.
2790. J. Macintosh, 40, North Bank, Regent's-park—Imp. in setting artificial teeth.
2791. J. Macintosh, 40, North Bank, Regent's-park—Imp. in cartridges and projectiles.

Dated 9th December, 1859.

2792. W. Boaler, 76, Cedar-street, New York, U.S.—An improved compound for washing purposes.
2793. J. Lawson and W. Hago, Lanark, N.B.—Imp. in apparatus to be used in spinning or twisting.
2794. J. Spiller, Cardiff, Glamorgan, Wales—Imp. in dry articles or bodies formed of plastic clay.
2795. J. Tenwick, Clarendon-street, Portsmouth—Imp. in the construction of steering apparatus adapted for ships and such like navigable vessels.
2796. H. Hughes, Homerton, Middlesex, and J. Moore, Manchester—Imp. in machinery for transferring and for transferring and engraving designs and figures on to cylindrical and flat surfaces.
2797. J. D. Dunnicliff, Nottingham—An imp. in the manufacture of bonnet fronts and ruches.
2798. W. Betts, Wharf-road, City-road, Middlesex—An improved manufacture of capsules.
2799. J. Thomson, R. Thomson, and H. Thomson, Buckden, Huntingdonshire—An improved agricultural implement.

Dated 10th December, 1859.

2800. R. Heilman, Manchester—The preparation of a new colour, called Azaleine, and its application to dyeing and printing. (A com.)
2801. F. C. Calvert and C. Lowe, Manchester—Imp. in dyeing and printing certain yarns and fabrics.
2802. G. Davies, 1, Serle-street, Lincoln's-inn—An imp. in tobacco pipes, mouth-pieces, and cigar or cigarette holders. (A com.)
2803. W. Horton, Smethwick, Staffordshire—An imp. or imps. in steam boilers.
2804. C. Gammon, 9, Cloak-lane, London—An improved fastener for gloves and other articles.
2805. J. Farquhar, Aberdeen, N.B.—Imp. in gas meters.
2806. W. Whiteley, Lockwood, near Huddersfield—Imp. in looms for weaving.
2807. J. Chatterton, 19, Wharf-road, City-road—Imp. in the manufacture of projectiles.
2808. I. L. Bell, Washington Chemical Works, Newcastle-upon-Tyne—Imp. in the manufacture of the sulphate of magnesia.
2809. J. Chatterton, Highbury terrace, and W. Smith, Pownall-road, Dalston, Middlesex—Imp. in insulating te'egraphic conductors, and in the treatment of gutta percha.
2810. S. W. Campain, Deeping Saint Nicholas, Lincolnshire—Improved machinery for removing or elevating straw and other agricultural produce.
2811. W. W. Bonnin and F. Pons, Genoa, Italy—A new system and improvements in locomotive engines.
2812. D. Strickland, Hayle, Cornwall—An apparatus for separating, sifting, sorting, and cleansing mineral ores.

Dated 12th December, 1859.

2813. R. Emery, 6, King street, St. James's-square, Westminster—Imp. in carriages for common roads.
2814. J. R. Breckon, Darlington, and R. Dixon, Crook, Durham—Imp. in the construction of coke ovens.
2815. P. G. Gennerich, 18, Welbeck-street, Cavendish-square—A new system of motive power, applicable for working cranes and wheels.
2816. T. Stather, Kingston-upon-Hull—Imp. in the ventilation of buildings, ships, and other enclosed places.
2817. P. Stirling, Kilmarnock, Ayr, N.B.—Imp. in traction engines.
2818. G. C. Watson, Chester—Novel and artistic bricks or "lumps" for the reception, growth, and propagation of ferns, mosses, and other plants.
2819. G. Lough, Flemington, North Melburn, Victoria, Australia—An improved compound motive power engine.
2820. G. H. Rollet, Liverpool—An improved machine for the manufacture of pressed bullets.
2821. W. Clay, Liverpool—An improved mode of manufacturing cannon and other ordnance.
2122. J. R. Isaac, Liverpool—Imp. in the construction of hand-boxes for travellers.
2823. J. Bailey, Dunstable—Imp. in the manufacture of corsets and stays.
2824. W. Teale, Wakefield—Imp. in treating fatty and oily matters obtained from wash waters. (A com.)

Dated 13th December, 1859.

2825. C. Vinall, 25, Walton-street, Brompton—Imp. in, and mechanism for, retaining the rollers of window blinds, maps, charts, and other articles requiring to be wound on rollers.
2826. T. Redwood, 19, Montague-street, Russell-square—Imp. in the manufacture of paper and of substances used in paper making, and for other purposes.
2827. G. Withers, West Bromwich, Staffordshire—Certain imp in blocks for moulding and shaping glass during the process of blowing or forming glass, for blowing sheet glass, glass shades, and such like articles.
2828. J. R. Johnson, Hammersmith, and J. S. Atkinson, Red Lion-square, Middlesex—Imp. in machinery for manufacturing printing types.
2829. W. Harding, Rutland-terrace, Forest-hill, Kent—Imp. in breech loading fire-arms and in cartridge carriers.
2830. J. Barling, Belle Grange, Lancashire—Imp. in propelling vessels.
2831. W. Robinson, Wembdow, Bridgewater, Somersetshire—Imp. in cask washing machines.
2833. J. H. Dickson, Commercial-street, Rotherhithe—Imp. in the manufacture of yarns and in the machinery to be employed in the preparation of certain fibres to be thus manufactured into yarns.

Dated 14th December, 1859.

2835. W. Clark, 53, Chancery-lane—A heating apparatus for boots and shoes and other coverings for the feet. (A com.)
2837. J. Champion, Manchester—Certain improved arrangements of spindles, flyers, and bobbins, applicable to machinery or apparatus for preparing, spinning, and doubling fibrous materials.
2839. G. Leach, Britannia Mills, Leeds—An improved mode of and apparatus for oiling, preparing, and mixing wood.
2841. R. Lawson, Manchester—Certain imp. in machinery or apparatus for punching patterns or devices upon metallic printing rollers or cylinders.
2843. J. Rhodes, Wakefield—Imp. in steam hammers.
2845. W. Watson, Leeds—An imp. in preparing indigo for dyeing and other purposes.
2847. W. R. Crocker, Northumberland-street, Strand—Imp. in cutting corks and bungs, and in apparatus employed therein.

Dated 15th December, 1859.

2851. B. Predavalle, Bloomsbury-street, Bloomsbury square, Middlesex—Imp. in producing or obtaining motive power.
2853. W. Westwood, 43, West-square, Southwark—Imp. in the manufacture and burning of Portland cement.
2855. J. K. Hardy, Fenchurch-street—Imp. in the manufacture of bottle stands.
2857. C. Hancock, West-street, West Smithfield—Imp. in insulating telegraphic conductors, and manufacturing cables for telegraphic purposes.
2859. D. J. Fleetwood, Birmingham—Imp. in machinery for raising and stamping metal.

Inventions with Complete Specifications Filed.

2873. T. Fairbanks, St. Johnsbury, Vermont, U.S.—An improved scale for weighing letters.—17th December, 1859.
2875. M. Wright, 17, Gracechurch-street, London—Fastening packing cases by which they cannot be opened without such opening being detected, and termed "detective fastening for packing cases."—17th December, 1859.
2996. J. Willcock, 89, Chancery-lane, London—A new and improved machine for cutting or mincing meat, vegetables, &c. (A com.)—20th December, 1859.

Patents Sealed.

[*From Gazette, December 23rd*, 1859.]

December 23rd.
1520. G. Redrup.
1526. C. W. Williams.
1532. R. Dick.
1541. J. M. J. Baillie.
1545. W. Wray and J. Wray.
1549. W. J. T. Williamson.
1557. R. A. Brooman.
1567. B. Standen.
1579. R. W. Morville.
1601. J. Luis.
1656. W. A. Munn.
1761. C. Kingsford.
1735. J. H. Johnson.
1781. W. E. Newton.
2423. F. N. Clerk.
2445. J. Z. Kay.
2511. L. Koch.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, December 23rd*, 1859.]

December 19th.
3029. W. H. Stratton.
3030. J. Redgate, E. Ellis, and J. Cropper.
3044. J. Lark.
3054. W. Taylor.

December 21st.
3023. W. J. Payne.
3028. T. L. Thurlow.
3034. W. B. Johnson.

[*From Gazette, December 27th*, 1859.]

December 22nd.
3102. W. Bray.

December 23rd.
3060. C. S. Rostaing.
3079. J. P. and W. McNaught.
3082. G. Ritchie.

December 24th.
3055. J. S. Barraclough.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, December 23rd*, 1859.]

December 19th.
1127. J. Roydes.

December 20th.
1121. G. Beadon.

December 21st.
1180. W. Busfield.

[*From Gazette, December 27th*, 1859.]

December 22nd.
1161. G. Bower.
1192. A. D. Brown.
21. J. B. Pascal.

Journal of the Society of Arts.

FRIDAY, JANUARY 6, 1860.

EXAMINATIONS, 1860.—NOTICE TO INSTITUTIONS AND LOCAL BOARDS

The attention of Secretaries of Institutions and Local Boards is specially called to Par. 8 of the Programme of Examinations for 1860, as follows :—

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other Members of the Board.

It is particularly requested that the names and addresses of the chairmen, members, and secretaries of the Local Boards which are already formed, or may hereafter be formed, in the various localities, be forwarded immediately to the Secretary of the Society of Arts.

EXAMINATIONS.

Mr. Joseph Hough, of the Leeds Young Men's Christian Institute, a Prizeman at the Society's Examinations, in 1857, and who obtained several certificates in 1858, formerly teacher of Mathematics at the Leeds Young Men's Christian Institute, and subsequently at the Leeds Mechanics' Institution, has received the appointment of Assistant-Astronomer in Lord Wrottesley's Observatory.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date :—

Charles Brooke, M.A., F.R.S.	£2	2
C. Wentworth Dilke, Vice Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

THE PROGRESS OF TRADE.

By the Hon. R. Temple, Chief Justice of British Honduras.

The following is the substance of a lecture delivered before the "Society of Arts, Agriculture and Commerce" of British Honduras :—

It is my intention this evening to make a few general observations respecting Societies for the Promotion of Arts and Commerce in the abstract, and of companies established for the furtherance of any particular branch of trade. I shall then leave that subject for the present, and attempt a brief account or sketch of the rise and progress of trade.

Fifty or sixty years ago, such companies were not very numerous, but a legion of them has sprung up in modern days, nine-tenths of which are formed with no other object whatever but that of imposing upon the credulous.

But, notwithstanding the many bubble companies which have been the causes of so much wide-spread ruin, the experience of the last 30 years has proved to us what wonderful results may be produced by public associations, where their objects are real and legitimate, and the principles on which they are conducted, sound. I need only refer you to the various railway companies which have within a very short space of time excavated rocks, cut long subterraneous ways through mountains, laced the earth with bars of iron, and changed the whole system of travelling in every civilized country.

Another wonderful achievement of the present day, which could only have been brought into operation by public companies, is the electric telegraph. Little did Columbus imagine, when he commenced his perilous navigation of unploughed seas, that a day would arrive when we should be able to communicate with the inhabitants of that distant land—a land unknown to the ancients—a land the existence of which the contemporaries of Columbus denied—in less than one day; that words uttered in Europe would be conveyed by electric fluid through thousands of miles of the ocean's depths, to that mysterious region, which he discerned with the eye of science.

To a public company we owe that vast Indian Empire which we now possess, and which has, no doubt, by God's providence been given to us, in order that we may be the instruments of securing millions of our fellow creatures from the thraldom of idolatrous superstition, and of bringing them to the knowledge of the truth.

But whilst freely awarding praise to the companies who have conferred, or whose object is to confer, great and lasting benefits on mankind, we must be careful not to fall into the error of according our approbation to every company, of whatsoever description it may be. Companies are only necessary and useful under particular circumstances.

Thus a company established for the purpose of making a railway, of digging a canal, of supplying a town with water, of laying a submarine telegraphic wire, of establishing a regular steam communication between two distant countries, or of insuring lives or property, such a company is a legitimate means to a desirable end. It is only by a company that such objects can be attained.

An important question connected with Companies is that of liability. Unlimited liability has long been felt in the mercantile world to be a great grievance, and to a certain extent it has been remedied by the 19th and 20th of Victoria, c. 47, which enacts that in the event of any company being wound up, the existing shareholders shall be liable to contribute to the assets of the company, with this qualification, that if the company is limited, no contribution shall be required from any shareholder exceeding the amount unpaid on the shares held by him. But joint-stock banks, and insurance companies are not included in this Act.

With regard to trading companies, it is utterly impossible that a trade can be carried on so economically, vigilantly, and skilfully by a company as it can be by private individuals.

There is, however, one branch of trade which can be conducted as well by a joint stock company as by private individuals—I mean banking. This has been reduced to a regular system, and those who are engaged in it have nothing to do but to follow strictly the known and fixed rules by which it is governed.

Societies established for the promotion of arts, science, and commerce in general, are perfectly legitimate, and are almost always successful. The object of such societies

is not the individual gain of the members, but the production of benefit to the whole community. They are, therefore, to be encouraged and supported by every man who is desirous of conferring good upon his fellow creatures, or promoting the prosperity of the country in which he resides. Of this description is the "Society of Arts, Agriculture, and Commerce of British Honduras," and it is highly gratifying that the gentlemen of this colony have displayed such laudable alacrity in contributing towards its support—an alacrity which, I doubt not, will ere long be amply rewarded.

In every period of the world, nations have been prosperous, civilised, refined, and happy, in proportion to their commerce. War, though it may for a time have added to the glory and lustre of a particular people, has impeded, whilst it lasted, the progress of the arts—desolated the earth—destroyed the species—and entailed misery upon mankind, even after it has ceased. Trade, the eldest daughter of Peace, has, on the contrary, stimulated invention, fostered the useful and ornamental arts, and by bringing the people of different and distant countries into amicable collision with each other, has taught men of various languages, complexions, and religions to discard prejudices, jealousies, and national antipathies, and to regard with fraternal affection every ramification of the human family.

In the compass of trade, the needle always pointed to the East. To obtain a monopoly, or at least a considerable share of the commerce with that opulent region, has been the endeavour of all countries.

The ancient Egyptians were an inhospitable and exclusive race. It was their policy to avoid all communication with foreigners, and content themselves with the productions of their own fertile country. Theirs is a land peculiarly favoured. Whilst not a drop of rain ever falls from its unclouded sky, the inundations of the Nile moisten the soil, and leave behind an incrustation of black unctuous mud, which produces three crops of wheat in a year. Sesostris, however, determined to break down the barrier of exclusiveness which separated the Egyptians from the rest of the world, and to establish with other nations a commercial intercouse. He collected a large fleet and army, and conquered almost the whole of Asia, penetrating into India as far as the Ganges. For a time the rich products of that country—the pearls, the spices, the peppers, the aromatics—flowed into Egypt. But after the death of Sesostris, this commerce ceased; the Egyptians relapsed into their former unsocial disposition, and Egypt was not again prominent, as a commercial country, until the time of Alexander.

The next people who occupied an eminent position as merchants, were the Phœnicians. They carried on a lucrative trade with all parts of the known world, and particularly with India, from which country they imported not only its own indigenous products, but also the silks of China. The Tyrians themselves were famous for the manufacture of a rich purple fabric, which was so costly that only princes could afford to wear it.

During the brilliant reigns of David and Solomon, the Jews became a mercantile people. Solomon, with the assistance of Hiram, King of Tyre, sent ships to Tarshish and Ophir, but after his death the Jews ceased to be a commercial people; the kingdom was divided, and its glory departed.

The next distinguished person who appeared upon the scene as a candidate for the advantages of commerce, was Alexander the Great. Having conquered the Syrians and possessed himself of Egypt, his object was to engross the whole of the immense trade which had been formerly centred in Tyre. For this purpose he built a city at the mouth of the Nile, which he called Alexandria. To this city the greatest portion of the Indian trade was transferred. What Alexander began, his successor, Ptolemy Lagus, continued. For the furtherance of the Indian commerce he accomplished many great works; one which he commenced, but did not complete, merits particular notice. This was a ship canal, from a place called Arsinoe, near Suez, on the Red Sea, to the eastern branch of the Nile. By means of this canal there would have been a direct water communication between the Mediterranean and the Indian Ocean. But Ptolemy, for some reason with which we are unacquainted, abandoned all idea of a canal, and built a city just within the tropic of Cancer, which he called Berenice. Here the ships of the Egyptian merchants unloaded their cargoes, which were conveyed upon the backs of camels across the Shebaid to Coptos, from which place there was a canal, three miles in extent, communicating with the Nile. For many years the Egyptians engrossed the trade with India by this route. But the magnet was not yet discovered, and ships, by creeping along shore, were tardy in performing their voyages. When Augustus had got rid of his rivals for the empire of the world, Lepidus and Antony, and the Ptolemaic dynasty in Egypt had ceased with the death of Cleopatra, that country became a Roman province, and the wealth which had flowed into it from the East now rolled its enervating tide into the Eternal City, and carried along with it the first seeds of that effeminacy, which, in the fullness of time, ripened, and caused the once hardy and unconquerable Roman to become an easy prey to the Scandinavian savage.

And now followed, under the domination of barbarous tribes, a long, gloomy period, which has been emphatically called the dark age. Learning, arts, taste, civilisation, were swept away.

But although, in the Western world, learning, commerce, and the arts, were buried in one common grave; although in Europe an almost total eclipse of the human mind had occurred; in the East, science had begun to shine with uncommon lustre, and the pursuit of commerce to be followed with extraordinary ardour. The Greeks were driven from Alexandria, the ancient dynasty of Persia was subverted, and the power of the Caliphs was established throughout the length and breadth of Asia. Under their rule, science flourished, and the arts were promoted. The Mahomedans found the Persians in the possession of a lucrative trade with India, and, sensible of its advantages, they engaged in commerce with the same enthusiasm and success which they had exhibited and obtained in war. In order to secure the trade with India, and to afford an easy supply of its productions to the various parts of his Empire, the Caliph Omar built the city of Bassora, at the junction of the Euphrates and the Tigris. This city soon became a great emporium of commerce, and rivalled in splendour its great predecessor, Alexandria. The Arabian merchants soon extended themselves beyond the gulf of Siam, visited Sumatra and the other islands of the Indian Archipelago, and even reached Canton, in China. The Arabian Nights, which were written about the time of Haroun Alraschid who was a contemporary with Charlemagne, and one Athelstane, King of the Anglo-Saxons, contain many circumstances illustrative of the manners, customs, and commerce of the East at that period. These stories are regarded by those who are not able to appreciate them, as mere nursery tales; there cannot however be a greater mistake. In those ingenious narratives, there are many important facts related which are deserving of serious attention.

The Mahomedans were so numerous in the city of Canton, that the Emperor of China allowed them to have a judge of their own to decide disputes amongst themselves. A very extensive traffic was pursued by the Arabians, not only with India and all the islands adjacent, but also with China.

There was a district in Italy, situated between the Alps and the Adriatic Gulf, which was called Venetia, The Veneti, its inhabitants, were a warlike people, but whence they originally came is not known. When the Gauls first invaded Rome, the Veneti compelled them hastily to retreat, by entering and ravaging their territories. In the second Punic war, they furnished an auxiliary force against Hannibal. They were celebrated for their breed

of horses, which were the fleetest in Italy. This country was not disturbed by the incursion of Alaric. But a few years later, Italy was invaded by a barbaric chief, much fiercer, more fell and ruthless than the Gothic king—this was Attila, the King of the Huns. What the former had spared, the latter came to destroy. Alaric reaped the harvest—Attila came to glean every ear which had been left.

Before this terrible invasion, the greater number of the inhabitants of Venetia fled, abandoning their wealthy cities and magnificent homes to the fell invader. Their personal safety was all they sought. On the north-western coast of the gulf of the Adriatic, and at the mouths of several rivers, are numerous small islands, divided from the sea by narrow slips of land. Here the Veneti found a safe harbour of refuge, and these islands they made their homes. On these wretched islands, so difficult of access, there were destined to arise the most magnificent structures, rivalling those of Greece and ancient Rome. Within those labryrinthian channels—now the resort of wretched fugitives from the sword of the Scythian savage—a time was to come when all the riches of the East were to roll in an effulgent stream.

The inhabitants at first gained a scanty subsistence by fishing and the manufacture of salt. But as the islands became more populous, in consequence of others following the example of the first settlers, the people began to extend their trade.

From the commencement Venice was a mercantile community. Her nobility were merchants, and her doges had sprung from trade. After the lapse of five centuries these miserable exiles, flying from barbarian invaders, and taking refuge amongst a number of small islands surrounded with mud, and supporting a precarious existence by catching fish, had so greatly extended their commerce that they had become an opulent and powerful state, and were able to make successful war upon other nations. Before the tenth century Venice monopolised the whole of the Oriental trade, and every nation in Europe was supplied by her with the valuable commodities of the East. As yet Pisa, Amalfi, and Genoa, destined ere long to become her powerful competitors, had not risen into importance. Wealth had its usual effect upon the Venetians. They built magnificent palaces, they enveloped their forms in robes of the richest materials, and they indulged in the most costly viands.

The pride and haughtiness of Venice so swelled with her prosperity, that at last she claimed to be the husband and sovereign lord of the Adriatic.

In the year 1096 an event occurred, which, although it greatly enriched Venice, also added to the wealth and importance of other states. This was the first crusade. At first Venice hung back from countenancing it in any way, being fully aware that the effect of it would be to destroy the monopoly of the Eastern trade which she had hitherto enjoyed. But the Venetian Government, finding that they could not prevent, determined to enter heartily into it, and obtain their share of the profits. It was now that Pisa and Genoa came forward, and laid the foundations of a commerce which was to rival, and for a time to eclipse, that of Venice.

The Crusades, if we view them merely as military demonstrations—if we regard them only in reference to the object sought to be attained—the protection of pilgrims visiting the Holy sepulchre—must be pronounced to have been insane projects—the offspring of ignorance and fanaticism—the produce of an age distinguished for chivalrous daring and personal prowess, but deficient in mental culture and intellectual progress; but when we consider the effects which they produced—the advantages which accrued to commerce—the knowledge which was obtained of arts and science, which until then had been confined to the East, and the refinement of manners, which, in Europe, notwithstanding the glitter of arms, the emblazonments of heraldry, and the songs of the troubadours, partook largely of the Vandalism of the Scythian invaders; when, I say, we take into consideration these effects of the Crusades—effects not contemplated—we cannot deny that they were productive of the greatest benefits to the western world.

A considerable time after that period, another Italian state rose into commercial importance, and became celebrated as the resort of learned men. This was Florence.

There was a family in that city, the members of which had immemorially practised medicine, from which circumstance they acquired the name of Medici, and adopted a coat-of-arms, which consisted of a shield argent charged with six golden pills. From medicine, they turned their attention to trade, and became wealthy and powerful. The first member of the family whose affluence was conspicuous, was Giovanni de Medici. "By a strict attention to commerce," says Roscoe, "he acquired immense wealth; by his affability, moderation, and liberality, he ensured the confidence and esteem of his fellow-citizens. Without seeking after the offices of the Republic, he was honoured with them all."

Cosmo, his son, added to the wealth and consequence of the family. But the splendour and magnificence of the Medici were complete in the person of Lorenzo, the grandson of Cosmo. The wealth of this distinguished Florentine was immense, and was derived from various sources. One branch of trade from which vast profits accrued to him, was the products of the East. In the year 1421, Taddeo di Cenni, a Florentine, having resided in Venice, and seen how wealthy that state had become from its Eastern commerce, induced his country to attempt to obtain a share of it. "Six new officers were accordingly created, under the title of Maritime Consuls, who were to prepare, at the port of Leghorn (the dominion of which city the Florentines had then lately obtained by purchase), two large galleys and six guard ships. In the following year the Florentines entered on their new commerce with great solemnity. A public procession took place, and the Divine favour was solicited upon their maritime concerns. Ambassadors were accredited to the Sultan, and were provided with rich presents to conciliate his favour. In the following year the ambassadors returned, having obtained permission to form a commercial establishment at Alexandria, for the convenience of their trade, and with the extraordinary privilege of erecting a church for the exercise of their religion."

Thus Florence became a formidable rival of Genoa and Venice in the Eastern traffic.

Another great source of profit to the Medici was agriculture. In various parts of Tuscany they possessed extensive lands. These they cultivated with great assiduity and success, and they were the exporters from the port of Leghorn of corn, wine, and various kinds of fruits. It was situated in the midst of a swamp, but the Medici, at their own expense, cut canals through the marsh, and built the mole and the port.

Another source from which the Medici also derived great riches was the trade in alum. Almost all the alum works in Italy were either owned or hired by them, which gave them a monopoly of that branch of commerce, the profits of which must have been immense, considering that the manufacture of alum was at that time confined exclusively to Italy. The manufacture of silks which the Italian Republics, but especially Florence, carried on to a great extent, rendered a plentiful supply of alum an object of the greatest importance. To give lustre and permanency to the colours which they imparted to their costly fabrics, alum was the best mordant.

The most valuable alum works were in the Papal dominions, especially those near Civita Vecchia. In the reign of Queen Elizabeth, Sir Thomas Challoner discovered alum mines on his estate, near Gainsborough, in Yorkshire, but he was ignorant of the mode of working them. Knowing that in Italy, and especially in the Papal dominions, there were persons skilful in that art, he tempted over two workmen from Civita Vecchia. He experienced considerable difficulty in getting them away, but he succeeded by concealing them in a tub. When the

Pope discovered the fraud which had been practised, he was highly incensed, and he fulminated that terrible anathema which is known as Genulphus's curse.

"But the principal source of the riches of the Medici family arose from the commercial banks which they had established in almost all the trading cities of Europe. At a time when the rate of interest greatly depended on the necessities of the borrower, and was in most cases very exorbitant, an inconceivable profit must have been derived from these establishments, which were often resorted to for pecuniary assistance by the most powerful sovereigns of Europe."

At a period when the princes of Europe were seldom at peace with each other, when gold was constantly required to pay the wages of the condottieri, or hired soldiers, which were retained in the service of almost every State, it was very convenient to be able to resort to a bank of this description, where, by pledging crown jewels, or other valuable property, the necessary sum would be advanced. In 1524 Charles V., requiring money to pay his troops, and the Spanish Cortes refusing to grant him any, mortgaged the revenues of Naples, and the Constable Bourbon, who had then gone over to the emperor, raised a considerable sum by pawning his jewels.

Most people are aware that the golden balls, two at the top, and one at the bottom, constitute the sign of the pawnbrokers. Few, however, know the meaning of it. The three golden balls represent the gilded pills which were the arms of the Medici, and over every bank and every establishment belonging to that family, gilded pills were placed.

(*To be continued.*)

COMPETITION FOR THE FIELD COMPARED WITH COMPETITION WITHIN THE FIELD OF SERVICE.

By Edwin Chadwick C.B.

Such is the title of a paper, read before the Statistical Society, by Mr. Edwin Chadwick, in which he discusses the principle as it regards the railway service, water supply, gas supply, burial of the dead, cab service, distribution of bread, flour, and beer. As the paper is too long for insertion in the *Journal*, a portion of it only, viz., that relating to the distribution of bread and flour, is selected. Before, however, proceeding to that branch of the subject, it will be right to call attention to Mr. Chadwick's remarks explanatory of the principle enunciated in his title.

In the first place, Mr. Chadwick calls attention to the following table, showing the comparative results of railway legislation and administration in Europe :—

Country.	Population per Statute Square Mile.	Average Cost of Railways per Mile.	Average Working Expenses per Mile.	Average Earnings per Mile.	Average Fares per Mile. 1st class.	2nd class.	3rd class.	Average Payment per cent. to Original Shareholders.	Proportion of Accidents and Injuries to Persons carried.	Number of Times Less Dangerous than in England.
		£	£	£	D.	D.	D.			
England, 1857... ...	304	39,275	1,564	3,161	2·01	1·41	·87	3·88† / 4·26§	1 in 183,903‡	...
France, 1854... ...	168	25,668	1,191	2,706	1·55	1·16	·84	6·58§	1 „ 1,375,092	7 times.
Belgium, 1856... ...	337	16,391	1,259	2,158	1·33	1·0	·65	5·48§	1 „ 1,611,237	9 „
Prussia, 1857.	138	14,486	1,248	1,983	1·4‖	1·15	·77	7·44§	1 „ 3,294,075	16 „
Austria, 1857... ...	143	18,465	1,239	2,686	1·4	1·1	·83	6·75§	...	...
Germany, 1857... ...	...	13,232	898	1,417*	..	...	...	5·52§	...	...

* The average cost of coke per mile travelled is, in Germany 4s. 8d.; in England it is 2s. 9d.

† Proportion per cent. of Net Receipts, less interest, on Preference Shares and on Loans, to the ordinary Share Capital; but the latest returns give it as 3·06.

‡ Out of 405 cases of so-called Accidents, inquired into from 1853 to 1857, only 43, or 1 out of 10, was reported upon as having arisen apparently from causes beyond control. The great bulk of Accidents were reported to have arisen, not from the neglect of the inferior officers, but from the insufficient regulations, or want of discipline, or misplaced parsimony of the Directors and superior officers.

§ Proportion per cent. of Net Receipts to the total Capital Expended, Governmental and private, but the return to the private Companies is 9 per cent.

‖ In Prussia and the rest of Germany the proportion of passengers is, of the 1st class, 1·7 per cent.; 2nd class, 23 per cent.; 3rd class, 75·3 per cent. In England, it is, 1st class, 13·5 per cent.; 2nd class, 31·6 per cent.; 3rd class, 54·9 per cent. "But it is to be recollected," says Captain Douglas Galton, "that in Germany the 2nd class is as comfortable as our 1st class." The same may be said of most of the continental 2nd class carriages.

On this table he remarks :—

"The first question which naturally arises on the consideration of this table is, what are the causes of the difference of results against England which it presents? To this question several answers may be given;—as defective legislative principles;—defective administrative principles. But I shall endeavour to show that the master defect, from which the two others arise, is defective economic science and principle; or, in other words, public ignorance that there are different conditions of competition—sound and unsound; that whilst there are conditions of competition which ensure to the public the most responsible, the cheapest and best service, and which are requisite to improvements of the greatest magnitude, there are conditions of competition which create inevitable waste and insecurity of property, which raise prices and check improvement, which engender fraud and violence, and subject the public to irresponsible monopolies of the worst sort."

Mr. Chadwick then proceeds to explain what is meant by the terms of his title. He says :—

"I may, perhaps, best expound the principle by which the differences in result presented in this one table, and others from different branches of service are governed, if I relate the circumstances under which that principle was presented to me.

"From 1838 to 1841, whilst examining the sanitary conditions of town populations, I found urban districts in England, where there are two or three sets of water-pipes carried through streets which might be as well or better supplied under one establishment, and competitions ending in strict monopolies, bad and deficient supplies at high charges to the public, with low dividends to the shareholders, and an almost impracticability of improvement in their separate condition without augmenting the already excessive charges of the ratepayers or further reducing the low returns to the capitalists. These competitions are what I then designated as competitions 'within the field of service.' As opposed to that form of competition, I proposed, as an administrative principle, competitions '*for* the field,' that is to say, that the whole field of service should be put up on behalf of the public for competition,—on the only condition on which efficiency, as well as the utmost cheapness, was practicable, namely, the possessions by one capital or by one establishment, of the entire field,

which could be most efficiently and economically administered by one, with full securities towards the public for the performance of the requisite service during a given period. The principle was, upon due consideration, extensively adopted and advocated by permanent public officers, commissioners and disinterested public investigators for the regulation of enterprises in railways, then at their commencement;* but the views chiefly advocated by speculators and persons who profit by multiplied conflicts—who gain whosoever else lose—were adopted by Parliament. The principle was, however, upon independent consideration, adopted by the continental administrators and legislators, and the results stand out in wide and undeniable contrast of legislative and administrative ability and integrity.—In France, for example, in a much more responsible and more regular service for the public at lower fares, with higher-priced materials, with dearer fuel, poorer, thinner, and less active population, and lower elements of traffic; and yet, with an average return of from seven to nine per cent. to the original shareholders of the lines worked by Companies. In England we have a clashing, immensely more dangerous, unsatisfactory, and generally less responsible service to the public; fares, as contrasted with the continental fares, generally one-third higher, with fuel, iron, and machinery cheaper, and population and traffic more active; yet with only an average return of 3·06 per cent. to the original shareholders, with extensive ruin to them—with gigantic fortunes to the promoters of conflicts. In France, the original shareholders have moreover, the elements of security and further improvement to their property, whilst the French public have in reversion, on the termination of the present concessions, the prospect of further reductions of fares, and increased facilities for intercommunication, or a new source of revenue, derivable from past economy in reduction of the general taxation of the country. In England, the greater mass of original shareholders have before them elements of further depreciation, loss, and even ruin, by the bounty afforded by the practicability of cheaper constructions and by competitive extensions, that are not to be averted by the patchings of quarrels or by any combinations of their respective directories,—whilst the public have the main arteries of communication—which ought with sound legislation to be as cheap and free as any in the world—clogged with inconveniences and even with delays as well with high charges, amounting to between six and seven millions per annum in excess at the present time of what a sound administrative principle would have insured. The maladministration which has incurred the excessive outlays—which maintains nearly a hundred separate chief and independent establishments, at the expense of the shareholders, and to the inconvenience and loss of the public in working,—seeks to impose these excessive charges upon the public by high fares, and does so in defiance of the experience thus enunciated by an observer of railway administration, that 'There is hardly an exception to the rule. that a high fare produces a low amount of traffic and stunts its growth, while a low or moderate fare collects a larger amount of traffic and fosters growth.'†

With regard to the application of the principle to the supply of bread and flour, Mr. Chadwick says:—

"I recognise as a fact of common experience, that where a single tradesman is permitted to have the entire and unconditional possession of a field of service, as in remote rural districts, he generally becomes indolent, slow, unaccommodating, and too often insolent, recklesss of public inconvenience, and unprogressive. To check these evils, competition of a second is no doubt requisite; and, where the two combine, the intrusion of a third. But experience should be consulted, and the public intelligence must be exercised against hounding on a competition which consideration would show involves palpable waste,—as where two or three capitals may suffice for the performance of a service moderately well, the intrusion of a fourth, fifth, or sixth competing capital eventually leads to its being performed immoderately ill.

"In the service of the baker, for example, in London, the profit in the production and distribution of bread is, under ordinary circumstances, about twelve shillings per sack of flour, making 94 four-pound loaves, being nearly one penny three farthings per loaf. A field of supply or sale of twelve or fourteen sacks a week, according to local circumstances, may be assumed to be a 'living profit' for a respectable baker in a moderate way of business in London, to pay the rent and taxes of a £60 or £80 house and shop, with its bakehouse. With the same bakehouse and shop, and nearly the same fixed establishment charges, he might produce and distribute double the quantity; but from this he is generally precluded by a competitor. Upon fields of supply so occupied with double capitals other competitors break in, until the share of the field is reduced, often to the distribution of six sacks a week, and sometimes to four sacks each, or to an occupation by four capitals of a field in which competition would be better maintained by two. The sanitary condition of the small bakers and competitors in towns, whether masters or journeymen, is most wretched. The bakehouses are confined, miserable, and unwholesome. The little master, to pay his rent, lets off the upper portions of the house, and crowds himself and family in the lower apartments. The small capitalist who enters into this sort of competition is frequently a man of small understanding and of the smallest skill in working of his material, except when, under the pressure of his necessities, his ingenuity is excited in adulterating it. He is obliged to obtain flour on credit, and is supplied with that of the worst quality.

Under the ordinary circumstances of the competitor within the reduced fields, he is almost compelled to extort from the public his excessive establishment charges by cheating, by adulterations, by short weights, by bribing servants, and by overcharges as to the quantities. Fines may be inflicted, but the necessities being pressing and continued, the frauds and invasions are continued. The only chance of relief for the public will, I apprehend, be found to be in removal of the producer's necessities and temptations by creating widened fields of supply and corresponding production on a larger scale.

"It must be admitted, however, that experience of the contracts for the supply of poor law unions and for large public establishments in England, show that the enlargement of the field of service does not alone suffice as a complete security, at the least under the existing conditions. So difficult was it found to obtain good biscuit for

* *Vide*, amongst other expositions, that contained in the admirable report of Messrs. Drummond and Barlow, Commissioners for Railways in Ireland.

† "Herapath's Railway Journal" of 1st January, 1859, cited with illustrations, in Mr. Samuel Brown's paper, printed in the Statistical Society's *Journal* for June last. *The Engineer* states some of the admitted loss thus:—"Our present lines fall immeasurably short of perfection in the character of earthwork, *drainage*, and ballasting, and in the form, bearing, and fastening of the rails. Their inequalities of whatever kind become the direct absorbents of a large proportion of driving power, and are constantly aggravating themselves in a worse and worse condition. But for the frightful waste of capital in the construction of our railways, the consequences of which are entailed perpetually on the people in the shape of high fares, moderate speed, and very inferior accommodation, we might, with the aid of proper improvements, be able to make the run from London to Liverpool regularly in three and a-half hours, and from London to Edinburgh as regularly in seven hours, and at a fare no greater, if as great, as that now charged. Under such circumstances there would, of course, be separate lines for passengers and goods, and with a system of road-police, or signal-men, throughout the length of the lines, there would be even less danger of accident than at present." On some of the public evils of separate railway establishments, *vide* report published by the Society of Arts on a "Parcel Post," July 9, 1858.

the navy, that it became absolutely necessary to establish governmental bakeries, a measure which was attended with entire success, both in the purity and economy of the product; and the experience of the army contracts for provisions, shows that resort must be had to original production as a security. At Birmingham the quality of the bread supplied under the highest competition of numerous small capitals, had become so bad that a private company was set up, on small shares, for baking bread, and having the good fortune, for a joint stock company, of getting a good practical management, pure bread was made and sold at a penny a loaf cheaper than by the numerous small bakers; and the company gaining a wide field of supply, a good profit was divided amongst the shareholders. In time, the principle of unity of management on a large scale prevailed, the shares of the company were bought up by one manufacturer, who had another large manufacturer as a competitor within the field. The result of this modified competition for the larger field was, that Birmingham was supplied much cheaper and better with bread than any of the adjacent towns.

"From the difficulty of obtaining unadulterated bread in London and elsewhere, private families are driven, much to their inconvenience, to bake for themselves; but their object is extensively defeated by the difficulty of obtaining unadulterated flour. At the meeting at Birmingham of the Association for the Advancement of Social Science, a paper, containing highly important economical and social facts, was read by John Holmes, of Leeds, on 'The Moral and Economic advantages of co-operation in the Provision of Food.' To meet the difficulty of obtaining unadulterated flour, co-operative associations, which were in reality joint stock companies, were formed, in £1 shares, first and most successfully at Rochdale, in 1844, and then at Leeds, in 1847, by the more intelligent persons of the wage class. At Rochdale the capital of one association amounts to £14,000, inclusive of a mill, and the business done by them, with a good profit, amounts to £90,000 per annum. Their profit is gained chiefly by the saving of establishment charges of numerous small capitalists, of whom it is calculated that eighty have been superseded by the one society, having less than half the number of places of subdistribution conducted by salaried servants, and by performing the service of distribution at little more than one and a quarter per cent. at the central or wholesale establishment, and two and a half per cent. at the retail branches;—whilst private trades do not effect the chief distribution at less than 5 per cent., and the subdistribution at less than 15 or 20 per cent., or even more. They have, from their complete success, been led to extend the operations of joint-stock stores to meat and groceries with the like success. In speaking of the results of the Leeds Flour Mill Society, Mr. Holmes says, 'if 20,000 people will agree at once to give their orders for flour, and will find the requisite capital, then all expense of catering for a business is saved and all risk avoided. Capital can be adapted to requirement, and the machinery can be exactly fitted to supply. No power need be wasted, and no disadvantage accrue from the want of means. No traveller need be paid to seek orders, no cost of law in recovering bad debts, and above all, no loss of debts being incurred."

"In one district near the Leeds mill it has been shown that the shops for provisions have no relation to the number of the consumers, and it has followed that of twenty persons beginning in these shops, fifteen have lost their all and more, for five who have succeeded in living. All failure is loss to the public as well as to the private "trader."*

"But the Birmingham example of the manufacture and distribution of bread on a large scale, and other instances which may be cited, appear to be in advance of those of extended distributions of flour, because in the large scale the saving out of the waste incidental to the home baking, is sufficient to allow the bread to be made and distributed to them for nothing beyond the prime cost of the materials. M. de Fautier shows that in France the public bread making is really eleven per cent. cheaper than the domestic bread making, allowing 4 per cent. as the value of the domestic labour, but not allowing for the domestic mischances of burned bread, ill-fermented, sodden, and spoiled bread; yet in France, the art of domestic bread-making is commonly in advance of England. In France, too, there have been of late improvements in the construction of the larger ovens, which further reduce the cost of fuel one-third. In the common practice of baking, in the kneading of the dough in England, the journeymen are stripped to the waist, and in consequence of the severity of the labour, and the excessive heat of the bakery, profuse perspiration is induced, and this is unavoidably mixed up with the material. Moreover the journeyman baker is afflicted with a skin disease peculiar to his occupation. In the government bakeries 450 pounds of dough is mixed up in four minutes, and kneaded in six minutes, by machinery, and the improved machine labour performs at 5d. per cwt., including wages, with wear and tear of utensils, what previously cost 1s. 5d. I am assured that at Carlisle, where some bakeries on a large scale have been long carried on, and the work is enabled by the scale to be performed by machinery, the workmen are better paid than in the common bakeries, and are put in a good sanitary condition, and the product is superior in quality, as well as cheaper.

"In France the principle of competition for the field, and a considerably improved production is effected by the authoritative extension of the field of competition and supply. In Paris the total number of bakers in proportion to the population is restricted to nearly one-third that of London; the establishments are consequently on a larger scale; the art of baking is in advance, and the rate of production of better bread is on the average one penny a loaf cheaper than in London, which it may well be with reduced establishment charges, and really more powerful competition. Dr. Ure states—it is proved, indeed, that in Paris the baker's charge on the four-pound loaf is a halfpenny, whilst in London it is about a penny three farthings. M. de Payen, a member of the Institute, has examined the practice of bread making in England, as compared with that in France, and reports, that the proceeding on the same basis as to the price of flour, the price of bread, which is pure in Paris, is as 6 against 7 in London, for bread which, on analysis, he found to be generally adulterated. Mr. E. O. Ward has examined the system of bread-making in France, as compared with that in England, and concurs with M. Payen as to the public advantage of the principle of regulated competition for the field. The bakers with whom I have spoken in England on the economy of their trade are unanimous in their declaration that the public might be better and cheaper supplied by one-half their present number.

"Mr. F. O. Ward informs me that in Paris the bakers of the *banlieue*, or suburbs, who have never been under regulation as to number by which the bakers of Paris are governed, have multiplied to about three times their number (relatively to the population they supply) of their Parisian brethren,—the increase bringing them up, curiously enough, to about the same excessive proportion as prevails in London; thus showing how in economical statistics the same laws in operation bring about everywhere the same results. The suburban bakers of Paris, Mr. Ward states, petitioned some years ago, as well in their own interest as in that of the public, to have their numbers reduced and placed under permanent restriction. In this singular document these bakers show the disadvantage under which they labour in consequence of this freedom to multiply at random. They set forth for a period of years, the annual excess of bankruptcies among the bakers of the *banlieue* above the average occurring among

* A proportion of these operative joint stock companies appear to have failed, from causes which occasion the frequent failure of the middle class joint stock companies—such as insufficient capital, defective accounts, insufficient audit, and want of business skill.

their Parisian brethren; and on other tables contrasted columns show how much more frequently shops change hands in the suburbs than in the city from the ruin of their proprietors. They further establish that the average quality of the suburban bread, made under free competition, is inferior to that of the bread made under regulated competition in Paris—the struggling bakers of the *banlieue* being driven to eke out their scanty profit by using inferior flour, and too often by having recourse to adulteration. They show how the poverty of a majority of the suburban bakers place them at the mercy of the great millers, who first get the poorer bakers a little into their debt, and then oblige them to accept inferior flour at a price beyond its value; an extortion of which the baker is only the first victim, and by which the consumers of the deteriorated bread, *i. e.*, the suburban population, are the ultimate sufferers. They offer to find among themselves the money required to buy up and close the redundant establishments, and they declare themselves ready to submit to the restriction of price imposed on their Parisian brethren, provided they can be secured against the intolerable evils of excessive multiplication, so injurious to the consumer as well as to the producer. It is rare, as Mr. Ward observes, to see two commercial systems at work in such close proximity, and with such sharply contrasted results; and it is probably rarer still to find the victims of unregulated economical freedom conscious of its pernicious influence on their own usefulness and happiness, and petitioning for regulated freedom as the only true remedy for their misfortunes. Bread in Brussels, with unregulated competition, was dearer and worse in quality than in Paris. In the poorer quarters of Brussels the small shops for retailing bread literally swarmed. To meet the evil a manufactory of bread on a large scale was established, which produced better bread at a lower price than the petty bakers could turn out, and it is stated to be prospering well. In France there are fiscal and other regulations requiring the bakers to keep reserves of flour, &c., to which economical objections may attach, but they are quite beside the principle propounded in the regulation of competition. Experience everywhere shows, that whilst the extension of the field of production reduces the temptations and the means to falsification and inferior production, the unlimited reduction of field augments and almost necessitates them, so much so, that it has become a popular aphorism, applicable to this particular branch of industry, that 'an empty sack can never stand upright,' whilst a full one may. By breaking the service in question into fragments, the large moral and legislative error is committed of putting sinister interest against duty, under conditions which it will be shown also in respect to another branch of service, make such interests too strong for private morals, for the law, and public administration.

"To give a conception of the extent of the financial bearing of the economical question, I may state that some years ago I had occasion to make what I term an economic analysis of a four-pound loaf—that is to say, how much of the cost of production, of transport, of distribution, there was in it; when I found, that at the prices and the rents of the time—averaging in England 25s. per acre—the rent in the four-pound loaf was about three-farthings, whilst the cost of distribution was more than three-halfpence. On the like economical analysis of the cost of a pound of meat to the consumer, the charge to him for distribution appeared to bear the like proportion, *i. e.*, double the rent in the price of the commodity to the consumer. It appeared, generally, that the cost of distributing the produce of the soil was double the rental of the soil. It appeared that, by the extension of the field of the service, and the saving of the charges of unnecessary establishments and labour, the service of distribution might be greatly improved, and the expense reduced to less than one-half; or, in other words, the result was indicated of a possible aggregate saving to the community equal to the whole rental of the land—equal to the whole of the general taxation of the country."

FIGURED WEAVING BY ELECTRICITY.

A very remarkable invention has just been brought over to this country, by M. Bonelli, the Director-General of Sardinian telegraphs, one which may possibly revolutionise the weaving art, as well as extend its capabilities in directions where hitherto it has been stopped by the costliness, both in time and money, of the multiplication of the necessary Jacquard cards. M. Bonelli, who has been long known as a man of science, as well as a practical engineer, has for many years past had his attention turned to the application of electricity as a substitute for the Jacquard apparatus in the loom, but he has only lately been able so to perfect his arrangements as to bring them before the commercial world in a form which he considers adapted for general use.

So long ago as 1852, M. Bonelli constructed an electric loom which was exhibited at that time in Turin, but the first trial to which the machine was submitted gave but small hope to those who saw it, that the inventor would succeed in his object. The public trial at Turin, in 1853, in the presence of manufacturers, was not so successful as to remove all doubts as to the merits of the novel apparatus. In the following year it was submitted to the judgment of the Academy of Sciences at Paris, who appointed a committee to examine it, but it is believed that no report was ever made. In 1855, a model of the loom had a place at the Universal Exhibition at Paris, but the lateness of its arrival there prevented any official report being made in reference to its merits. Since then, M. Bonelli has devoted much time and attention in endeavouring to remedy its defects and to perfect its working, so as to render it capable of holding its place in the factory. This M. Bonelli believes he has at last accomplished, and he has brought over to this country not merely a model, but a loom in complete working order, which he is prepared with confidence to submit to the judgment of manufacturers, as a machine which, from its economy and efficiency, may be put in favourable comparison with the Jacquard loom.

To explain in detail the actual mode by which M. Bonelli produces the required results would be impossible without diagrams, but the general principles upon which the loom acts may be described.

In the first place, it must be understood that the special object of M. Bonelli's machine is to do away with the necessity for the Jacquard cards used to produce the pattern at the present time, the source of delay and very considerable cost, more especially in patterns of any extent and variety of treatment. M. Bonelli uses an endless band of paper, of suitable width, the surface of which is covered with tin-foil. On this metallised surface, the required pattern is drawn, or rather painted with a brush in black varnish, rendering the parts thus covered non-conducting to a current of electricity. This band of paper, bearing the pattern, being caused to pass under a series of thin metal teeth, each of which is in connection with a small electro-magnet, it will readily be conceived that as the band passes under these teeth, a current of electricity from a galvanic battery may readily be made to pass through such of the teeth as rest on the metallised or conducting portion of the band, and from such teeth, through the respective coils, surrounding small bars of soft iron, thus rendering them temporary magnets, whilst no current passes through those connected with the teeth resting on the varnished portions. Thus, at every shift of the band, each electro-magnet in connection with the teeth, becomes active or remains inactive according to the varying portion of the pattern which happens to be in contact with the teeth. In a moveable frame opposite the ends of the electro-magnets which, it should be stated, lie in a horizontal direction, are a series of small rods or pistons, as M. Bonelli terms them, the ends of which are respectively opposite to the ends of the electro-magnets. These pistons are capable of sliding horizontally in the frame passing through a plate attached to the front of it. When this frame is moved so that the ends of

the pistons are brought into contact with the ends of the electro-magnets they are seized by such of them as are in an active state, and on moving the frame forward, those are retained while the others are carried back with it, and, by means of a simple mechanical arrangement, become fixed in their places; thus there is in front of the frame a plate, with holes, which are only open where the pistons have been withdrawn, and this plate, as will be readily understood, acts the part of the Jacquard card, and is suitable for receiving the steel bars or rods in connection with the warp threads as ordinarily used.

Each shift of the pattern, combined with the backward and forward movements of the frame bearing the pistons, produces a different series of holes in the plate, which thus becomes what may be termed a universal Jacquard card, changing its face each contact, in accordance with the requirements of the pattern. Thus the electric loom gets rid of all those costly preliminaries which are required for the preparation of the cards, accomplishing instantaneously and automatically an analogous operation.

The electric power required is that derived from two cells of a Bunsen battery. The operations necessary for weaving by means of electricity are reduced to tracing the design on the metallised paper with a non-conducting varnish.

The inventor claims the following as the results of his invention:—

First.—The great facility with which in a very short time, and with precision, reductions of the pattern may be obtained on the fabric by means of the varying velocity with which the pattern may be passed under the teeth.

2nd.—That without changing the mounting of the loom or the pattern, fabrics thinner or thicker can be produced by changing the number of the weft, and making a corresponding change in the movement of the pattern.

3rd.—The loom and its mounting remaining unchanged, the design may be changed in a few minutes by the substitution of another metallised paper having a different pattern.

4th.—The power of getting rid of any part of the design, if required, and of modifying the pattern.

The length of paper required for a pattern depends, of course, on the nature and extent of it, but an idea may be formed generally by recollecting that at each stroke of the shuttle a card of the Jacquard apparatus is brought into operation, while in M. Bonelli's invention, the paper having the pattern moves at the rate of a fraction of a millimètre, at each stroke. M. Bonelli gives the following calculations by way of comparison between the old and the new systems.

He takes a damask design on the old system, requiring 4,000 cards, and with 400 Jacquard wires.

The cards will cost, at 12s. per hundred, £24. The time employed for the *mise en carte* of the pattern, the reading it off, and punching 4,000 cards, cannot be taken at less than about five weeks.

On the electric system, the executing the design on the metallised paper, ready for putting on the loom, he calculates at £6. The time employed would be a week, showing a difference in favour of M. Bonelli's system, in this case, of £18 in money, or 75 per cent., and in time of 80 per cent.

Taking a more complicated case, namely, furniture damask, with a simple ground, and two sets of wires of 600 each, and requiring 20,160 cards.

The cards at 15s. the hundred will cost £151 4s. As regards time, assuming that it is desired to get the loom to work quickly, there must be employed a designer, and five persons for the *mise en carte* for one month, and after this, six readers employed for another month, thus making six men employed for two months, or, what amounts to the same thing, one man employed for twelvemonths.

On the electric system:—

The cost of the first sketch	£ 4
Putting the design on the metallised paper	22
Total	£26

The time employed by the designer would be one month, showing a difference in favour of M. Bonelli's system of £125 4s. in money, or 81 per cent., and in time of 90 per cent.

The cost of the electricity is calculated at one penny per day.

The loom has been set up in one of the rooms of the Magnetic Telegraph Company's offices, in Threadneedle-street, and M. Bonelli has courteously invited the Members of the Society of Arts to witness it in actual work.

FLOATING GRIDIRON FOR RAISING AND REPAIRING VESSELS.

An apparatus, intended to answer these purposes, has been designed and patented by Mr. William Collett Homersham, whose attention appears to have been drawn to the subject, by having been called upon to advise as to the best form for a floating dock in a port on a tideless sea, and who spent considerable time in ascertaining the particulars and details of the various projects relating to the subject that had been brought before the public.

The apparatus consists of a longitudinal or lower series of caissons, which are preferred to be circular in their cross section, for economy of construction, but may be oval, or any other convenient form, if the difference in the draught of water is material. These caissons have bulkheads fixed in them at convenient intervals, which have the effect of dividing the caissons into portions, into some of which water may be admitted, or from some of which it may be withdrawn, as required, for the purpose of trimming the structure. There is also a transverse or upper series of caissons, which are intended to be rectangular in their cross section, and partly curved under the vessel's bottom, being formed in such manner as is best adapted for given lateral stiffness and steadiness to the structure when afloat. These transverse caissons are united firmly to each of the longitudinal caissons, but need not have any internal communication therewith, excepting as to the centre one, or other which may be preferred, and which likewise communicates with the engine and pump rooms by means of hollow columns. The engine and pump rooms consist of a hollow pontoon on each side of the structure, supported by means of caissons, tapering towards the bottom, or by columns, or in any other convenient manner. There are also caissons which are intended to be placed on the top and along the outer ends of the transverse caissons, when a "Gridiron" of considerable magnitude is constructed, such caissons having each a power of displacement equal to about one-twentieth of the entire weight to be lifted. There are gangways, one on each side of the structure, which will be found convenient in working, and are supported on columns of timber or metal, having racks formed on their sides. Below these are water-tight caissons, built with holes or passages through them, corresponding with the columns in such a manner as to allow of the latter passing through them and working up and down therein, with the raising and lowering of the structure. The last mentioned caissons are capable of sliding freely on these columns, or of being retained, as required, by pawls taking into the racks, and the parallelism of their up and down motion may be regulated by a shaft with bearings and pinions taking into racks, or otherwise.

The object of these caissons is to give stability to the structure when raising or lowering a vessel, and, in combination with the engine and pump rooms or hollow pontoons, to prevent the structure from sinking too low. It is preferable to have the transverse caissons of such cubical contents as to render the whole structure slightly above the specific gravity of water, at the time when the lower caissons only are filled with water, as it is better never to admit water into the transverse caissons. There is a flooring on the top of the transverse caissons, forming an extended platform, on which workmen may carry on their opera

tions. The bed for the keel of the vessel to rest on extends as usual along the centre of the dock or "Gridiron." The ordinary sliding blocks for shoring up or supporting the vessels are made use of.

The mode of using the "Gridiron" is to let water into the longitudinal caissons, so as to lower the structure to the required depth, and by regulating the quantity of water admitted between the different bulkheads, the structure is brought into the position adapted to receive the keel of a vessel which may be drawing more water abaft than forward, or vice versâ. By taking a greater portion of water from between the bulkheads situated immediately beneath that part of the vessel containing the greatest weight (say, the engine room of a steamer), all undue tendency to strain the vessel or the "Gridiron" is avoided. When the vessel has been placed in position over the Gridiron thus sunk to receive it, the moveable caissons described above are floating freely on the top of the water (their pawls having been thrown out of gear before the sinking commenced), and in order to raise the vessel the water is pumped or forced out of the longitudinal caissons, at an equal rate on both sides of the keelson. As these caissons are lightened of the water, the whole structure gradually rises on a level, while the water is pumped out equally on both sides, but should there be an inequality in the pumping, or should the centre of gravity of the vessel get displaced, the Gridiron would have a tendency to sink on the heavier side. This tendency, however, will be counteracted by the moveable caissons, the pawls of which, being now in gear, establish a connection between them and the structure, so that the latter cannot go down without taking the said caissons with it, and these are made of sufficient capacity to resist such tendency.

Hence by merely pumping faster from the heavier side, the whole structure is readily made to assume its required horizontal position. As the vessel is raised out of the water, the weight on the structure becomes materially increased, and therefore in lifting large vessels there should be caissons fixed in such a position that they may come into operation when the vessel is drawing five or six feet of water. These caissons may be in any number of pieces, and of very light material, as they are not intended to add strength to the structure.

Some of the advantages claimed for the Gridiron by its inventor are, simplicity of design and details, and consequent cheapness in first cost; the fact of no bolt holes being required through the shell of the pontoons; the facility with which every portion can be easily examined, when the structure is in use or otherwise; great stability *transversely*, as well as longitudinally, when submerged, and the vessel is being raised or lowered; capability of being moored in any ordinary dock or sheet of water, without any alteration in the dock-walls, &c.

The inventor is of opinion that the great lateral stiffness possessed by it, not only when floating with its load, but when raising the vessel, will render it useful in examining ships' bottoms and steamers' screws, &c., in a protected roadstead. He states that one of moderate dimensions (say 220ft. in length) could be taken to pieces, and moved from any dock in London to another, and refitted in working order in one week, and at a cost not exceeding one hundred pounds.

The inventor anticipates that the "Gridiron" will prove a very useful auxiliary to the various lifting apparatus used in raising sunken vessels. It is well known the greatest difficulties and the most severe strains on the sunken vessel are experienced in raising it above the surface of the water. In combination with the "Gridiron" he states that it would only be necessary to raise the vessel beneath the surface sufficiently to get that structure under, when it would accomplish the rest without straining the vessel in the slightest degree.

The inventor has a large working model to a scale of a Gridiron, 165 feet on keel, and a model ship loaded in proportion to 1320 tons (equal to 8 tons per foot run) placed upon it for the purpose of experiment.

Proceedings of Institutions.

Derby Working Man's Association.—The members of this Association held their annual meeting in the Temperance-hall on Monday evening, the 2nd January, under the presidency of W. T. Cox, Esq., the Mayor of the borough, who was supported by the founder of the Association, the Rev. J. Erskine Clarke, Alderman Gadsby, H. Holmes, Esq., Dr. Spencer T. Hall, and other gentlemen. The Rev. J. E. Clarke read the annual report, from which it appears that the past year has been one of decided progress in the prosperity of the Society. The most important advance has been that the Association, in March last, obtained possession of the premises in front of the reading-room, and so the Committee were enabled not only to make such accommodation for the Penny Bank as its growing importance demanded, but also to provide more convenient rooms for the classes. Another gratifying feature of the past year has been that the Trustees of the Working Men's Memorial of Gratitude to Sir Robert Peel selected this Association to share the annual dividend with the Bristol Free Library and the Worcester Working Men's Institute. From this source the association received a grant of books and maps to the value of £15. The number of books in the library has been increased from 390 volumes to 508, and the number of issues has been 2,605. The Committee hope that they have made some steps towards an improved system of classes. The thanks of the Association are again due to Mr. Hammond, for an English Literature class; to Mr. Walter Meakin, for a drawing class; to Mr. Billieald, for writing; to Mr. Spencer, for instrumental music; and to Mr. Gardner, for a singing class. A discussion class has also been formed among the members, and has had several interesting meetings. A series of eight Saturday Evening Musical and Literary Entertainments have been given, which were attended by great numbers, and were so far successful in a pecuniary point of view that the Committee were able to hand over £7 to the treasurer The Committee have made two experiments in the last year. The one was a "Show of wild-flowers and cottage-window plants," which they held in the early autumn, but it was not successful in attracting as large a number of spectators as it deserved. The other was a social evening of the members and their friends in the reading-room, with the view of promoting more intimacy among the members, who can hardly make each other's acquaintance during the usual hours when the reading-room is open, without their talking disturbing those who are engaged with the papers. This social evening was spent in simple readings, conversation, and music, and was so satisfactory that the Committee have only been prevented from repeating it by their engagements at the Temperance-hall on Saturday evenings—the only evening on which arrangements can be made without the members losing time from their various avocations. The numbers of the Association indicate a marked advance on the previous years; the highest number in the year 1858 was 134 ordinary members; in the last year they have reached 212. In addition to this the honorary members have increased from 42 to 52. The total number of members enrolled since the Association was formed, in September, 1856, has been 705 The funds of the Association also indicate improvement, the debt to the treasurer having been diminished from £82 at the last gathering to £56. The Penny Bank has gone on most satisfactorily, though the balance in hand has not increased much. The balance last year was £1,021 17s. 8d.; this year, £1,120 15s. 2d. Number of deposits since opening (March 2, 1857), 6,472; number of open accounts, 3,494. Average of each withdrawal, 10s. 4½d.; of each open account 6s. 5d. Number of individual deposits, 49,104; average of each deposit, 1s. 6¾d. Paid in from beginning, £3,782 17s. 9d.; paid back, £2,662 2s. 7d.; leaving £1,120 15s. 2d. New accounts this year, 2,870; closed do., 2,101.

After the reading of the report, Mr. Herbert Holmes, hon. local secretary to the Society of Arts, explained the functions and workings of the Society's Union of Institutions, dwelling particularly upon the system of examination. He announced that the following gentlemen had consented to act as a Local Board, for conducting the preliminary examinations in connection with the Society of Arts for the Institutions in Union, at Derby :—Rev. E. H. Abney, Mr. W. T. Cox (mayor), chairman, Mr. J. Gadsby, Dr. J. Goode, Mr. F. M. Haywood, Mr. A. S. Henley, Mr. J. Hicklin, Mr. A. E. Holmes, Mr. J. Hudson, Mr. M. Kirtley, Rev. T. H. L. Learey, Mr. W. L. Newcombe, Mr. C. Pratt, jun., Mr. J. A. Warwick, Rev. W. F. Wilkinson, Mr. H. M. Holmes (secretary). —Three prizes, of two guineas, one guinea, and half a guinea respectively, were given to the writers of the three best essays, for which there were twenty-six competitors. The adjudicators were the Rev. W. F. Wilkinson, Mr. Alderman Gadsby, and Dr. S. T. Hall, who desired to make honourable mention of four other competitors.—The Rev. J. E. Clarke then read the first Prize Essay, upon the "Helps and Hindrances to Home Happiness," which was listened to with much attention, and heartily applauded.—Mr. Alderman Gadsby held it to be very creditable to the town of Derby that it contained within its ranks twenty-six artizans competent to send in twenty-six essays such as he and his coadjutors had been called to adjudicate upon. Every one of the essays sent in he had read, and from every one he had derived considerable pleasure. There was hardly one of those compositions but was exceedingly creditable to the writer. It was a novel experiment for the town of Derby, but it had been exceedingly successful, and would, he hoped, be repeated for many years to come. — Dr. Spencer T. Hall said he had great sympathy with those writers who had gained the prizes, but he had a warmer sympathy with those who had been unsuccessful. He thought some of the unsuccessful productions were from men whose literary powers were worthy of a better education to give them a polish; indeed some of them had a spirit, a picturesqueness, and an originality that might surpass in some respects the successful essays; but they had to adjudicate upon works for their completeness. Dr. Hall concluded with a few genial and encouraging words to the unsuccessful candidates.—The meeting, which was enlivened by music, closed with a vote of thanks to the Chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. Joseph Towne, "On the Organs and Phenomena of the Senses, Intellectual Powers, and Memory."
British Architects, 8. 1. Mr. G. R. Burnell, "Sixty Years Since; or Improvements in Building Materials and Construction during the Present Century." 2. Mr. James Edmeston, "On the Use of Zinc in Roofs, and the Causes of Failure therein."
Geographical, 8½. 1. Mr. J. Petherick, "Journey up the White Nile to the Equator, and Travels in the Interior of Africa in the Years 1857-58." 2. Mr. William Wheelwright, "Proposed Railway Route across the Andes from Caldera to Rosario, *via* Cordova."
Medical, 8½. Mr. Henry Thompson, "On the Great Importance of Early Diagnosis and Treatment for Stone in the Bladder."
Tues. .....Royal Inst., 3. Professor Owen, "On Fossil Birds and Reptiles."
Syro-Egyptian, 7½. 1. "On the Baal of the Bible, illustrated by a Large Fac-simile Drawing of the Assyrian Bell." 2. "On some of the Seals mentioned in the Bible." By Mr. Charles E. Harle.
Civil Engineers, 8. 1. Address on taking the Chair, by Mr. G. P. Bidder, President. 2. Renewed Discussion upon Mr. Grantham's Paper, "On Arterial Drainage and Outfalls."
Medical and Chirurg., 8½.
Zoological, 9.
Wed. .....Literary Fund, 3.
London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Graphic, 8.
Microscopic, 8.
Archæological Assoc., 8½.
Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Society Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Astronomical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December 30th*, 1859.]

Dated 23rd August, 1859.

1924. A. C. Hope, 60, Cornhill—The manufacture of a new material from Spanish moss, applicable as a substitute for horse-hair. (A com.)

Dated 1st December, 1859.

2715. A. Mercier, Louviers, France—A machine for felting the rovings, stubs, and threads or yarns of wool and other fibrous materials.

Dated 16th December, 1859.

2861. J. L. King, 56, Well-street, Oxford-street—A submarine lamp and safety lamp for mines and other useful purposes.
2863. W. Mosley, jun., Salford, Lancashire—Certain improved machinery or apparatus for washing, scouring, or cleansing textile fabrics or materials.
2865. J. J. Bennett, Homer-terrace, Victoria-park, Middlesex—An improved construction of fluid meter.
2867. R. Morrison, Newcastle-upon-Tyne—Imp. in double and single action steam hammers.

Dated 17th December, 1859.

2869. F. Hochstaetter and H. Hochstaetter, Gresham-street, City—The preparation of a substitute for gunpowder.
2871. F. C. Hills, Deptford, Kent—Imp. in means and apparatus for purifying gas, and in the preparation and treatment of oxides of iron to be used in such purification, or for other purposes.
2877. P. Spence, Pendleton, Lancashire—Imp. in repairing bells injured by cracks or fractures.
2879. W. Clark, 13, Chancery-lane—Imp. in the supports or chairs of railway rails. (A com.)

PATENTS SEALED.

[*From Gazette, December 30th*, 1859.]

December 30th.	
1558. L. Boigeol.	1662. J. Taylor.
1564. J. Bernard.	1698. J. Luis.
1574. R. Royds and A. Harcourt.	1701. H. Parent.
1584. H. Hirsch.	1702. J. C. Riddel.
1586. J. Simon.	1704. T. Curtis and J. Haigh.
1602. J. Luis.	1708. Z. G. A. N. P. Orioli.
1608. B. Seed and T. Steel.	1764. A. V. Newton.
1620. W. H. Dawes.	2188. P. I. Lejeune-Chaumont.
1652. J. Luis.	2262. W. E. Newton.
	2490. A. V. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, December 30th*, 1859.]

December 27th.	
3087. H. Vaughn.	72. J. J. Russell and J. B. Howell.
12. J. Fowler, jun.	*December 28th.*
	3089. T. Alden.

[*From Gazette, January 3rd*, 1860.]

December 30th.	*December 31st.*
3. W. Rigby.	10. A. Lorimier.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, January 3rd*, 1860.]

December 30th.	
1206. R. Taylerson.	14. C. E. Amos.
11. J. Bleackley, jun.	*December 31st.*
	9. M. Tomlinson.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name	Address.
4,222	Dec. 22nd.	Design for Dressing, Jewel, and such like Cases	James Brooks	16, Vere-street, Oxford-street, W.
4,223	,, 26th.	Picking Motion for Power Looms	Matthew Andrew Muir and James McIlwham	Anderston Foundry, Glasgow.
4,224	Jan. 6th.	A Glove	S. J. Watts and Co.	Manchester.

Journal of the Society of Arts.

FRIDAY, JANUARY 13, 1860.

THE PROGRESS OF TRADE.

By the Hon. R. Temple, Chief Justice of British Honduras.

(*Concluded from page* 114.)

A great stimulus was given to commerce by the discovery of the polarity of the magnet. The attractive power of the loadstone was well known to the ancients. The term magnet is said to be derived from Magnes, the name of a shepherd, who first discovered it with the iron of his crook on Mount Ida. The principal use which the ancients made of it was in medicine. They considered it to be a cure for burns, and for defluxions in the eyes.

In 1302, Flavio Gioia, a native of Amalfi, is by some supposed to have discovered the polarity of the magnet, and to have invented the mariner's compass. It is, however, asserted by others, that it was known to, and used by, the Chinese long before that period, and that Marco Polo, the Venetian, brought it from China in the year 1260. It is certain that the first compasses which were made were exactly similar to those which are used by the Chinese at the present day. Instead of the needle being suspended on a pivot, it was made to float in the water by means of a piece of cork.

But whether Flavio Gioia was or was not the inventor of the mariner's compass, he is certainly entitled to the honour of making it generally known and bringing it into use. From this time the science of navigation underwent a complete revolution. The discovery of America, in 1492, dealt a severe blow to Venice and the other Italian Republics, which for a long period had engrossed the most lucrative commerce in Europe, and they saw with bitter feelings the riches of the new continent pouring into Spain, which had only just extinguished the dominion of the Moors, and begun to occupy a prominent position amongst Christian nations. But they were doomed to still greater vexation by an event which took place in the year 1497. This was the voyage of Vasco de Gama to India by the Cape of Good Hope. This occurrence for ever destroyed the monopoly of the Italian States in the East Indies.

Although Vasco de Gama was the first person who doubled the Cape, and arrived at India by that route, he was not the discoverer of it. The honour of this discovery belongs to Bartholomew Diaz, who made it 1487.

In 1520 another important discovery was made, which contributed to the power of Spain, in addition to that which had already accrued to her by the conquest of Mexico and Peru. Ferdinand Magellan, a Portuguese, went to Spain, and informed Charles V. that the Molucca Islands rightfully belonged to that country. He succeeded in discovering the passage which he called the Straits of Magellan, thence steered in a northerly direction, and arrived safely at the Phillippine Islands, where he was killed. Two of the vessels, however, belonging to his fleet, arrived at the Moluccas. The route by Cape Horn, discovered in 1616 by Jacob Le Maire, a Dutchman, is, however, preferred on account of its greater safety.

Whilst Venice and the rest of the Italian Republics were driving a successful trade with the East, civilisation had, by slow marches, arrived at the more northerly parts of Europe.

This improved condition of society led to the establishment of a great mercantile confederation, called the "Hanseatic League," and those cities which became members of it were called the "Hanse Towns." Hanse is an ancient Teutonic word, signifying "Alliance." This association was established in the 12th century, the two cities which commenced it being Bremen and Amsterdam. But in the year 1200 no less than 72 cities had joined the confederation. The Hanse Towns traded with the Italian Republics, and gave them in exchange for the products of the East those natural commodities and manufactured articles which were common in the north.

At a very early period the inhabitants of Britain carried on a trade with the Phœnicians. That enterprising people obtained from them skins, wool, tin, and lead. In exchange for these articles they obtained from the Phœnicians salt, earthenware, and brass ornaments.

The Britons next carried on an extensive traffic with the Greek colony of Marseilles. It seems that they also supplied the merchants of Cadiz and Carthage with tin. Indeed, in such esteem was British tin, that it even found its way to India, and was given in exchange for the most valuable productions of that country.

But not only has Britain been celebrated for her tin at all times, but she very early became noted for her shipbuilding wood.

Two hundred years before Christ, a large ship, with three masts, was built at Syracuse, under the direction of Archimedes. "The second and third masts were got without much difficulty, but it was long before they could find a tree fit for the mainmast. This, at length, was discovered in the mountains of Britain, and brought down to the sea coast by machines invented for the purpose."

But at the same time that the Britains exported their goods to Marseilles, they also pursued a lucrative trade with the merchants of Narbonne.

But some time after the Roman invasion British commerce very greatly increased, and they exported large quantities of iron to Rome. At that time Britain contained several gold and silver mines, and those metals became also articles of trade. Jet, another product of this country, was also much valued by the Romans, and Britain was, at that period, celebrated for pearls. Julius Cæsar consecrated to Minerva, and hung in her temple, a breastplate of great value, which was composed of British pearls.

Lime, chalk, and marl were also articles of commerce. They likewise exported corn, cattle, hides, cheeses, and horses. The British horses were very beautiful and well-trained. They were purchased by the Romans for their cavalry, and it is singular that English horses are still unrivalled in any part of the world.

Another article of exportation, and by no means an unimportant one, was the dog. Three different species of this animal were exported.

Amongst the first manufactured articles exported from Britain were baskets. The banks of many of the rivers in England then abounded, and do still abound, with osiers. These baskets were highly ornamented, and were purchased by the Romans at a great price.

There was one other branch of trade which reflects very little credit upon our British ancestors. This was a traffic in slaves, who were exposed to sale in the market-place at Rome.

What the Britons received in exchange for their commodities, with the exception of four articles, we are not informed. Those articles, Strabo tells us, were ivory bridles, gold chains, amber cups, and drinking glasses. But it is probable that they imported spices, peppers, perfumes, linen and woollen fabrics, and weapons employed in war, and in the chase. It is not impossible also that they imported pictures, and brazen images of the gods.

One of the first trading towns in Britain was Clausentum, situated near where Southampton now stands. But London very soon became the great emporium of commerce. In the reign of the Emperor Claudius it was a rich and flourishing town.

In the year of our Lord 63, Tacitus describes London as "a city famous for its wealth and the great number of it merchants."

Although trade at that time was principally carried on by barter, yet the Britons, as early as the year 43, had an abundance of coined money. In the fourth century the

Britons had 800 ships employed in the exportation of corn alone.

At the commencement of the Anglo-Saxon period trade declined, but Alfred the Great, having established himself firmly on the throne, applied himself to the improvement of commerce. That monarch encouraged his own subjects, as well as foreigners, to undertake voyages of discovery, introduced new manufactures, opened a trade with various countries, and greatly improved the art of ship building. London continued to be the centre of commerce. The venerable Bede says, "The city of London, the capital of the little kingdom of Essex, was a famous emporium, frequented by merchants of several nations, who come to it both by sea and land on account of trade."

We are not acquainted with any manufactured articles which the Saxons exported, though doubtless there were many. Horses continued to be exported in great numbers, and also slaves. But laws were made, even at this early time, in restraint of trade, the presence of witnesses being necessary when bargains of any importance were made.

The object of these regulations, no doubt, was laudable. At that time few persons could either read or write, and it was deemed necessary, to prevent fraud and imposition, to have respectable witnesses to every transaction. But these laws greatly hampered commercial proceedings.

Amongst the laws of Howell the Good, one of the Princes of Wales, there was a singular law regulating the price of cats. The price of a kitten before it could see was to be a penny (be it remembered that a penny at that time was a considerable sum); till it caught a mouse, twopence; and when it commenced mouser, fourpence. It was required to be perfect in its sense of seeing and hearing, to be a good mouser, to have its claws whole, and be a good nurse. But if it failed in any of these qualities, the seller was to forfeit to the buyer the third of its value. If any one stole or killed the cat which guarded the Prince's granary, he was to forfeit a milch ewe, its fleece, and lamb, or as much wheat as, when poured on a cat suspended by its tail (the head touching the ground) would form a heap high enough to cover the tip of the former.

Between the Norman invasion, in 1066, and the 13th century, the trade and shipping of England greatly increased. Slaves were still an article of traffic, and were bought and sold not only within the island, but exported to foreign countries. A law was made against this inhuman trade by a Council, held at Westminster, in 1162.

"Let no man for the future," thus said the law, "presume to carry on the wicked trade of selling men in markets, like brute beasts, which hitherto hath been the common custom of England." But, notwithstanding this prohibitory law, the slave trade continued to flourish.

English horses continued to maintain their superiority, and sold for a high price. A war horse, or horse for the tournament, sold for thirty marks, which was equal to £300 at the present time. Wool was still exported, and also leather. At this period the English began to manufacture not only for home use, but also for exportation, woollen cloths. But the art of weaving woollen fabrics, in which the English were destined to excel all other nations, was originally imported from Flanders. Henry I. established a colony of Flemings in Pembrokeshire, who, there is little doubt, introduced the woollen manufacture. Corn was exported in large quantities. From the sale of lead and tin very great profits were derived. Most of the cathedrals and castles in Europe were covered with English lead. Amongst many other articles which were exported were salt, salmon, honey, bees' wax, and tallow.

The imports were of course various, for they came from many countries. Wines were imported from France. Spices, aromatics, gold, precious stones, silks, and other Eastern productions, came from Italy. Woollen cloth, of a finer texture than that which was manufactured in England, was brought from Flanders. Tapestry, from Arras, and furs from Norway and Russia. All persons who could afford it had their garments in winter lined with fur. Wood and other dye stuffs were imported in large quantities.

In the year 1197, no less a sum than £1,400 of our money was paid in the port of London alone for import duties on these articles. This proves that the manufacture of cloth must have been very extensive. But notwithstanding the immense quantity of foreign articles which were imported at this period, the balance of trade was in favour of England, for although no gold money was coined in it, it abounded with foreign coins of that metal.

The greatest amount of wealth was in the possession of Jews. Great numbers of that industrious and indefatigable race, after the Norman acquisition, settled in all the trading towns in England, and soon, by their skill, knowledge of trade, and command of capital, amassed great riches, but, as is well known, they were subject to tyrannical exactions.

The Jews themselves, however, when they had the power, were not less extortionate. At that period all Christians were prohibited from lending money on interest. This law was founded upon the 25th chapter of Leviticus, which says:—"Take thou no usury of him, or increase," and "Thou shalt not give him thy money upon usury, nor lend him thy victuals for increase."

The Jews, however, although this prohibition was grounded upon their own law, did not scruple to lend money upon usury, and in doing so they took a more rational view of the question, and displayed a more correct knowledge of the principles of trade then those Christian legislators who had forbidden the practice.

English ships during this period had become much more numerous, were larger, and better constructed then those of any other country; English sailors also excelled those of other maritime nations. Very early they acquired a reputation for skill, hardihood, and daring, which they have never lost. By a law of Henry II., English sailors were prohibited from entering into the service of foreign states.

During the two following centuries English commerce continued to increase, but the articles of export varied very little from those which I have already mentioned. Commercial treaties were entered into with Spain, Portugal, Bretagne, Flanders, and Norway.

The domestic trade was carried on principally at the great fairs, which were held at different places at stated periods. These fairs lasted for a considerable time, and people crowded to them from all parts of the country. The king and the nobility purchased at them jewels, plate, cloths, furniture, liquors, spices, horses, cattle, corn, and provisions of all kinds, and men and women slaves were there sold.

A considerable number of foreign traders, called merchant traders, were established in the commercial towns in England. The wealthiest, and the most numerous, were the Lombards. The English people were, however, jealous of so much of their commerce being in the hands of strangers, and they clamoured for their expulsion. The City of London presented a petition to Edward I., praying for their banishment. But the reply of that monarch was—"I am of opinion that merchant strangers are useful and beneficial to the *great men* of the kingdom." This was not a very patriotic speech, but it shows clearly in what estimation the people were held in those times. But it so happened that the merchant strangers were not only beneficial to the great men of the kingdom—they promoted the general prosperity of the country. There is little doubt that Spain began to decline immediately after the injudicious expulsion of the Moriscoes by Philip III.

About this time bills of exchange came into use. It is recorded that Peter Egiblanke, Bishop of Hereford, employed them in a very singular manner. Henry III. had contracted an enormous debt to the Pope in his attempt to make his son King of Sicily. The Pope, who was himself indebted to the Italian merchants, pressed for payment. In those days it was no light matter for a tem-

poral Prince to have the Pope for a creditor. The Holy Father had more powerful means of screwing out of his debtors what they owed him than any ordinary writ. There were such things as interdicts in those days, at which the most powerful monarchs in Europe trembled.

In this case, King Henry owed the Pope money, and the Pope wanted payment. The Pope owed the Italian merchants money, and they wanted payment. To clear away this complication of liabilities, the Bishop of Hereford aforesaid, proposed the following notable scheme to the King, "That the Italian merchants to whom the Pope was indebted should draw bills in favour of their creditors in England, on all the rich bishops, abbots, and priors in that kingdom, for certain large sums of money, alleged to have been lent by them to these prelates for the use of their respective churches; that these bills should all be sent to the Pope's legate in England, who should compel the prelates to accept and pay them by threat of ecclesiastical censures." This ingenious, if not very honest, mode of raising money, was approved of by the king, a prince who, Hume says, "was noted for his piety and devotion, and his regular attendance on public worship." In order to further the plot, the bishop was sent to Rome to obtain the consent of the Pope. This was not withheld. Bills to the amount of 150,540 marks were drawn and presented, and the prelates were compelled to pay them on pain of excommunication.

The balance of trade was greatly in favour of England at this time, as is proved by the immense amount of money which was in the country.

English shipping did not however at this time keep pace with the progress of trade. It had greatly declined since the former period. This retrogression has been thus accounted for. A very great number of merchant strangers had settled in England, and commerce was principally in their hands. In consequence of this, most of the exports and imports were conveyed in foreign bottoms.

During the next two centuries the useful arts made considerable progress. Woollen cloths of a superior texture were now manufactured in all parts of England. Metallic manufactures had likewise greatly increased. "The arts of spinning, throwing, and weaving silk, were also brought into England, and practised by a company of women, in London, called silkwomen." But now that lock upon the wheels of trade—PROTECTION—made its appearance. "This female company presented a petition to Parliament, representing that the Lombards, and other Italians, imported such quantities of silk thread, ribbons, &c., that they were in danger of being reduced to great poverty." An Act of Parliament was consequently passed prohibiting the articles enumerated in their petition.

A petition of the like nature was likewise also presented by the pinners, bladesmiths, blacksmiths, goldbeaters, coppersmiths, &c., which caused an Act to be passed prohibiting the importation of pins, knives, hangers, tailors' shears, scissors, tongs, fire-forks, gridirons, stocklocks, keys, buckles, standing candlesticks, and a great variety of other articles. The list of articles prohibited from being imported, proves the great progress which had been made in metallic manufactures.

Commerce had much increased, but not so much as it ought to have done. Its advancement had been greatly retarded by the civil contentions of this period, as well as by foreign wars.

At this time, however, an extensive trade began to be carried on in cod, stockfish, and herrings. The seaport towns on the coast of Norfolk became very wealthy in consequence of the herring fishery, which returned large profits. The reign of Henry VII. was celebrated for three grand discoveries, which greatly contributed to the English trade. These were the discovery of the West India Islands, by Columbus; the discovery of the Continent of North America and the Island of Newfoundland, by John Cabot, a Venetian merchant, established at Bristol; and the discovery of the passage to India by the Cape of Good Hope. Short-sighted men could not anticipate, that from these three events, the British Empire would become the most extensive, the most powerful, and the wealthiest which the world had ever seen.

The imported articles were very various, and were brought from every country in Europe. But English shipping continued to decline. In the former periods, of which I have spoken, when the king required ships for the conveyance of troops, or for naval warfare, he hired them of English or foreign merchants. In the reign of Henry VII. the foundation was laid for a regular Royal Navy.

There is some doubt as to who was the individual who invented printing. But the credit of it has been given to Laurentius Coster, the keeper of the cathedral at Haarlem. He made a fixed wooden type, with which, between the years 1430 and 1440, he printed several small books. During his life the invention was kept a profound secret, but after his death, his apprentice, John Geinsfleich, fled to Mentz with his master's types, and began to print in that city, where he was supported by John Faust, a wealthy citizen.

In 1474, William Caxton published the first book printed in England. It has been asserted, however, and it must be confessed that there is some evidence to favour that assertion, that Frederick Corsellis, a Dutchman, printed a book at Oxford, in the year 1468, which was six years before Caxton published his first book.

The island of Newfoundland and the coast of North America having been discovered, as I have already stated, by John Cabot, Henry VII. determined to plant colonies in that and other countries which might hereafter be discovered. He accordingly issued a commission to certain merchants in Bristol to sail into the Eastern, Western, Southern, and Northern seas, to make discoveries, and hold them as the King's lieutenants, and "whenever," says the commission, "any discovery shall be made, it is our will that men and women from England be freely permitted to settle therein and improve the same, under the protection of these grantees."

It does not appear, however, that any colonies were planted at this time, or for a considerable period afterwards. The reign of Henry VII. being one of almost profound peace, commerce and the useful arts increased and prospered. It was in this reign that that little article of universal use, the pin, was invented. Henry VII., a wise and sagacious prince, gave great encouragement to commerce.

In the reign of Henry VIII. commerce made large strides. It was an age of barbarous splendour and rude magnificence. Although the character of Henry VIII. is one which we cannot contemplate without indignation, we must not allow those feelings to blind us as to his merits. Possessing great intellectual superiority, he saw the benefits which would accrue to his kingdom by the extension of its commerce. Under his auspices, the English trade increased so much in the Mediterranean, that it was found necessary to establish a consul at Chios. Although the English had not yet planted any colonies in the West, they carried on a considerable trade with the Spaniards in that quarter, and they established agents in Cuba and some of the smaller islands.

In the reign of this monarch, the fraternity called the "Trinity House" was formed. Henry may be said to have laid the foundation of the English navy, "by appointing a Board of Commissioners of the navy, by erecting storehouses for naval stores, and making yards and docks for building and equipping ships of war." Many restrictive laws, however, from ignorance of the true principles of trade, were made in this reign, which were extremely prejudicial to commerce.

During the reign of Mary, whose sole object was to re-establish the ancient faith, trade languished. One reason was, that that princess bestowed upon her favourites, who belonged to the same church as herself, monopolies of various articles of merchandise.

In the reign of Elizabeth monopolies had become so numerous that the channels of trade were nearly dried up.

When complaints of these grievances were made to the Queen, she did not fly out, as Charles I. would have done, and bluster about prerogative. Elizabeth was a wise monarch. In reply to the remonstrances of her people she informed them that she would cancel the most grievous and oppressive of these patents; she thus avoided a conflict with her parliament. In her reign a trade was opened with Turkey, and she obtained from the Czar of Muscovy a patent to the English for the whole trade of that country. It was in this reign that an Exchange was first built in London, in imitation of the *Bourse* at Antwerp.

But the most important commercial event in the reign of Elizabeth was the incorporation of a company, under the title of the Governor and Company of Merchants of London, trading to the East Indies. When that trading company was established, little was it supposed that the foundation was then laid of an empire under the British Crown, consisting of one million three hundred and fifty seven thousand square miles, and one hundred and thirty four million three hundred and one thousand people.

During the reign of Elizabeth shipping declined. The time had not arrived when England should assume the proud title of Mistress of the Seas.

James I. was very anxious to encourage the commerce of his subjects, and there being happily profound peace during his reign, trade did certainly make considerable advances. The king endeavoured to introduce the manufacture of silk into England, as well as the production of the raw material. For this purpose he caused a great number of mulberry trees to be planted, and silk worms to be brought over. He annulled all the patents for monopolies, which had so grievously restricted the free operation of commerce during the two preceding reigns, and he established a Board of Trade. During this reign Greenland was discovered, and the whale fishery commenced. But trade still suffered from impolitic restraints. The patents for monopolies granted to individuals had been recalled, but there yet remained a great number of exclusive companies, which checked the elasticity of commerce.

The whole trade of London was confined to about 200 individuals, who were able by combination to govern the markets. James recommended to the commissioners of the Board of Trade "to inquire and examine whether a greater freedom of trade, and an exemption from the restraint of exclusive companies, would not be beneficial."

But the time was not ripe for such an innovation. There were too many powerful interests at stake to permit such an invasion of "vested rights."

James caused the cultivation of the hop to be greatly extended, and the use of it in brewing became general. The hop had been brought from the Netherlands in the reign of Henry VIII.

The ale of our Saxon ancestors contained no bitter whatever. It was merely the sweet wort, or decoction of the malt fermented, and it was preserved by the addition of cloves and other spices. Before the introduction of the hop, various herbs, more or less wholesome, were employed to impart a bitter quality to ale, but the hop, when its properties became better known and appreciated, superseded the use of all others, and although at first laws were made forbidding its addition to malt liquor, the addition of anything else was now prohibited.

During the reign of Charles I. commerce continued to increase. A direct trade with the East Indies and Turkey was carried on to a great extent, and the trade with the West India Islands, at that time almost exclusively in the possession of Spain, was nearly monopolised by the English. The colony of New England was established as a refuge for the Puritans, and that of Maryland as a retreat for the Catholics.

During the Commonwealth commerce not only increased, but it began to be considered an honourable occupation. The House of Lords had ceased for the time to exist,—the aristocracy no longer exercised a predominating influence, and the profession of arms, into which alone men of high birth would condescend to enter, was engrossed by stern Presbyterians, or sour Independents. Trade was now the only avenue to wealth and power, and country gentlemen, in whose families the paternal acres had been for centuries, scrupled not to bring up their younger sons to the lucrative pursuits of commerce. Thus the foundation was laid of that commercial prosperity which has caused Great Britain to become so wealthy and powerful—of that rich and intelligent middle class, whose temperately but firmly expressed opinions rule the destinies of that great country.

The naval superiority of England was established during the Commonwealth. The victories of Blake over the Dutch, and of Penn and Venables over the Spaniards, gave to the English seaman a prestige which he has never lost, and which I trust he never will lose, until the names of Nelson, Duncan, and Jervis, shall cease to be "familiar in our mouths as household words."

It was during the Commonwealth that a discovery was made which has exercised great influence on human affairs. The Marquis of Worcester being a royalist, and most probably in the language of the day a malignant, was confined in prison. Having no attendant, he was compelled to cook his own meals. One day, as he was seated in his solitary cell watching a pot upon the fire which contained some edible, he observed that the heated vapour forced up the lid with considerable violence. This led to the discovery of the applicability of steam as a motive power. There seems little doubt that that ingenious nobleman was the first inventor of the steam engine—an engine which has been brought to so much perfection by the immortal Watt.

After the Restoration, and until the Revolution, trade made great progress. A number of new manufactures were introduced. A Dutchman, called Brewer, brought over from the low countries the art of dyeing woollen cloth, and the Duke of Buckingham, from Venice, the manufacture of glass and crystal.

Shipping also greatly increased. When Charles II. ascended the throne, the Royal Navy consisted of 63 vessels. At the end of the reign of James II., there were 173 vessels, requiring 42,000 seamen to man them.

In 1688, the revolution occurred, and a constitutional monarch was placed upon the throne to govern a free people. The struggle for despotism was at an end—the limits of prerogative were fixed—the rights of the crown were defined—the rights of the people were established.

From this era, as from a new starting point, England commenced a career which has conducted her to her present glorious position. No longer is she indebted to Venice for the products of India—India itself is hers. No longer does she trade with Spain for the products of the Western world—Newfoundland, Canada, Nova Scotia, New Brunswick, and the greater portion of the West India Islands are hers. On every continent she has colonies—in every port she has her merchant ships—her manufactures are floated to every part of the habitable globe—her woollens, her silks, her cottons, her cutlery, her gold and silver plate, her jewellery, excel those of every other country. Her power is incalculable, her wealth it is impossible to estimate.

With thirty millions of free men she fears no foreign foe—with a Sovereign, who is not only honoured as a Queen, but adored as a woman, she dreads no domestic enemy.

In former days it was enough, to secure respect, if a man said, "I am a Roman citizen." With how much more pride—with how much more glory, may a man *now* say, "I am a Briton."

FLAX AND ITS PRODUCTS IN IRELAND.

By Wm. Charley, J.P., Seymour Hill, Belfast.

Letter XIV.*

Several years have elapsed since I forwarded my last paper on the above-named subject, during which time some

* For Letter XIII., see Vol. IV., page 98.

unlooked-for changes have taken place, which it will be my duty to mention, so far as they have direct reference to any of my previous communications. In the first place I regret to say that the Royal Flax Improvement Society of Ireland, specially referred to in Letter VIII., has ceased to exist; I hope, however, the North East Agricultural Association, a young and vigorous society, possessing the confidence of the agricultural community, will eventually take measures to fill up the unfortunate blank thus caused.* It is also an unpleasant duty to announce the premature death, from lock-jaw, brought on by an injury from machinery under trial, of Mr. Watt, whose patent system of retting I explained in my last paper but one; and the relinquishment by his employers of any further experiments for the present is a natural consequence of this sad event. Some explanation perhaps is required as regards my long silence, so I wish to state that I shall in future have great pleasure in affording any information to members of the Society of Arts that my local experience enables me satisfactorily to offer, but I may candidly confess that my time is so fully occupied with public and private affairs, that I cannot be reckoned on as a *regular* contributor to the pages of the *Journal;* nevertheless, if the readers of the *Journal* will grant me a little kind indulgence as an *irregular* correspondent, I shall make an effort this year to complete the subject I have opened up in your pages.

The history of the flax plant has occupied eight papers, and the other five published bring us up to the end of the cleaning or "Scutching process."

This operation renders the flax fit for market, and the farmer now acts with it as with any other crop. He either holds for a high price or at once realises by sale. The principal markets in Ireland at present are, of course, in Ulster. The following extract, from this week's Trade Circular, shows the localities and the present range of prices:—

"Flax.—The country markets have been well supplied during the past week. In those of the County Armagh district an extra number of buyers attended, and prices ruled somewhat higher. In the Derry and Strabane markets, in consequence of increased supplies, and a less numerous attendance of buyers, the advance of £2 10s. per ton, as reported in our last, was not maintained.

"Reports received from some Country Markets for the past week; from others, no returns:—

Armagh	about	70 tons *milled*	prices	8s. 0d. to 13s. 6d. per stone of 16¼ lbs.
Ditto	about	15 tons *hand-scutched*	prices	6s. 3d. to 9s. 0d. per stone of 16¼ lbs.
Monaghan	about	20 tons *hand-scutched*	prices	6s. 0d. to 8s. 9d. per stone of 16¼ lbs.
Ballybay	about	35 tons *hand-scutched*	prices	6s. 0d. to 9s. 4d. per stone of 16¼ lbs.
Tandragee	about	60 to 70 tons *milled* (Store lots included).	prices	7s. 6d. to 13s. 9d. per stone of 16¼ lbs.
Cootehill	about	20 tons *hand-scutched*	prices	6s. 0d. to 9s. 0d. per stone of 16¼ lbs.
Cookstown	about	30 tons *milled*	prices	8s. 0d. to 12s. 6d. per stone of 16¼ lbs.
Ditto	about	10 tons *hand-scutched*	prices	6s. 0d. to 9s. 6d. per stone of 16¼ lbs.
Derry and Strabane	about	180 tons *milled*	prices	50s. 0d. to 80s. 0d. per cwt. of 124 lbs.

Flax has been dearer this year and last than for many years previous, owing to the short supply and the consequent eagerness of the buyers. These buyers are either agents for the spinning firms or themselves speculators in the article. By some singular perversity, flax is generally sold by a stone (illegally so called) of 16¼ lbs., while the farmer probably pays for the scutching by the legal stone of 14 lbs., or by an old-fashioned weight of 24 lbs., called the Scotch stone. These discrepancies are very confusing and very absurd, and it is hoped will eventually disappear by adopting uniformly the simple lb. or legal stone of 14 lbs.

Some flax fibre is injured by the owner keeping it too damp, in order to make it weigh well in the scale; like all dodges, this is short-sighted policy, as the buyer generally detects, and offers a proportionately lower price. It is not, however, injurious to have a little damp, and the flax certainly does look more inviting to the purchaser in that state than when harsh and dry. I was once greatly amused at "a scutcher" recommending me to put my flax into a damp potato-house and sprinkle it with "milk and water" to improve its appearance. I declined, but some of his customers probably have taken his advice, and applied the mild elixir in due form. The flax brought into the Irish markets is generally of a bright pale greenish-brown colour, called "silvery blay," but some of it is nearly as white as the Courtrai flax. The former colour is the result of steeping in still ponds, not unfrequently dug in soil of a boggy character, and this shade of colour is also a distinguishing mark of Dutch flax.

The Belgian flax, steeped in the river Lys, is of a nice rich cream colour; a peculiarity probably caused by the water being in motion, and I have recently seen some from Stra-

* On this subject I addressed the following letter to the editor of the *Irish Farmers' Gazette* in March last:—

The late Flax Improvement Society.

Sir,—A few days ago, on looking over some back numbers of your useful paper, which had been received during my absence from home, I found an excellent article referring to the dissolution of the Royal Flax Improvement Society of Ireland.

As my name is mentioned, and also appears among the gentlemen who acted last year on the Committee of Management, I think it desirable to state that I was not nominated to this office till last year, and that finding the day and hour of the ordinary meetings exceedingly inconvenient, I wrote to the secretary offering my resignation.

Not having attended the committee meetings, I am not prepared to give any account of the unfortunate, and, apparently, premature termination of this once thriving Society; but as one of the public and a subscriber to the funds of the Association, I may with propriety seek for a solution of the problem. The Belfast spinners, I am told, say that for some years past they could not see any benefit derived from the transactions of the Society, and they, therefore, it must be granted, very naturally became rather lukewarm in its support. After some years of active exertion all such associations run the risk of losing a certain amount of public sympathy; and some young society, even with other objects in view, by its very novelty, may attract attention, and prove a formidable, though unintentional, rival.

The operations of the Flax Improvement Society did not, for instance, clash in any way with those of the North East Agricultural Association; yet we see the former decline and "vanish from the stage," while the latter gradually rises in popularity, influence, and wealth.

But, making every allowance for the really attractive power of something new, may there not be a deeper seated reason for this contrast? I think there is; and when I hear from almost every working farmer the warmest expressions of good will and sympathy for the North East Society, and an equally unanimous expression of want of confidence in the other, I am inclined to arrive at the opinion that the exclusion of practical working farmers from the management of the Flax Society was a grave error, and has, perhaps, contributed as much as anything else to its late unpopularity and final extinction.

It is to be hoped that some good will result from the attention now promised by the North East Society to this important crop, and that the presence of tenant farmers on their committee will ensure a large amount of confidence from the class that must produce the flax, if it is to be grown extensively in Ireland.

I am, &c.,

WILLIAM CHARLEY.

bane market so exactly like it, that it was christened Irish Courtrai. I am informed by buyers that flax grown precisely in the same field, and on the same soil, will vary sometimes as much as 2s. or 3s. a stone in price, if watered in different places, or in the same pond at different times.

This is confirmed by a farmer telling me that this year he filled a large flax pond with half his crop, and when it was taken out, the other half was put in with fresh water, and treated in every way the same. To his surprise, the price he obtained for one-half was 2s. per stone more than for the other, although there was no perceptible difference before watering. He cannot fancy any cause except something in the temperature of the atmosphere.

These facts show how very important a part of the management the watering process is, and how carefully the flax requires to be watched while undergoing it. When the flax is brought from market it is of course stored for use.

The first process in the Spinning Mill is the rough sorting, so as to suit the different kinds of yarn to be made. This is done by hand, and the handfuls or pieces as they are called, are about one-eighth of a pound each. The fine Irish and all the fine foreign fibre is now passed to the cutting machine, which cuts off bluntly, or rather tears off, the low ends and the tops of the stem, leaving the prime centre part for the best yarn. All hand-scutched flax, low priced milled Irish, and all Riga intended for coarse yarns, are passed on without this cutting. The next process for all is "the hackling;" there are several kinds of machines for this purpose, the object of which is to clean the fibre further, by combing it, as it were. A large quantity of refuse called "tow" is taken off here. One of the nicest hackling machines is Ardell's intersecter—two rollers covered with needles work close together, and the flax is held between them so as to be hackled on both sides at once; the way the tow is taken off these needles by a brush to prevent their clogging is very ingenious.

Combe and Co.'s Patent Self-acting Sheet Machine is a very suitable one for coarse flax, and is an improvement on the old-fashioned flat machine of Robinson. The latter, however, has been in use for 25 years, and answers very well, the only objection being, it requires too much manual attendance.

After being hackled, the flax goes to the sorting and dressing-room; here the ends are nicely finished by skilled hands, and the fibre arranged for the next process. This consists in placing the handfulls of flax longitudinally on a kind of table, gently overlapping each other at the ends; from this they are drawn forward by a clever invention, comprising a series of moveable rods, with needles on top, which pull the fibre on until it is passed through rollers into a high-shaped tin case, arranged in the form of a wide thick ribbon, technically called the "sleiver." This machine is styled a "faller," and the rods "screw-gills." I believe Wesley, of Leeds, is the patentee, and it is said he took the idea from a German clock he once saw on the Continent, that marched forward a company of miniature soldiers at the time of striking the hour. Wesley substituted needles for the military dwarfs, also continuous action instead of a retrograde, and succeeded in producing a very perfect piece of mechanism. In each case are placed about 1,000 yards of the ribbon "sleiver," and the whole is now removed to the "drawing" machine. The drawing machine extends the length of the ribbon by having two sets of rollers going at different speeds—the first drawing is generally managed by placing eight cases together, and passing eight ribbons through the machine in one mass, but extended at the rate of 16 yards to 1 yard; this leaves the ribbon half its original size. This process is repeated at another machine with like result—the next drawing reduces the ribbon to about one-eighth of its dimensions, and another turn again reduces to the half of that. The whole of these processes tend to the equalisation of the fibre; the machines I last saw were from Leeds, Lawson's patent, but I believe in Belfast they are made equally well now. The drawing-wheels are made of alder wood, working against iron rollers, and the demand for this kind of timber, in old times of little value, is now very considerable. Fresh wood has been known to dye the yarn, and ought not to be used. The ribbon now goes to the "roving frame," where it is wound on large spools or bobbins, and made ready for the spinning.

There is a very clever arrangement in connection with this frame, that is self-acting, and prevents the ribbon being more tightly wound as the spool fills; it is a cone-shaped piece of iron with a singular complication of wheels, called sun and planet, very puzzling to a stranger's eye, but excellent in operation. A new patent by Combe and Co., styled the expanding pulley, is just out, and I hear is likely to succeed equally well. The rove-bobbins or spools are now taken to the spinning room.

The flax here passes through hot water, and is again drawn between small rollers of box-wood working against brass; it is then twisted in the same way as heavy cotton yarn, on the "throstle" principle.

I do not think flax has ever been spun by the "mule" system, which is used for fine cotton, and suits a weak material of that class very well.

The technical names given by workmen to machinery, and the operations in connection with it, are sometimes very curious, but are generally founded on a likeness to some simple object with which their minds are well acquainted.

The name "throstle" and the name "mule," as applied to principles of spinning, I have never heard explained. Perhaps some of my readers may be able to give a satisfactory reason; meantime, I might mention what has struck my mind as a possible origin, but on my part it is a mere surmise.

The twist given to the yarn in the old hand spinning wheel, of which the throstle system is an imitation in machinery, is by a crooked little machine, just the shape of a huntsman's spur, but the stem which projects to hold the roller of the spur, in the other case has an opening or throat, through which the yarn comes out between the extended sides.

These extended sides, with the throat in the centre, might be compared to a thrush or throstle singing with its mouth wide open, and as the spinning has a humming or *singing* sound, the resemblance to the thrush or throstle is more perfect.

Some one said to me the other day that possibly the inventor, or his residence, might have been named "Throstle." I can find no trace of this in any documents I have. I think my theory a more likely one, but I am willing to be corrected if any better explanation can be given by others.

The "mule" system resembles the ancient distaff in the principle of action, pulling out the thread first, and twisting afterwards, instead of a continuous action, like the throstle; but why styled "mule" puzzles me. My friend's simple definition of tracing to the inventor's name would not be complimentary, I fear; certainly, there is no historical *Mr. Mule* in the ordinary books we read. My dictionary says it is "an animal between a horse and an ass;" perhaps, speaking metaphorically, the mule system may be a cross between the throstle and some other to me unknown parent principle.

Flax can be spun dry, like cotton, but being a much stronger and firmer fibre, in that way much less can be taken out of the flax than when hot water is used. Probably fibre which, spun dry, would produce only 20 leas yarn, would, when wetted, spin up to 70 leas or more, and thus prove greatly more remunerative. Cold water is sometimes used instead of hot, and is of course scarcely so trying on the fibre; it is a kind of half-way affair between the dry and hot water systems.

The "spinning jenny" is so well known that no description is required, so we will follow the small spools of yarn into the reeling room. Here they are unwound and measured on the reels,—60,000 yards make a bundle, which is sub-divided into hanks and cuts.

Each hank contains 12 cuts, or leas, and each cut 300 yards; consequently, 16⅔ hanks are equal to a bundle. These bundles are tied up in bunches of 3, 6, 9, or 12, according to the fineness and quality. After being carefully dried by steam in lofts the yarn is ready for sale.

The finest spun for commercial purposes is about 340 leas, of 300 yards each to 1lb. weight; but for the Exhibition of 1851, I believe it was once worked up to 700. The coarsest spun out of pure flax is about 20 leas to the pound.

The "tow" thrown off in the hackling process is not allowed to go to waste; it is collected in bags, shaken out by a special machine, and then undergoes a most elaborate "carding" or combing process, ending in being reduced to a large ribbon, ready for "drawing" and spinning, as already described, for the flax or "line." This operation certainly is very ingenious, and is a triumph of mechanical skill.

The yarn from tow is used for making only coarse articles; it has a peculiar softness, which renders it very suitable for towelling, being pleasant to the skin and an excellent absorber of moisture.

The following list of prices will show the ranges in general use at present, and perhaps be interesting to refer back to in the *Journal* at some future day:—

Leas.	Weight per Bundle.		PRICES OF IRISH LINE OR FLAX YARNS.										Leas.	PRICES OF IRISH TOW YARNS.	
			Medium and Prime Warps.		Ordinary Linen Warps.		Cambric Warps.		Medium and Prime Wefts.		Ordinary Wefts.				
	LBS.	OZS.	FROM	TO	FROM	TO	FROM	TO	FROM	TO	FROM	TO		FROM	TO
			S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.	S. D.		S. D.	S. D.
6	33	5	...	...	...	...	...	...	...	...	...	...	6	...	...
8	25	0	...	...	...	...	...	...	...	...	...	...	8	...	...
10	20	0	...	...	...	...	...	...	...	...	...	...	10	...	...
12	16	11	...	...	...	...	...	...	...	...	...	...	12	8 3	9 0
14	14	5	...	..	...	...	...	...	...	...	...	...	14	7 6	8 6
16	12	8	...	...	...	...	...	...	...	...	...	...	16	7 4½	8 0
18	11	2	...	...	...	...	...	...	...	...	...	...	18	7 3	7 0
20	10	0	10 9	11 6	...	...	...	...	...	...	...	...	20	7 0	7 6
22	9	1	10 3	11 0	...	...	...	...	...	...	...	...	22	6 9	7 3
25	8	0	9 3	9 9	8 3	8 9	...	...	...	9 0	7 6	...	25	6 4½	7 0
28	7	2	8 9	9 0	8 0	8 6	...	...	...	8 6	7 0	...	28	6 0	6 6
30	6	10	8 3	8 6	7 3	7 6	...	...	...	8 0	6 6	...	30	5 9	6 6
32	6	4	7 9	8 3	7 0	7 3	...	...	7 6	7 9	6 3	...	32	5 9	6 3
35	5	11	7 6	8 0	6 6	7 0	...	...	7 0	7 3	5 9	6 0	35	5 6	6 3
40	5	0	7 0	7 6	5 10½	6 3	...	...	6 6	6 9	5 4½	5 6	40	5 3	5 10½
45	4	7	6 9	7 3	5 6	5 10½	...	...	6 0	6 3	5 1½	5 4½	45	5 0	5 3
50	4	0	6 3	7 0	5 1½	5 4½	4 10½	5 1½	5 6	6 0	4 9	5 1½	50	4 9	5 0
55	3	10	6 0	6 9	4 10½	5 1½	4 6	4 9	5 6	5 10½	4 4½	4 9	55	...	...
60	3	5	6 0	6 9	4 9	5 0	4 3	4 6	5 6	5 10½	4 1½	4 6	60	...	...
65	3	1	6 0	6 9	4 7½	4 10½	4 0	4 3	5 6	5 10½	4 0	4 3	...	...	...
70	2	14	6 0	7 0	4 6	4 7½	4 0	4 3	5 6	5 10½	3 10½	4 1½	...	...	...
75	2	11	6 0	7 3	4 6	4 7½	3 10½	4 1½	5 6	5 10½	3 10½	4 0	...	...	...
80	2	8	6 0	7 6	4 7½	4 9	3 10½	4 1½	5 3	6 0	3 9	4 0	...	...	...
85	2	6	6 3	7 9	4 9	5 0	3 10½	4 1½	5 3	6 0	3 9	4 0	...	...	...
90	2	4	6 6	8 0	5 0	5 3	3 10½	4 1½	5 3	6 0	3 9	4 0	...	...	...
95	2	2	6 9	8 3	5 3	5 6	3 10½	4 3	5 3	6 3	3 9	4 0	...	...	...
100	2	0	7 0	9 0	5 6	6 0	4 0	5 0	5 3	6 3	3 9	4 0	...	...	...
105	1	14	...	...	...	...	...	...	...	...	3 10½	4 0	...	...	...
110	1	13	7 9	10 3	6 3	6 6	5 3	5 3	5 6	6 6	3 10½	4 0	...	...	...
115	1	12	...	...	...	...	...	...	...	...	3 10½	4 1½	...	...	...
120	1	11	8 9	10 6	7 0	7 3	5 6	5 6	...	7 3	3 10½	4 1½	...	...	...
130	1	9	10 0	11 6	8 0	8 3	5 10½	6 0	...	...	4 0	4 6	...	...	...
140	1	7	...	...	...	...	6 6	6 6	...	...	4 3	4 9	...	...	...
150	1	5	...	...	...	...	7 6	7 6	...	...	4 4½	5 0	...	...	...
160	1	4	...	..	...	...	8 6	8 6	...	...	4 7½	5 3	...	...	...
170	1	3	...	...	...	...	10 0	10 3	...	...	5 0	5 6	...	...	...
180	1	2	...	...	...	...	12 0	12 0	...	...	5 3	5 9	...	...	...
190	1	1	...	...	..	...	13 6	13 6	...	...	5 9	6 1½	...	...	...
200	1	0	...	...	...	...	15 0	15 0	...	...	6 6	7 0	...	...	...
220	0	14½	...	...	...	...	...	...	...	...	8 9	9 0	...	...	...
240	0	13¼	...	...	...	...	...	...	...	...	10 9	11 0	...	...	...
260	0	12¼	...	...	...	...	...	...	...	...	13 0	13 6	...	...	...
280	0	11½	...	...	...	..	...	...	...	...	...	17 6	...	...	...
300	0	10½	...	...	...	...	...	...	...	...	...	23 0	...	...	...

These prices, for all kinds, are per bundle of 60,000 yards of Grey Yarn, with the usual discount for cash.

Hand-spun yarn from the Continent is still used for very fine cambrics made in Ireland, the prices for the best warps are about:—

No.	200,	220,	240,	260,	270,	280,	300,	320,
	20s.	20s. 9d.	21s. 6d.	22s. 3d.	23s.	24s.	24s. 9d.	25s. 6d.

340,	360,	380,	400,	450,	500,	550,	600,
26s. 3d.	28s.	29s. 6d.	31s.	32s.	33s. 6d.	36s. 9d.	40s.

the weft being somewhat less of course.

The waste of bulk alone in spinning after the first hackling is, I am told, generally 20 to 25 per cent. in pure flax or line yarns, and in tow rather more.* Some spin-

* A gentleman who tested the matter, reports to me regarding the flax crop itself, that "the yield of fibre from green flax straw is 3 per cent.; if dried and stacked, 9 per cent.; when steeped and dried, 25 per cent." This shows a large loss from the original weight of the flax in the field.

ners sell all the yarn they produce at home, others have a large export demand; some make the yarns into linens, bleach them, and become regular linen merchants; others have power-loom factories, and sell the linens in the brown state, after being manufactured on the spot.

In going carefully through the spinning process I have no improvement to suggest; in fact, I think everything has been done here that skill and capital can accomplish.

Every new improvement in machinery is carefully examined, and if approved of, at once brought into use in the mills, while the general neatness and order that rule throughout these establishments are really wonderful, when you take into consideration the great number of hands employed. As a consequence of this good management many spinners have realized considerable fortunes, and very few, if any, who began business on their own *bona fide* capital have failed. The unsuccessful mills have generally been built with borrowed money, and a mortgaged mill, like a landed estate in the same position, is very rarely prosperous, and in bad times can seldom be expected to weather the storm.

People talk of mills by the number of spindles they contain; less than 4,000 will not pay, and some have as many as 20,000. One enormous single mill (York-street Flax Spinning Company, Belfast) has nearly 30,000 spindles, value,—with buildings, say £90,000.

In external appearance a large flax-spining mill closely resembles the ordinary buildings to be seen in the manufacturing counties of England, and, lighted up with gas, looks very brilliant these winter evenings.

Flax spinning is carried on very extensively in Belfast, but there are also mills in the country districts of Ulster. There is one at Limerick, and several in the North of England. Messrs. Marshall, of Leeds, have a splendid mill, and, indeed, a world-wide celebrity for the quality and quantity of their productions. Steam-power is chiefly used, and a much greater power is required in flax spinning than for the proportionate amount of cotton fibre.

In Ireland there are 82 spinning mills, containing 651,872 spindles at most, and the flaxen manufactures are as essentially our staple trade as the cotton is British. The high price of flax last year, and also this, has curtailed demand so much that the full quantity of spindles erected is not in actual work just now, probably only four-fifths.

Every effort must be made to extend the home growth of this valuable fibre; as an auxiliary a new company has been proposed, with reasonable prospects of success, to promote the developement of flax cultivation in India. In some years, it is hoped, this company will have a very beneficial effect in increasing the supply, and, consequently, in tending to prevent a recurrence of those periodical famines of the raw material which have hitherto been so very prejudicial to the extension and prosperity of the linen trade of Ireland.

The ground under flax in Ireland last year was 136,000 acres, a considerable increase on the previous year's crop, yet, even last year the amount of flax imported into Great Britain from the Continent will be in excess of the home growth. Spinners admit there is no flax so generally useful as Irish; being a medium class, neither very coarse nor very fine, it suits the qualities of yarn in chief demand for ordinary manufactures, while, at the same time, it abounds in the spinning quality called "nature," and produces a strong serviceable yarn that bears exceedingly well the action of the different processes the linen fabric has eventually to sustain before reaching the consumer. In conclusion I may state my conviction, that if a good supply of raw material can be kept up, at moderate prices, the spinning process will be conducted in a creditable manner, and that the flax spinners, as a body, will "go with the times," and never lag behind in the march of industrial progress.

N.B.—The following errata occurred in my last letter, published in No. 163, Vol. IV. of the *Journal;* at p. 99, col. 1, line 55, "for 272 acres," read "25½ acres;" page 100, col. 1, line 21, for "well experience," read "well expressed."

HAMPTON-COURT PALACE.

The following remarks on Hampton-court Palace, its pictures, tapestry, and other works of decorative art, are by Mr. Henry Cole, C.B., Secretary to the Department of Science and Art:—

It is now eighteen years since I investigated the contents of Hampton-court Palace in order to write a handbook upon it, and recently my attention has been again called to them in the course of my official duties. The result of my observations has prompted me to prepare the following remarks.

I. Since George IV. commanded that the pictures at Kensington Palace should be transferred to Hampton-court Palace, the latter has been little else than a storehouse for works of art belonging to the Crown and the public, and the character of the decorations of the palace has been much deteriorated. The tapestries forming the original decoration of the walls, as in the Queen's gallery and elsewhere, have been covered up, and the pictures hung almost at haphazard. In some cases pictures have been actually nailed to the tapestries. Models and remains of funeral decorations have been placed in the rooms. In very few instances are the pictures seen well. The metal work and wood carvings require looking to.

II. The state of the pictures, and perhaps still more of the tapestries, require immediate attention, if they are considered to be worth preserving. At the present time, little doubt can be entertained that all works shewing the art of former periods are well worthy of the utmost care and preservation.

III. In the year 1839, her Majesty the Queen graciously permitted Hampton-court Palace to be most freely opened to the public, and it has become one of the chief popular metropolitan attractions. Some improvements in the arrangements and administration of the different works of art in the palace would not only maintain the rights of the Crown in its property, which appear to be somewhat forgotten, but also increase greatly the public use and enjoyment of them.

IV. I venture to submit that instead of being treated as a mere storehouse, Hampton-court Palace would be a much more attractive public sight if the rooms were restored as much as possible to their original state of decoration. In many rooms this could be done by simply taking down the battens and faded calico which conceal the tapestry. The tapestries themselves would be much more interesting to the public than the present incongruous arrangement of pictures, for the proper display of which the lighting is rarely suitable.

V. The pictures collected at Hampton-court may be divided into the following classes:—

1. Furniture pictures, which for a long period have formed part of the decorations of the palace, and are in some cases fitted into panels on the walls.
2. Pictures more interesting as historical or decorative illustrations than as works of fine art, such as: The Battle of Pavia, The Battle of the Spurs, Embarkation of Henry VIII. from Dover, etc.
3. Portraits of persons eminent in English history.
4. Portraits of foreigners of distinction.
5. Pictures of a technical interest, such as hulls of ships, dockyards, architecture, decoration, etc.
6. Works of fine art.

VI. If all the pictures were exhibited together in classes, it cannot be doubted but that their utility and interest would be greatly increased. I would suggest that the above classes, from 1 to 4, should be retained at Hampton-court Palace, and that, where necessary, screens and other improved arrangements should be adopted for exhibiting them. As respects the technical pictures (class 5), those on nautical subjects for instance would be all the more interesting if publicly exhibited with models of ships, of which there is a public collection at the Admiralty. The architectural pictures with architectural models, and so on. As respects the Pictures of Fine Art,

they are obviously out of place at Hampton-court. They cannot be well seen, and require especial care, which it is difficult and would be very costly to provide for them there. It was formerly the practice of the Crown to lend the cartoons as studies to the Royal Academy, and it is still the practice for the Science and Art Department to avail itself of the gracious permission of the Queen to use the pictures for the Schools of Art.

VII. I would suggest that the works of Fine Art should be brought to the metropolis where they would be much better preserved, where the facilities for making them available for public instruction would be greatly increased, and all classes of the public infinitely more benefited than by leaving them at Hampton-court Palace, which is visited by the great majority of persons as a palace in the country, having beautiful gardens, rather than for the study of works of fine art.

VIII. I have already said that all the works of art urgently demand immediate attention, a fact which I believe the Crown surveyor of the pictures, etc., would confirm. The authority over them is divided between the Lord Chamberlain, as the representative of her Majesty, and the Board of Works as having the material custody and responsibility for the repairs of the building, and controlling the admission of the public. It will be admitted that these departments have no technical knowledge, or special interest, or public duties in works of art as such. Hitherto when the Crown pictures have required attention, they have been placed in the hands of picture-cleaners, virtually without control, which experience has shown to be a process attended with great mischief to pictures. A proper reparation of works of art requires not only the labour of the picture-cleaner and varnisher, but occasionally the attention of most skilful artists, of different powers, and the knowledge of the chemist.

IX. If the Crown graciously permit the public to have the use of its pictures, it is quite clear that the public should be charged with the cost of their preservation.

X. The public also possesses pictures and works of art which require constant care, at many institutions, such as the National Gallery, the British Museum, the National Portrait Gallery, Greenwich Hospital, and at the South Kensington Museum, etc.

XI. I would suggest that a small committee of consultation, consisting of three artists, with one chemist and one amateur, be appointed to determine what measures should be taken for the preservation of all works of art, either belonging to the public or lent by the Crown for public use, and that premises be provided and skilful persons be chosen for the purpose of carrying into effect, under proper superintendence, the recommendations of this committee.

HENRY COLE.

South Kensington, December, 1859.

PENNY READINGS FOR THE WORKING CLASSES.

A series of readings have been recently given at Ipswich for the working classes, the admission to each reading being one penny. At the last reading of the season, an address was delivered from which it appears that for some years Mr. T. S. Gowing had entertained the idea of interspersing readings with the lectures of the Ipswich Mechanics' Institution; but it was only by degrees that he arrived at the conviction that a more popular form might be given to these readings, and that through them that most numerous and important class of the community might be reached, to whom it was obvious that the lecture, in any shape yet given to it—and even when gratuitously offered—possessed no attraction.

Mr. Gowing mentioned his ideas to several gentlemen, among others to Mr. Alderman Cowell, as stated by that gentleman on the first night of the weekly readings. It was not, however, till last year, when Mr. Sulley was consulted, that any approach was made to a practical solution of the question.

After many discussions between Mr. Gowing and Mr. Sulley, and aided by the experience obtained in the Elocution Class of the Institution, established last winter under their guidance, the way was at length seen to commence the Weekly Penny Readings in the distinctive form they have since asuumed; *i.e.*, of a variety of reading and readers on the same evening.

However strong their convictions, it was not without feelings of great anxiety that the projectors looked forward to the result of the experiment about to be made; but the first night's success not only relieved them from doubt, but enabled them to venture on hiring the Lecture-hall, on the usual terms, for a succession of evenings, thus ensuring one of the main elements in all permanent success—regularity of action. Hoping that their success might stimulate others to make similar attempts, the managers stated some of the principal points which their experience warrants them in considering as essential to success.

I. That the pieces should be varied in character; complete in themselves; and so arranged as to afford, by contrast, mutual relief.

II. That no piece should exceed half-an-hour in length, while the majority should be much shorter.

III. That purely didactic pieces should be introduced either at the beginning, when the senses of the audience are fresh, or towards the middle, when a certain amount of repose may be advisable.

IV. That learned and far-fetched allusions should be resolutely sacrificed, as well as all unnecessary or questionable passages.

V. That everything should be read with well-considered expression, so as to bring out clearly the descriptive beauties, the passion, the pathos, or the mirthful excitement characteristic of each selection.

VI. That the aim should be to reach men more through the imagination and the feelings than by direct didactic instruction.

VII. That it is inexpedient to introduce more than two or three untried readers on the same evening.

From the list given in the Report it appears that in the course of 13 evenings, 28 gentlemen have read no less than 102 carefully selected pieces from a great variety of the best authors. And when it is considered that the managers have been obliged to leave the choice of the pieces almost entirely to the readers themselves; to have always a fortnight's readings prepared beforehand; that they have had to listen to the directly opposite complaints, on the one hand that the pieces were too light, and on the other that they were too heavy; and that the whole scheme was a new one—and consequently there was no experience to guide them, there seems to be no doubt that the managers have had a very difficult part to play.

The balance-sheet shows that these Penny Readings, unlike most schemes of the kind, instead of having to depend on external pecuniary assistance, have enabled the managers to defray all expenses connected with them, and yield a good profit besides; so that instead of paying to the Mechanics' Institution the sum of £9 15s., the amount agreed on for the hire of the room, they have had the pleasure of contributing twenty-five pounds to its funds.

Having thus in the first place paid a tribute to the Mechanics' Institute, the managers intend during the ensuing season to devote a portion of the profits in aid of several of the charitable Institutions of the town—as the Hospital, the Friendly Society, the Shipwrecked Seamen's Association, the Ragged School, &c.; hoping that thus the working classes will feel that, while paying their pence for the readings, they are also contributing to the support of Institutions intended by the benevolent to aid them in sickness and distress.

Encouraged by the evident popularity of their undertaking, the managers have obtained permission of the Committee to hire the room for a further period of 13 weeks, on the terms on which it had been previously let to them.

THE "GREAT EASTERN."

The following report has been made to the shareholders by the builder of the Great Ship:—

As one of the originators of the design of the great ship, and as the builder of the ship, I find it an imperative duty to lay before you, as the owners, a short report on the present state of our property.

Had Mr. Brunel, who originated the idea of the undertaking, survived, he would, as a part of his duty, have made a full report to you on this subject; but his premature death has made me feel it my duty to afford you certain information connected with the original intention, recent performance, and future usefulness, of the ship, which those only who designed her can supply.

Allow me, then, to report to you shortly some of the knowledge obtained from recent experience regarding the qualities, powers, and usefulness of our ship.

I. It has been proved conclusively by the late trials, and contrary to general expectation, that the great ship is as handy and manageable as a small vessel.

This is no light gain—for it was constantly put forward, as one of her disadvantages, that there were not two harbours in the world she could enter. It is now proved that there is no port, where any ship of equal draft of water could safely navigate, that the great ship could not enter. Here, then, is one fact now established, by experience, in contradiction to one of many hostile predictions.

This fact proves that the means adopted in her original design—to make the ship steer well—have been entirely successful. That she has the proper fineness of run—that her forefoot is sufficiently rounded off—that the shape and size of her rudder are accurately proportioned—and that her steering gear is efficient—all this is now proved beyond dispute.

Now look at the real effect of these facts on the value of the property. She can now be safely chartered to sail from Southampton, Weymouth, Milford Haven, Holyhead, Liverpool, Kingstown, Cork, or Galway. She can be navigated up the Hooghly—if not to Calcutta, at least to Diamond Harbour. Sidney and Melbourne are open to her in Australia, and Portland in Canada; and New York might be safely approached as near as by other vessels of the same draft of water. The great ship, therefore, is neither an exception nor a monster, but is able to thread safely the entrance of any harbour where she is likely to find work to be done.

II. It has been conclusively proved, by the late trials, that the sea-going qualities of the great ship are good, and that her properties as a piece of naval architecture are what I, who designed her lines, intended. It was said that, from her great height out of the water, she would be crank, and lie over on her side as the *Perseverance* did; experience has shown that she stands up admirably, and that under sail she has little inclination. Others said she would have the opposite defect, and would be so stiff as not to yield at all to a heavy sea. By this defect, the sea, they said, would strike her like a rock, and do her great damage. Now, the contrary of this has also been proved, and she has a gentle easy rolling motion, with scarcely any pitching, but just enough of both to prevent her having anything to fear from the shock of the sea.

III. It had been proved that the great strength of her mechanical construction had not been overstated by her designers. If any trial on land conclusively have proved this, the great strains she underwent at launching, without change of shape, did so. But experience of the ship, under the strain of the engines when under way and working up to more than 7,000 horse-power in the sea, has shown that the vibration, which in vessels of high speed is so common an indication of weakness, exists in her to a smaller extent than in any other ship ever built. She has therefore, been proved to be, even for her great size, the strongest vessel in the world.

This is a most important fact to bear in mind in estimating the value of your property, and it most materially affects the question of insurance.

IV. In regard to safety. The peculiar structure given to her, consisting of longitudinal strengthening, and an unusual number of longitudinal and transverse bulkheads, by which she is divided into many water-tight compartments, has stood the severest test. The efficiency of these compartments was tried before the vessel left the Thames. A portion of the vessel was entirely filled with water up to the level of the deck. One hundred and twenty feet of her length were for some days inundated as completely as if that portion of the vessel had been torn open by running on a rock. During this period the remainder of the ship was perfectly dry. Even the sad accident of the explosion of a heater, so deeply lamented from its injury to life, did nevertheless prove the efficacy of this peculiar structure of the ship in securing the general safety; for the whole of the damage was confined to the compartment where it originated.

V. In regard to speed. The facts which have been ascertained are, that in the first trials, made under the disadvantages attending every novelty, the vessel attained a speed of 14½ knots, or about 17 statute miles an hour. It is right you should be informed, that 14½ knots was the original speed assigned to the vessel by Mr. Brunel, in the early reports to the directors of the original company. There is, therefore, no good reason for disappointment on this head. It must be admitted that there were many people who hoped for more, but they had no right to expect it, for the vessel has an extremely small proportion of power for her size. The object of this small power was great economy of fuel on a long voyage. Taking into account the great size of the ship, and the comparatively small amount of horse-power intentionally given to her, she realises a greater speed than any vessel hitherto constructed.

VI. In regard to the nature and speed of a voyage. It ought to be kept in mind that the Great Ship was not built for extreme speed on short voyages, but for the express purpose of maintaining fair speed, with great economy of transport, on a long run of over 13,000 statute miles. For this use, and this use alone, were all her contrivances of construction originally designed. In considering, therefore, how to turn this property to profitable account, you should never lose sight of the fact that she is able to do this voyage in one-third less time than it has yet been done.

VII. Cost of Transport.—I find, according to our present experience, that the cost of running the ship is £2 a mile, including every kind of expense. The goods alone which she can carry, even at the most moderate freights, will repay this cost, and leave the entire passenger traffic as pure profit. The freights she could earn by passengers are more than double what she could earn by goods.

VIII. Remuneration from Passengers.—The comparative exemption of passengers by this ship from seasickness, confined cabins, close air, and the other usual inconveniences of a sea voyage, has been proved by experience to be more complete than her most sanguine promoters anticipated. The large space afforded for air and exercise, the light, luxury, and ventilation of the cabins, have never been paralleled in any other ship. There can, therefore, be no doubt, that on those great lines which passengers frequent in large numbers, a strong preference would be given to that ship which substitutes for the sickness and misery of a long sea voyage all the comfort and luxury of an hotel. Two thousand passengers can be thus conveniently accommodated at fares that would yield a net revenue of £4 a mile.

IX. Summary of Results.—Such, then, are a few of the sea-going qualities and money-earning capabilities of our ship; and you will thus see that all the qualities and powers of the vessel originally promised when she was designed have been borne out by experience. She has proved handy and manageable so as to go into, and out of, any harbour in this or other countries that affords

suitable traffic. She has ample power to stand up in a sea-way or storm, without such rigid stiffness as to make the sea strike her with violence. She has proved herself the strongest ship in the world. She has proved that in danger, whether from external violence or internal accident, her system of separation into compartments is so successful, that no damage to one part of her affects another. She has realised the speed for which she was designed, and which is such as to enable her to reduce the time of a voyage to Australia from 59 days to 39 days. She can not only carry coals for the entire passage to Australia, but find room besides for 5,000 tons of goods. Along with this, she affords ample accommodation for from 500 to 800 first-class passengers, and might be fitted up for 1,000 additional berths, as first or second-class, and 1,500 third-class, if desirable. She has been proved to afford comparative immunity from sea-sickness, along with the comfort and luxury of a first-class hotel; thus rendering a passage across the sea in every way more enjoyable than a long journey by land.

Such are the proved advantages which our ship presents, and yet we are told that our property is a bad one, and must be laid aside as unseaworthy!

It has been stated that the ship is not now completed throughout her whole extent. Of course she is not; she was not meant to be entirely completed until after her return from America, when her permanent station and trade could be determined. Originally she had been designed to accommodate 3,000 passengers or 10,000 troops; but, for the purpose of going to sea, on her trial trip to America, she was only to be completed for 675 passengers. Only two compartments of her length—one of 90 and another of 60 feet long—were completely fitted up for passengers. The rest of the ship remains, as intended, almost entirely unfitted, or provisionally fitted only, for temporary purposes.

In conclusion, I would suggest to you, as fellow-shareholders, not to allow our property to be depreciated by the exaggeration of small faults over great merits.

For myself, as builder of the ship, and as joint-author with Mr. Brunel of her design, I beg to state that I am proud of her general structure, design, and performance. As constructor of her paddle engines, I am satisfied with their performance, and prepared to allow my reputation as an engine-builder to stand or fall by them. I know that Messrs. James Watt and Co. are satisfied with the solidity and excellence of their engines. In regard to the fitting out of the ship, I can certify that Messrs. Ferguson, the mast-makers; Messrs. Westhorp, the riggers; Messrs. Hall, the sail-makers; Messrs. Crace, the fitters and decorators of the saloon; Messrs. Smee, the upholsterers; Messrs. Derby, the plumbers; the Butterley Iron Company; and the other respectable firms whom I employed to complete the work, are the best men in their respective departments of business, and that for the great ship they did their very best.

Before I conclude, let me say a few words about myself. You have been taught to suppose that you and I have opposite interests. Do not believe it! My interests can never be separated from those of the great ship. I am proud to have been her builder. I expect yet to earn great reputation by her; and I am, like yourselves, a large shareholder. It is, therefore, my interest, even more than yours, that your property in the ship should turn out valuable.

It is true, you owe me money for work done; but we are not, therefore, enemies. I want no more for my work than three honest and able arbitrators, to whom you and I have both referred the matter, shall say is due to me; let us both, therefore, set about turning our mutual property to account, for our mutual good.

As a fellow-shareholder of the ship, let me tell you that what is now wanted is the best possible management of the ship. Steam-shipping property is not easily managed; but if you can agree upon men of ability, experience, and success in the management of steam property, to take the entire practical control of the executive part of your business, you will not be disappointed with the result.

J. SCOTT RUSSELL.

London, January, 1860.

Home Correspondence.

THE "GREAT EASTERN."

Sir,—Absence prevented an earlier reply to the observations of Mr. Hawes, but, at the risk of encumbering your pages, and tiring the patience of your readers, I will endeavour to meet his remarks.

In the first place, the "opinions," as stated to be mine, are the result of constant discussion with naval men, as well as engineers; and a late article in the *Times* proves that, for some years, the same questions were matters of contest between the projectors and shareholders.

In my former letter, I said:—"I would have advised separate contracts, under certain sectional plans, accurately defining the spaces for each separate piece of machinery, confining the builders solely to the construction of the carcass, and leaving to them the responsibility and entire expense of delivery into the water, according to custom in such cases." Such is the practice in H.M. yards. It is therefore clear that Mr. Hawes's first assertion is unfounded.

I do not intend to run a tilt with anyone on the merits of any of Mr. Brunel's achievements, nor do I assume any opinion of my own. "*De mortuis nil nisi bonum.*" Indeed, I have ever heard Mr. Brunel's talents spoken of in the highest strain, but, at the same time, as expensively exerted, and it is to this matter that I direct my remarks. I strongly advised my friends to withhold their subscriptions to the *Great Eastern* scheme. I appeal, not to assertion and useless argument, but to the low purses of my friends, for the justness of my advice. I may be allowed, perhaps, to remark that those to whom I look for approval, warranted by proved facts (the Lords of the Admiralty), thought fit to place unlimited power in my hands, in order to carry out public expenditure at the minimum cost; and, moreover, I think I may assume that the first ships of war on the sectional compartments—*Erebus* and *Terror*—were directed to be fitted under my supervision; and altogether, although not connected with any of the works carried out on the *Great Eastern*, I was from time to time asked for advice by influential friends.

But to facts:—It is the custom of the naval service to give the officers appointed to command special expeditions, the power "to fit the vessels for their assigned duties;" and when Government intrusts this power, it is with a conviction that the officer so favoured will do his utmost in fitting the vessels most effectually, at the same time not wantonly incurring expense.

I do not stand alone in condemning the gaudy fittings and adaptations in the *Great Eastern;* nor do I yet know, as a fact, that Captain Harrison approved, disapproved, was consulted, or possibly beaten by those who would not yield. But to my expression—"If such a prime mover, possessing the full confidence of the Company, had guided the fittings." It is here simply suggested that the Company (that is the Directors) should, through their superintendent, and after mature deliberation, warrant the expenditure on her "fittings."

Now the fittings are matters with which the builders should not have been permitted to meddle. The objects should have been distinct, and my humble opinion remains unchanged, that, under similar circumstances, if the hull of that vessel had been delivered at a certain rational sum per ton alongside one of Her Majesty's yards, and a captain superintendent been empowered to supervise, and take care that her engines were delivered and fitted by the several contractors, in due working condition, in their

allotted spaces, and finally, had adequately fitted the vessel for sea,—I reiterate the assertion—supposing Captain Harrison, or any other adequate superintendent, to control—"that vessel under her original owners would long ere this have brought home triumphant records of success."

Is this deemed adverse to the ship, or her constructors? No; but adverse to the gross absence of judgment in dispensing, or not guarding, the funds of the shareholders. I cannot see (with the facts published in the papers of her present incompleteness in every respect) how the life of Mr. Brunel could have changed matters?

The question put by Mr. Hawes is:—What more would Sir Edward desire? But I am totally mis-read, mis-apprehended. I desired safety to the shareholders, and their safety would have insured public safety, success, and the upholding of the national character.

I desired, or contemplated, a stringent, scrupulous supervision of the fund subscribed, under such a contract as men of business would draw up; and further, due care, under adequate security, that this should be executed to the uttermost farthing. May I be permitted to ask the question—If a body of men contemplate a vast work, do they not obtain estimates (in excess), and having obtained the subscriptions, do they reckon upon such a loss as is now patent in this *Great Eastern?*

It would be taking up too much valuable space to reply to any mere opinion expressed on my opinion. But the building in docks is too simple a matter to discuss; and within the last few days I have been informed that in three convenient sites, offers, very similar to my views, were made, which would have obviated the outrageous expenses of the launch.

My views are simple. If the contract had been made "to deliver the hull, at a stated price, in the water," it would have been immaterial to the shareholders, whether the contractors preferred to construct her on Wimbledon common, or to incur any other outrageous expense,—their funds would be safe.

But, as Mr. Hawes may smile at the mention of Wimbledon common, I must remind him that I am a "go-ahead" man also, and if he wants a fact to warrant the idea, let him seek for the launch of H.M.S. *Genoa*, 80, at Genoa, after the capture of that city.

The question of building vessels of 10,000 or 12,000 tons, I believe, will presently be discussed more ably in public, therefore I shall leave Mr. Hawes to contend with other opinions, and merely ask, how many more Great Easterns will find men mad enough (at present) to risk capital?

Mr. Hawes assumes as a fact that the *Great Eastern* will answer. I have never questioned the fact of her getting to sea, and behaving tolerably well there under judicious command; and, provided she quits her present moorings, is sure of cargo, sure of smooth water, indeed free from any liabilities to failure, or accidents from elements, or breakdown of machinery, I do think she may make one or two voyages; and I here wish it to be understood, I sincerely hope she may succeed, for the interest of many friends in whom I feel deep interest, but more especially as a matter of national character.

But, setting aside diversity of opinion, as beneath the consideration of men in earnest, let us inquire what the difficulties are which beset her, allowing she may be completed for sea. Are our merchants prepared to form another company to insure cargo and passengers? Are they content even to risk their goods? Is the Government content to risk the number of troops she can accommodate in one bottom? Or can the difficulties attending the reception and discharge of cargo, at every port, be overcome? To say that a vessel is to be built for certain ports is manifestly begging the question. If she is fit for mercantile purposes she should be independent of the enormous triple freight-charges, entailed on visits to certain places—for manifestly the appliances for loading, for conveying, and discharging, involve vessels adapted to convey goods to and fro larger than any lighters now in use—and these charges, added to freight, will be swelled to full the amount now charged by ordinary although less expeditious vessels.

But one *Great Eastern* will not attract nor monopolise the traffic, nor bear the palm, uncontested, of pre-assigned velocity—pre-assigned consumption of fuel, nor the hitherto forgotten difficulty "clean and smooth bottom"—an evil too great in iron-built vessels to be lost sight of; and, being entitled to an opinion on such matters, I may add, eternally clean flues and boilers. These are the matters which hang on the minds of practical seamen.

Let us go back a few years, and seek experience as to "reputed velocities." I have thought, perhaps, as deeply as most men engaged nearly 48 years in sea life. Can any of us fail to recollect the speed we were promised for the packets between Holyhead and Kingston—*Caradoc*, *Vivid*, &c.? They were to average 20 knots an hour; and for a short period, with clean bottoms, and engines which could be depended on for the vessels, they performed admirably, and far outsped anything we dream of now for the *Great Eastern?* What is their average speed now?—one of this family, I was informed, could not keep pace with the *Great Eastern* at the slow pace of 12 knots!

Now we know full well that our frigates built at Milford, and sent round to Plymouth under jury-masts, generally beat our coppered ships of war, complete for service. This is precisely the condition of the *Great Eastern*. When she sinks to her load-line, has taken up the usual stock of vermes and crustacea on her bottom, has close-reefed her paddle-floats, and is ready for the Atlantic struggle, she will only then be in a condition to compete with other vessels between port and port. That is the only test which will satisfy seamen.

But I fear her engines. If pressed for velocity beyond 13 knots, I know of my own experience—not fancy—that the expenditure of coal, fouling of flues, encrustation of boilers, and heating of bearings—*inter alia* (a very awkward addition—will tend to throw her upon her masts and sails. Then her want of keel will be felt; and I will only refer to one of the numerous difficulties to which she will be liable, and, in spite of all the balderdash of pluck, talent, and resources, she cannot avoid it. If she be to leeward of all ports, where will she go? and wherever she may happen to reach, will she not there make it her final resting place? No aid by other steamers will avail her, even to tow her to an anchorage, unless in calm.

Now, as to breaking her shear. Mr. Hawes travels out of his way to seek a wrong construction. Any practical seaman (and those about me confirm this) must understand my expressions; even landsmen tell me they have no difficulty.

Possibly there are few seamen who have experienced the amount of anchor work, daily for years, which fell to my lot; and it is a critical point even with first-rate seamen to force their ships ahead riding during a gale over a slack cable. It is beyond the control, too, of the captain. Any diminution of wind, excess of steam, or chop of the sea throws the bow obliquely to the strain; then the length of the *Great Eastern* is the danger to be feared.

I know full well that among the causes adduced by our best seamen which prevent their entering for our ships of the line, "large chain cables, and yards too large to lie out on," are their principal objections; and where once these "chain cables" get rapid motion, it is, even to the most experienced seaman, terrific. And it may be noticed in my communication, in treating of the *Great Eastern*, I observe—"thanks to the skill of the commander;" for I believe that had some of Mr. Hawes's over-zealous (it is not courage) "young mates, aspiring to command," conducted operations on that occasion, we should not now be discussing her merits.

I regret to see "was" in Mr. Hawes's remarks, because that intimates another difficulty—the removal or resignation of Capt. Harrison, for no one who has less experience of the vessel can so well command her, or expect confidence from the public.

Now, as regards Dr. Scoresby. It is needless to observe more than to say that we both discussed the matters referred to at Swansea, when he made the following observation—"The facts you have adduced are deserving of serious consideration; I have partially witnessed them myself, and have not quite shut my eyes to them, but I will make further investigation before I deny the validity of your reasoning."

I stated facts. I have no time to enter into discussion merely for argument's sake. The overwhelming of the old Eddystone lighthouse, and observing the sea wash very high up the present; the washing of the sea over that at Whitehaven; the surf of the coast of Africa, without any strong off-shore gales; the rollers at Mazatlan, Gulf of California; those similar at Tristan d'Acunha, with numerous other instances, satisfy me of "the freaks of nature." Why the *Great Eastern* is to be free from them I will not argue. But if "the Bellerophon seas" struck her, inevitably damaging paddle-wheels and steerage, her internal machinery, to my comprehension, would be useless. What she may perform under canvass remains to be proved.

It would be useless on my part to wade further; my only object is to answer matters clearly within my own province. I entertain no "jealousy of landsmen daring to construct;" but, as a constructor, and knowing what form best suits the seaman, and, really, "what can be got out of even a tub," to use a nautical expression, I hope I may, without offence to landsmen, give expression (and free from any offensive inuendo) to professional opinion.

I repeat, in few words, I give Mr. Brunel the fullest credit his utmost admirers could wish for his brilliant masterly genius. But, before we construct such mammoth vessels, men capable of handling their cables and sails should be found. If the *Great Eastern* proceeds to sea, I hope her voyage may be confined to temperate climates, until adequate trial proves her capabilities. A friend at my elbow inquires "How any set of seamen, however tall, muscular, or able, could handle her cables or chain gear during winter months on the coast of America." I would add, "even hempen gear and sails."

In conclusion, I regret extremely that Mr. Hawes has replied. First, because he endeavours to make me appear invidious of the vessel; next, as to assumed speed and management; and, finally, as to behaviour if her machinery or steerage become damaged. If his object was simply to uphold the character of the undertaking as a venture, I think discussion such as he has courted will not tend to support his object. Again wishing the *Great Eastern* every success and Godspeed,

I am, &c.,

EDWARD BELCHER.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. Joseph Towne, "On the Organs and Phenomena of the Senses, Intellectual Powers, and Memory."
Medical, 8½. Clinical Discussion.
United Service, Inst., 8½. Capt. Sherard Osborne, "On the Arctic Researches."

Tues. .....Royal Inst., 3. Prof. Tyndall, "On Fossil Birds and Reptiles."
Civil Engineers, 8 Continued Discussion on Mr. Grantham's Paper, "On Arterial Drainage and Outfalls."
Statistical, 8. Prof. Leone Levi, "On the Distribution and Productiveness of Taxes, with reference to the prospective ameliorations in the public Revenue of the United Kingdom."
Pathological, 8.

Wed. .....Royal Society Literature, 4½.
London Inst., 7. Conversazione.
Meteorological, 7.
Society of Arts, 8. Dr. R. Angus Smith, "On Science in our Courts of Law."
Geological, 8. 1. Prof. J. Phillips, "On some Sections south of Oxford." 2. Prof. R. Harkness, "On the Old Red Sandstone of the Grampians." 3. Mr. A. Geikie, "On the Old Red Sandstone of the South of Scotland."
Ethnological, 8½.

Thurs. ...Royal inst., 3. Professor Tyndall, "On Light."
Royal Society Club, 6.
Antiquaries, 8.
Linnæan, 8. 1. Drs. Carpenter and Claparède, "On *Tomopteris oniscíformis*." 2. Mr. J. Lubbock, "On the Tracheary System of Insects." 3. Mr. F. Walker, "On the Dipterous Insects collected in Amboyna, by Mr. Wallace."
Chemical, 8. Mr. R. Warington, "On Metallurgical Chemistry."
Royal, 8½.

Fri. .....London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Prof. Tyndall, "On the Influence of Magnetic Force on the Electric Discharge."

Sat. .....Asiatic, 8½. Mr. J. A. Mann, "On India as a Source of Cotton Supply."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January 6th*, 1860.]

Dated 3rd September, 1859.

2012. W. Wheatstone, 20, Conduit-street, Hanover-square, Middlesex—Certain imp. in harmoniums.

Dated 28th October, 1859.

2468. J. Higgins, Salford, Lancashire—Imp. in machinery or apparatus for warping yarns or threads. (A com.)

Dated 3rd November, 1859.

2500. G. White, 34, Dowgate-hill, Cannon-street—A mechanical arrangement for steaming grain or other grits in order to allow the bran better to separate from the flour. (A com.)

Dated 26th November, 1859.

2676. L. J. Vandecasteele, Bruges, Belgium—An improved method of coupling the locomotive with the tender for the purpose of giving greater adhesion between the wheels of the former and the rails.

Dated 30th November, 1859.

2704. G. J. Wainwright, Dunkinfield, Chester—Imp. in apparatus for supplying moisture to the air in cotton factories, and for indicating and registering the strength and elasticity of yarn and thread.

Dated 5th December, 1859.

2750. W. Youens, Hackney, Middlesex—Imp. in apparatus for playing keyed musical instruments.

Dated 6th December, 1859.

2756. E. Dowling, Woodford bridge, Essex—Imp. in fire escapes.

Dated 8th December, 1859.

2782. J. R. Foord, Acorn-wharf, Rochester, Kent—Imp. in applying travellers or lifting engines to barges or other craft, for drawing piles, raising sunken craft, moorings, and other such like purposes.

Dated 13th December, 1859.

2832. S. C. Lister, Manningham, and J. Warburton, Addingham—Imp. in machinery for preparing and combing wool, flax, silk, and other fibrous materials.

Dated 14th December, 1859.

2836. T. Bolton, J. Bertenshaw, and J. McConnell, Bolton-le-Moors, Lancashire—Certain imp. in machinery or apparatus for roving, slubbing, spinning, and doubling cotton and other fibrous materials.

2838. G. Bedson, Manchester—Imp. in puddling furnaces.

2840. S. Bentley and J. Stringer, Wednesbury, Staffordshire—Certain imp. in railway chairs.

2844. A. B. Ibbotson, Sheffield—An improved draw and buffer spring apparatus for railway carriages. (A com.)

2846. G. Hawksley, Three Mill-lane, Bromley-by-Bow, Middlesex—Imp. in pumps.

2848. G. Leslie, Hammersmith—Imp. in preserving casks by means of self-acting apparatus for closing up the holes made in casks, and excluding air from such casks, when in an empty tate.

Dated 15th December, 1859.

2850. J. Bettles, Kingsland, Middlesex—Imp. in apparatus for propelling vessels.

2852. C. Reeves, Birmingham—An imp. or imps. in breech-loading fire-arms.

2854. E. Cormier, Paris—Imp. in the preservation of eggs.

2858. W. Gadd, Langsyne-terrace, Nottingham—The manufacture of edgings and quillings made simultaneously on lace or warp lace machinery.

2860. W. H. Harfield, Royal Exchange-buildings, London—Imp. in windlasses, capstans, and shackles for chains.

Dated 16th December, 1859.

2862. E. P. Holden, Bolton-le-Moors, Lancashire—Imp. in machinery for opening, carding, and cleaning cotton and other fibrous materials, when in a manufactured or partially manufactured state.

2864. J. Knight and A. Walbank, Great Horton, Yorkshire, and J. Bentham, Bradford—A new woven fabric, and in the materials employed in its manufacture.

2866. H. Stokes, 27, Coventry-street, Middlesex—Imp. in boots, particularly applicable for military purposes.

Dated 17th December, 1859.

2870. J. Sellars, Manchester—Imp. in the manufacture of size for stiffening, finishing, and dressing woven fabrics and yarns.

2874. T. W. Plum, Blaenavon Iron Works, Monmouthshire—Imp. in the manufacture of tyres for railway and other carriage wheels, and of hoops and rings, and in machinery employed therein.
2876. R. P. Busk, Lille, France, and T. Greenwood, Leeds, Yorkshire—Improved machinery for opening and drawing fibrous substances.
2878. J. D. Hinsch, Saint Paul's-churchyard, London—Imp. in the construction of gun boats.

Dated 19th December, 1859.

2880. M. Todd, Bradford—Imp. in machinery for combing wool or other fibrous substances.
2881. E. T. Hughes, 123, Chancery-lane—Imp. in apparatus for cutting out the soles and counters of boots and shoes. (A com.)
2883. G. S. Goodall, Brighouse, Yorkshire—Imp. in wire card-covering, for carding tow, flax, or other fibrous substances.
2884. L. Serbat, Saint Saulve, France—Improved means of removing incrustations in boilers, and of preventing the same.
2885. A. Bathgate and J. H. Wilson, Liverpool—Improved apparatus for distilling water, and cooking on board ship.
2886. L. Pellissier, J. Jannesse, and E. Castillon, Bordeaux, France—An improved brake for railway carriages, and mode of transmitting signals for working the same.
2887. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in musical instruments with piston or cylinder valves, and in the method of writing or arranging music for the same. (A com.)
2888. T. Symons, Plymouth—Imp. in propelling vessels through water.
2889. J. Cowan and P. Cowan, Barnes, Surrey—Imp. in revivifying or restoring animal charcoal and in the apparatus employed therein.
2890. D. Hitchin, Coventry, Warwickshire—An imp. in the caps of watches.
2891. J. Smith, Birmingham—Imp. in the manufacture of composition jewellery and ornaments, and in cases for jewellery, photographs, and for other similar purposes.

Dated 20th December, 1859.

2893. M. Jones, Cardiff—Imp. in the mode of preventing explosions in boilers and steam generators.
2895. M. Turnor, Birmingham—A new or improved method of manufacturing metal boxes.
2897. W. Bayley, jun., 79, White Lion-street, Islington—Imp. in machinery for cutting wood.
2898. G. Collier and J. Collier, Halifax—Imp. in means or apparatus for the manufacture of carpets and other pile fabrics.
2899. J. Fenton, Low Moor, near Bradford, Yorkshire—Imp. in cannon and other fire-arms, and in projectiles.
2900. W. Henderson, Alderley Edge, Chester—Imp. in treating certain ores and alloys, and in obtaining products therefrom.
2901. R. S. Howden and E. Thresh, Wakefield—An improved construction of safety lamps.
2902. A. V. Newton, 66, Chancery-lane—An improved construction of churn. (A com.)
2903. A. Welch, Southall, Middlesex—Imp. in portable railways to facilitate the movement of carriages on common roads and other surfaces. (A com.)
2904. J. Ferrabee, Phœnix Iron Works, Stroud—Imp. in screw-wrenches or spanners, and in securing the cotters of connecting rod and other bearings.
2905. H. Bayley, Stalybridge, Lancashire—Imp. in the construction and manufacture of cop tubes used in machinery for spinning fibrous materials.
2906. J. H. Johnson, 47, Lincoln's inn fields—Imp. in the manufacture of 'water traps,' and in the apparatus employed therein. (A com.)
2907. P. G. Gardiner, New York, U.S.—Springs for carriages or railroad cars.

Dated 21st December, 1859.

2909. S. Plimsoll, 32, Hatton-garden—Facilitating the unloading and transferring from railway waggons into carts and barges, &c., the coals and other matters with which they may be loaded, and for storing the same.
2910. W. Dempsey, Buglawton, near Congleton, Chester—An apparatus to fold bindings of any description.
2911. A. V. Newton, 66, Chancery-lane—Improved machinery for cutting and dressing stone. (A com.)
2912. W. Abbott, 118, Cambridge-street, Warwick-square—An improved method of preserving timber, particularly adapted for railway purposes. (A com.)
2913. W. Abbott, 118, Cambridge-street, Warwick-square—An improved method of rendering fire-wood inflammable. (A com.)
2914. J. Glasson, Newark-upon-Trent, Nottinghamshire—Imp. in steam engines.

Dated 22nd December, 1859.

2915. L. B. Ollivier, Bron, France—Imp. in plough shares, hoes, and other similar cutting parts of agricultural implements.
2916. W. E. Gedge, 4, Wellington-street, South, Strand—Imp. in the manufacture of artificial feathers. (A com.)
2917. W. E. Newton, 66, Chancery-lane—An improved process and apparatus for extracting or separating paraffine from schistose or mineral oils and other hydrocarbons. (A com.)
2917. A. V. Newton, 66, Chancery-lane—An improved construction of kiln or oven for burning bricks, tiles, limestone, and other substances. (A com.)
2919. T. Allen, Wain-gate, Sheffield, Yorkshire—Improved machinery for cutting out clothing and every description of textile fabrics.
2920. G. F. Stidolph, Ipswich—Imp. in organs and other wind musical instruments.

Dated 23rd December, 1859.

2923. F. A. Abel, Woolwich Royal Arsenal—Imp. in protecting from fire textile materials in the raw or in the manufactured state.
2925. W. E. Gedge, 4, Wellington-street, South, Strand—An improved box or case for packing sardines or other provisions. (A com.)
2926. E. Ecroyd, Limefield, Little Marsden, J. Dodgeon, Burnley, and J. Heyworth, Little Marsden, Lancashire—Imp. in looms.
2927. H. Penney, 17, Finchley-road, St. John's-wood—Imp. in the treatment of vegetable fibres for the manufacture of papers.
2928. W. Laird, Birkenhead—Imp. in floating batteries.
2929. R. Telford, Birmingham—Imp. in castors.
2930. R. D. Guthrie, Leadenhall-street—An improved method of lowering ships' boats.
2931. R. A. Brooman, 166, Fleet-street—Imp. in hot water heating apparatus. (A com.)
2933. T. Aveling, Rochester, Kent—Certain imps. in locomotive engines, parts of which improvements are applicable to the transmission of motive power.

Dated 24th December, 1859.

2936. G. K. Geyelin, 462, Oxford-street—Making transparent metallic twisted columns, pillars, tubes, &c., for bedsteads, gaseliers, building, warming, and other purposes.
2936. D. Hulett, 55 and 56, High Holborn, and G. Boccius, Totnes, Devonshire—Imp. in cannon and fire-arms, and in percussion cap-holders and chargers.
2937. W. Sander, New Basford, Nottingham—Imp. in machinery for embossing lace or other textile fabrics made on bobbin net machines.
2939. E. Huber, Paris—The preparation of certain colouring substances for printing and dying, or other purposes.
2941. E. Smith, Sheffield—Imp in ornamenting metal pipes or tubes.
2942. G. G. Brown, Deptford, and W. D. Brown, Greenwich, Kent—Imp. in oil lamps.
2943. F. G. Spillsbury, Bow, Middlesex—A certain translucent or transparent fabric, and for certain applications of the same to various purposes.
2945. R. M. McTurk and G. East, Liverpool—Imp. in the manufacture of collars and cuffs. (Partly a com.)
2946. W. E. Newton, 66, Chancery-lane—Imp. in mills for grinding. (A com.)
2947. J. Smith, Birmingham—Imp. in the manufacture of buttons and other dress fastenings.

Invention with Complete Specification Filed.

2993. W. E. Newton, 66, Chancery-lane—Imp. in spinning machinery. (A com.)—30th December, 1859.

Patents Sealed.

[*From Gazette, January 7th*, 1860.]

January 4th.	
1589. H. C. Howells and J. C. Howells.	1626. E. Livermore.
1590. R. A. Brooman.	1630. H. Brinsmead and J. Lawrence.
1591. R. A. Brooman.	1632. T. D. Duppa.
1594. W. Knapton and A. Aitchison.	1634. W. N. Nicholson.
1605. S. B. Haskard.	1635. W. N. Nicholson.
1606. S. Lloyd.	1642. J. Smith.
1609. J. T. Edmonds.	1660. W. Cotton.
1613. J. Knowelden and D. Edwards.	1684. Henry Cunnew.
1615. Sir F. C. Knowles, Bart.	1697. A. V. Newton.
1616. J. Smith.	1711. J. Todd, jun.
1619. G. Ellis.	1823. J. Cunningham.
1622. F. A. Le Mat.	2084. W. B. Adams.
1623. J. Gibbs.	2385. A. S. Rott.
	2416. W. Fox and J. Willis.
	2487. L. Pohl.
	2495. J. L. Budden.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, January 7th*, 1860.]

January 3rd.

71. Thomas Ball and J. Wilkins.

[*From Gazette, January 10th*, 1859.]

January 5th.	*January 6th.*
50. H. Bougleux.	77. J. H. Johnson.
52. R. A. Brooman.	95. R. A. Brooman.
68. J. Harris.	
69. A. McDonald.	*January 7th.*
84. J. and C. Gratrix.	185. H. Cater.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, January 7th*, 1860.]

January 2nd.	*January 3rd.*
25. C. F. Whitworth.	41. P. Graham.

[*From Gazette, January 10th*, 1859.]

January 5th.	*January 7th.*
45. T. Pape.	75. J. Petrie, jun., & S. Taylor.

Journal of the Society of Arts.

FRIDAY, JANUARY 20, 1860.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date :—

Charles Brooke, M.A., F.R.S.	£2	2
C. Wentworth Dilke, Vice Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

SEVENTH ORDINARY MEETING.

Wednesday, January 18, 1860.

The Seventh Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 18th inst., Vice-Chancellor Sir W. Page Wood, Vice-President of the Society, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Ashworth, Edmund
Edgar, William, Jun.
Kennedy, Rev. Benjamin Hall, D.D.
Waddell, James, Jun.

The following Institutions have been taken into Union since the last announcement :—

Droitwich, Literary and Mechanics' Institute.
Faversham, Mutual Improvement Society.
Rotherham, Young Men's Christian Association.
Scarborough, Mechanics' Institute.

The Secretary called attention to a new method of bottling liquids, invented by Sir James Murray, M.D., of Dublin, a bottle filled by this method being shown. The plan adopted consists in placing the bottles, previously to their being filled with the liquor, in a vessel containing carbonic acid gas, of a depth more than sufficient to cover the bottles. The gas, by its greater specific gravity, enters the bottles, driving out the common air. The liquid is then poured in, and the bottles are corked while still in the gas. By this means the liquid entering the bottles does not come in contact with the common air in the bottle, as in the ordinary mode of bottling, and the interval between the surface of the liquid in the bottle and the cork is thus filled with a powerful antiseptic.

The Paper read was—

SCIENCE IN OUR COURTS OF LAW.

By Dr. R. Angus Smith, F.R.S.

Prefatory Remarks.—The mode of taking scientific evidence in Courts of Law having engaged my attention, I brought the subject before the Social Science Association in Birmingham at its first meeting in 1857, and, subsequently, by a letter published in the *Athenæum*. These papers excited some interest, and when I brought the matter before the Chemical Section of the British Association at Aberdeen, I found every one ready to agree in the propriety of forming a committee for considering it, whilst the Rev. Vernon Harcourt drew up the resolution. Soon afterwards Dr. Letheby read a paper on a portion of this question at the Social Science meeting at Bradford, and I also read there a second paper, which was again read before the Law Amendment Society, and the Rev. W. Vernon Harcourt brought it before the Council. The Social Science Association and the Law Amendment Society have both shewn interest in the matter, and the Medical Society and many journals have discussed it.

Since it has become a public question, I do not see any impropriety in bringing the subject before this Society, instead of waiting for the report to the British Association.

Although aware of the eminent services of Professor Christison to the country in promoting the study of medical jurisprudence, I was not aware of his pamphlet, published in 1851, on the present state of medical evidence. Nearly all that pamphlet, or lecture delivered before the Royal College of Physicians, Edinburgh, although referring to medicine specially, may equally apply to science generally. I had marked out many passages in his lecture to which I wished to refer, but I found my own mode of discussing the matter to be such that I was not able to introduce them. I preferred, therefore, to request Dr. Christison to send a summary of his own views, and these views may be appended in his own words if they arrive in time.

I do not pretend to any knowledge of law; this subject is one with necessarily new aspects, because the great influence of science is new. It seemed to me that the question, in its present relations, had never yet been put into a distinct form, and I can only give you that form of discussion which it has first taken in my mind. Much has been written on the law of evidence; I do not touch it in its isolated condition, but endeavour to see the subject only in relation to the scientific man. Each part must afterwards be studied in detail. As law is not my study, I may be allowed, without blame, to err in my proposal of remedies, but as science is my profession I may be listened to in detailing some of its disabilities.

At present my object is to prepare the subject for public consideration and discussion. Time will not permit me to give full reasons for all that I say.

Position of Science and General Principles.—If it were required that I should advocate the claims of science I would certainly not appear here, because to plead requires eloquence. Science has made its own claims felt, and has gradually won, at least the second place of importance amongst our ideas. It has patiently waited under the neglect of nations, who have now found that they only neglected themselves, and under the displeasure of authority which has been found to punish itself. The time has now come when we look to the beneficent aid of science to teach us everything relating to our material welfare, and guide us in much that relates to our moral civilization. We have learnt that to manage houses, lands, towns, or nations, it is absolutely needful to obtain a knowledge of man's relation to natural law and objects; and many great questions of state policy, which at one time were settled only by those who were wise in social and international law, are now referred to those who know the power of the elements and the method of using them. We instinctively recognize the greatness of mental power, and it will always govern the world. Experience too,

which has ripened into wisdom, will never cease to cause all right-hearted men to listen with respect, and we recognise in genius a power that comes in a way uncomprehended, and nearly allied to our ideas of the Divine. But all these exist amongst us in imperfection, and from their decision the meanest may appeal, and find in nature, or in science which represents it, a mode of obtaining the most satisfying justice, delivered frequently with such power that it seems to emanate directly from the throne of the Creator. In such cases the wisdom of the greatest, and the ignorance of the smallest, bow equally before the verdict. It is as if a true theocracy were growing amongst us, when men will cease to be oppressed by cunning reasoners, who have so long distorted truth and disarranged the action of less acute minds.

Viewing this as the position of science, I do not come before you to beg that you will consider its deserts and bestow on it some of your favours. Science can help man, but man cannot help science. I come only as one who recognises the greatness of what science has done, and its willingness to perform still more, and who is desirous to assist in removing any obstacle that may interrupt our progress in its knowledge and our enjoyment of its benefits.

We see science moving with irresistible force, gradually seizing more and more of the rights and properties of every subject and of every government, whilst the scientific man, the expounder of science, has no recognised place, but is allowed to give his evidence as a necessity, and frequently in a manner that might be shown to be as illegal as it is for the time unavoidable. High as the position of a man is who conscientiously and clearly expounds natural law, I have no desire to ask for him either the place of Judge or of Jury. The power of science will always increase, and it is to be desired that this power should be wisely regulated. I am not aware that physical law has ever been represented in our legislation, still less the men who represent that law. Moral, religious, and social laws all have their representatives. But without discussing the character of each I would say, that great as science is, and greater as it must be, and in its own department without opposition, there is a something that is greater; and although its decisions may seem to come from the throne of the Creator, there is a something which is still more allied to the Divine, and that is the spirit of man. It came into the world, as everything would indicate to us, long after nature had made physical science; it came with a strange instinct of being master of a house prepared for it, peremptorily refusing to be a mere slave of external nature, however powerful, much less the slave of any pedantic array and circumstance of law hitherto propounded by man. The spirit will sometimes claim its independence and its freedom; it rises then far above science, into religion, poetry, and prophetic vision, driven on by Divine instincts, where science and reasoning cannot yet follow.

I propose that these two principles guide us in considering the subject.

1st. That physical science is the ultimate referee, in cases where it can give a clear answer, and that suitable arrangements should be made for obtaining the unprejudiced opinion of those who have studied it.

2nd. That in all differences of opinion, whether in social or physical law, and in all difficult cases, the instincts of man, in a free country, will take the lead (right or wrong).

I have put these propositions in a form which I think few, if any, will contradict. They might both have been differently expressed; speaking more abstractly, I would say, for the first, physical science expresses the mind of the Creator as far as it relates to physical laws and objects. Some might object to this, and for them it might be said with equal truth, that to a certain extent, physical science expresses necessity as shown in physical objects.

If we knew science perfectly well, the second proposition might be unnecessary here, for although the genuine instinct and moral sense of man are above physical law, they cannot be opposed to it. The second proposition is intended to show the necessity of defence even against science, because science is liable to be expounded by its teachers pedantically and imperfectly.

Some men of science may object, but I will not defend myself here.

There is little to see in the world but a desert, until the spirit of man brings out of it life, and thought, and wisdom; and science is not all that it has produced, although at times it does threaten to absorb all the rest. A better organisation is needed, to enable us to reap the harvest, some of which is constantly ripe. It might be said that scientific law is so powerful that it will administer itself—we may let it take its own way; but man has the right of exercising some of the functions of the Creator, and uses or neglects the machinery of the world as he thinks fit.

The use of science in the State must, like everything else, be regulated by law. That law, again, will be controlled by the free spirit of man. Too close adherence to law, without wide sympathies, may be called pedantry. Science and exact knowledge represent man enslaved to law. Feeling and instincts represent him free and above law. Both being true, they must control each other.

For example, everybody recognises the high position of a judge. All laws, moral and physical, bearing on the question to be decided, should act upon him, producing a ready sympathy. Every fact should be measured in relation to all others, and take its place in its proper line of perspective. There probably never was a time when the smallest community lived without a real or a nominal judge. The position of advocate is also fully recognised. It was wanted at a time when the law was the ready servant of despotism, and when it was a good and great thing to deliver the innocent by the force of truth only. The advocate or barrister is no less wanted now. Men are not all able to see their own case clearly, and few are able to explain it; education and experience are needed for the purpose.

The position of the jury has been less fully defined, as far as I know. I look on it as a mode of protecting us against the pedantry of law, or its intellectual expression as existing in our own legislation, by bringing to bear upon it the free spirit of man and his penetrating instincts. But as the wisdom of our neighbours and ancestors expressed in words frequently makes the path of instinct very clear, the judge expounds the law to the jury. The judge stands as an example of Proposition 1, the power of law. The scientific man is in a similar position. The jury is an example of Proposition 2, the free action of the spirit. The position of the witness is very vague; he stands as one in a mass of confused facts, fancies, and fabrications, out of which the advocate shall bring order.

Again, as the instruction of the judge may shew that he himself is on a wild moor without a road, the twelve jurymen, each a centre of instinct, at once take the lead, and find out the path by shrewd although inexplicable guesses. I speak of the ideal and perfect jury, which, like other things, must be matured gradually.

Complaints against the Present System.—The following are some of the objections against the present mode of giving scientific evidence. When a barrister examines a witness he asks such questions as suit his case, and lead directly in the line of argument which he adopts. To do this he exaggerates some points and he diminishes or passes over others. We cannot blame the barrister for this; it is his duty to win the cause if possible, and his interest is so strongly set in that direction that it would be too much to expect a perfectly impartial statement. It may even be true that a perfectly impartial statement is not desirable, and that it is much better for the public that there should be persons who will say in the fullest method all that can be said by the most prejudiced person in favour of each side. Let us allow at any rate that this is the general idea of a barrister in practice. If the scientific man does the same we have two parties with the same duties. The scientific man in that case simply becomes a barrister who

knows science. But this is far removed from the idea of a man of science. He ought to be a student of nature, who loves whatever nature says, in a most disinterested manner. If we allow him or encourage him to be an advocate, we remove him from his sphere; we destroy the very ideal of his character; we give him duties which he never was intended to perform, and we turn him aside from the objects which first in early life led him to study in the direction of science. Again, we lead men who were educated to one mode of thought to act under the auspices of another. We teach them to study impartially, and then tell them to practice with partiality. We educate them for one thing and tell them to act out another. Such a division of the moral nature of a man is extremely hurttul, both to the individual and to society. Many men, finding this disruption of their nature to be a natural consequence of giving evidence in courts, refuse to do so. The public of course lose their help. Others again are sufficiently courageous to attempt to take an independent course, but so difficult is it that none can do so without being complained of, none can do so without feeling that his position as a witness does not permit him to give all his evidence. Even supposing a witness to insist, as some will do, on giving all his fullest evidence, it is scarcely possible to avoid having it distorted by the examining party. One trifling remark may be so examined, and so much questioning may be spent upon it, that it takes the place with the jury and the public of an important point. On the other hand, a most important remark is passed over in silence. Now this destroys the due proportions given to the evidence in the mind of the scientist. His careful elaboration of the subject is made into a rough mixture of thoughts; he weighed his words carefully at home, and wrote his evidence patiently and with scrupulous attention to exact phraseology, and he now finds that the great and the small are confounded together by the extreme skill of the practised examiner. Again, his words, carefully chosen at home, are not so carefully chosen in a crowded court, where he does not feel at his ease, and he is not even capable of expressing truth in the exact manner in which he has thought it out. It is true that the barrister must be allowed to put the matter in the light which suits best his case, and by examination, as well as afterwards by speaking, he has opportunity enough, but I do say that the scientific man ought also to be heard in his own method, and if not, the truth will only be half told, or obtained with great difficulty, as at present. The scientific man may give his opinions a certain bias; he cannot do so to a great extent without loss of character when he is unaided by the barrister. We want his facts and then his opinion. The bar must use them for its purposes, but we do not wish his evidence to be given by the mouth of the bar, which is professionally biased. The principle is essentially wrong. Again the scientist's clearness of evidence does not at present depend on himself wholly, but on the bar, which brings out fragments of his opinion most difficult to unite. If once thrown into the confused form which suits the advocate, there is no chance of again restoring it to order. Even if opportunity were given, the scientist is seldom able to equal the barrister in ready expression, just as the barrister is unable to equal the scientist in giving a finished expression to scientific thought. The functions, as well as the capacities, of the two men are essentially different, and the present method confounds instead of defining them.

Science in its modern form is a new institution, and has not yet been recognised formally in the social system. For this reason its students have no status in a court of law, but are allowed to appear under the vague name of witnesses, and expected to say yes or no at the instigation of another. Although it is needful that men of science should resist this want of respect, it cannot be entirely avoided without the interference and assistance of the law.

It would be a mistake to say that the subject has been taken up on account of any very recent events, or even on account of the frequent opposition of opinion among scientific men. All professions and all classes have differences of opinion, and none more so than the legal body. Why then do we object to the opposition of physicians, chemists, and engineers? Because it is repugnant to our feelings to see great questions from nature played with, distorted and hidden for selfish purposes. Any method which will compel a fairer utterance will diminish the frequency of the fault or crime which is now imputed to the man of science, but which fault in reality lies hidden partly in the heart, which we will not attempt to alter, and partly in the system, which must change with society.

Neither is the subject brought before the public because science is not sufficiently respected. There is a sense in which it or some of its professors have been too much favoured. Respect should be shown with some discrimination. This false syllogism guides most men:—

Science is powerful;
Certain men are the highest in science;
Therefore give them the power.

In this way men are requested to give their opinions on subjects perfectly new to them, because they have studied with success other subjects, and the public can approach the laws of creation only through a clique. Men, even in scientific matters, weigh each other down by great names, forgetting that nature is the only authority.

> "At last you fixed a vacant stare,
> And slew him with your noble birth."

However vacant the stare, the great name gains the day. Thousands of pounds are given to men to support an opinion by their name and their cunning, when men of less name know it by experiment to be false. I refer to no chemical questions. This is a subject requiring a separate lecture, one not agreeable because revealing principally the sores and crimes of our highest civilization. I introduce it merely to show that it is not, in a sense, the neglect of science that is so much in fault as the absence of the decent order and supervision of law.

I speak of the subject chiefly for the purpose of protecting the scientific man from his false position or want of it, and to protect men from blaming and defaming science, which appears to lose its high character when coming from the mouths of men who, if they do speak, must do it under the disorganisation of a trial involving scientific questions. But the public will be the greatest gainers by the introduction of a wise method, and to be gainers they must expect a great deal of opposition of opinion among scientists. I should be sorry to see the time when any man, however high in science, carried despotically the opinion of a court, unless he showed in the fullest examination that he could stand his ground against every adversary, to the satisfaction of a sound judge and enlightened jury.

There are in a court of law various positions in which a scientific man may be placed. Let us consider these separately. All of them a scientific man has occupied, or does occupy, nominally or really in this country or in others, although generally and nominally with us he occupies only that of witness. We may imagine the scientific man acting—

1st, as judge. When scientific evidence is received before a scientific man as judge.

2nd, as judge and jury united. When a question is referred to a commission plenipotentiary, or deciding commission.

3rd, as commission recommendatory, or advising commission.

4th, as jury—a jury of scientific men.

5th, as advocate.

6th, as witness.

7th, as assessor—assisting a judge to examine scientific witnesses.

8th, as scientific man, or in his own character.

The principles laid down lead us to reject the first three proposals with only a few remarks.

1. As Judge.—Although scientific men, as a class, have ideas of justice as clear as men can have, allied to capacities

for all the higher duties of life, there can be no desire to give to anyone of them the office of judge. It cannot be their ambition to encroach on the functions of the legal profession; nor can we imagine scientific men acting as judges, in a manner equal to those men who have all their lives been familiar with the study of the numerous relationships of men and circumstances that make up our social life. There is no trial in a court purely scientific; such trials take place in the scientific societies and periodicals. There are portions only relating to science. The trial is begun, not because of its science, but because of the individual and social rights involved; and these rights are the exact province of the judge, demanding the knowledge, experience, and wisdom which are derived from observing the various relations of life. It does not belong to the scientist's province to see all the social bearings of a question; nor is it his business to deal with feelings, emotions, suspected fraud, and numerous other points that require the watchfulness or sympathy of a judge. I use the word science for the physical and exact sciences only, in which exact observation is more prominent than tact, feeling, or knowledge of character, or even a finely-balanced judgment.

2. As Judge and Jury United.—When a scientific commission is appointed to report on a question, the members unite the power of judge and jury. I am not aware that this was ever done in our courts of law. I believe the practice would be hurtful. The value of a jury is great according as the instincts of our nature and the general progress of cultivation are above the condition of our written law. This I believe to be the case in all highly privileged countries; of course we can imagine a nation falling back and sinking far beneath what was once its practical code. All law, as we hold it, has a tendency to pedantry, that is, a belief in its absolute perfection, forgetful of numerous antagonistic possibilities for which a wider observation willingly makes allowance. The jury represents this wider observation or the untrammelled human spirit, and the number is twelve or more instead of one, because the operations of the individual spirit are uncertain, of the average man nearly certain. It represents also the absence of pedantry, or the exaggeration of law by the absence of legal knowledge. If we put scientific inquirers in their place, we increase the pedantry by adding physical to social law, and we remove still further the instinctive element and the representatives of the wider observation. The jurymen would then cease to come from all corners of the social system with all their human feelings fresh, and their sympathies undisturbed by self-interest, representing on one side the very kindness of our nature, and on the other a natural indignation against oppression or injustice. In addition to this, they bring all that vague and inexplicable foresight that interferes, often most justly, with the clearest reasons which the intellect can adduce. A country like this, so remarkable for acting by these instincts, would never allow a plenipotentiary commission in the cases brought before courts, but I do not altogether pass it over as, by giving reasons on various points, the subject appears more orderly before us, and we are gradually able to reject and to choose with more facility.

Besides this, it is against the principles of the country to give to any class of men uncontrolled authority, and no class has ever at any time been able to exercise its maximum of caution and sound judgment when absolutely freed from the control of others.

3. As Commission Recommendatory.—In some States of Europe this commission is usual; at least I believe it is theoretically of this kind, although in practice it becomes a commission plenipotentiary. This will in general be the case, as we might *a priori* conclude. The power of a scientific commission, reporting without being cross-questioned, must be invincible, and their opinions may be expressed in such a manner that most persons will believe them to be the simple expression of ascertained natural law; and how can we appeal from that tribunal? More than that. Even if it were absolutely clear to a jury that a mistake had been made, or that a point was strained, it would put them in an uncomfortable position to oppose directly without any reason which they could clearly express even to themselves. They might be oppressed in the same way that great intellectual power or knowledge will sometimes oppress without convincing an inferior. The jury would cease to be of value. I may again point to propositions first and second. We must have all the aid of intellect and science, but we refuse its despotism and oppression. When both sides are heard the jury has the benefit of having the arguments of both; when clear, he becomes convinced; when uncertain, he has abundant right to repose on his perceptions or instincts.

It has been suggested that the court should appoint scientific advisers and receive their report. If this were done without cross-examination ensuing, it would, *de facto*, be a commission recommendatory. If, however, an examination ensued, it would be necessary that the parties at issue should have their opinions represented in the questioning. If this were done they would require scientific men to assist their advocates. This would be equal to the present method of taking scientific evidence, with the addition of a recommendatory evidence, which the court would be more inclined to take. Now, if these advisers studied the subject before coming to court, and gave their opinion, they would require to hear previously all that the opposing parties stated. This would constitute a court within a court. But it is absolutely necessary that the whole court hear the mode of reasoning, and this method would not give an opportunity. Besides, men like to take their own advisers, and do not wish to be controlled by an unsympathising body. Their scientific advisers, as well as legal, are frequently friends who take a strong interest in the matter. This can never be prevented, nor is it desirable to prevent it. The bias of friendship existing even among the most honourable and highest minds, is very easily neutralised in a court; although to neutralise the bias of dishonest men, there is needed the whole complicated machinery on which we are arguing, and it is for them chiefly that laws are made.

Again, parties in a suit may require many advisers, one for each special point, and to obtain the authority of the court to appoint them, or their appointment by the court would turn out a mere formality; the court could not refuse to accede to their request, as the parties in the suit are frequently the only persons that know where the special knowledge is to be found.

There may be disadvantages in appointing persons to report to the court. The advantage would be that the judge might have confidential advisers in them. In that case they would take the place of assessors properly speaking, and their appointment must be separately discussed.

It was my belief that if the scientific witnesses, on their appointment by either side, met and arranged their points of agreement, and arrived at their exact points of disagreement or divergence, much time would be saved to the courts. I believe that this will gradually become a practice, although I see many difficulties in forming it into a law. It is frequently so difficult to tell what points are most required, that a barrister would be afraid to endanger his case by allowing any portion of it to be managed either out of his hearing or out of the position in which it would tell best. The method alluded to will I believe only come into practice when scientists and barristers learn their places better, and learn more thoroughly to confide in each other. At present, time is wasted by the most miserable trivialities, with which this system would entirely dispense.

4. As Jury.—This has already been spoken of, but not in its relation to a jury of scientific men or "experts." The principle of such a jury is partly recognised in special juries. I suppose it to be successful where more information than usual is needed on special subjects, but not where all the jurymen have arrived at the stage of being scientific men. The limits of information in a jury are not to be defined. Intelligent are better than non-intelligent men amongst

jurymen as amongst others. A little knowledge is a dangerous thing, but a little less is more so. It is not the knowledge of the scientific man that is objected to on a jury, but the habits of mind he acquires by his mode of life and study. He would introduce as was said too much law, and leave out mutual considerations. He would increase formal law and diminish instinct. He would enlarge the head of the court and leave no room for its heart.

5. As Advocate.—I have already shown, when speaking of some objections against the present plan, abundant reason for not giving the scientist the place of advocate. We can listen to the barrister using as tools the interests and feelings of men, and moulding them to his purpose, but we stand aside from a man who twists the expression of natural law for his own interest, as from one who, before his eyes, has neither the fear of God nor the love and admiration of nature. Barristers might be supposed to advocate this use of scientific men. They may use such as will be used for their own purposes, but, in their hearts, they despise men who stand as if devoted to science, and yet descend to advocate falsehood, either directly or by evasions, for the sake of individual benefit. But one may say, let us not be too severe. If the barrister advocates, why not the scientist? I have already shown what I conceive to be the barrister's high and important position. Nature rarely presents us, if indeed ever, with definite boundaries. All things shade off into other things. The barrister speaks science as he is instructed, and uses it as he sees fit; he shades off into the scientific man. Must the scientist not also shade off into the barrister? It is probable that he will always be found somewhat inclined to do so, and especially after having given his opinion. It is for that very reason that it becomes important to assist him in keeping his place independently, and prevent him from being driven where circumstances and temptations impel him. At present he only appears through the barrister, who is an advocate. He appears therefore in reality as an advocate. To this we must object. I consider it time to seek for him a position of his own, to seek that he shall come into the court, not as a mere tool of a barrister or his client, but as a student of the exact sciences, as one whose business it is to weigh and to measure to small fractions, and to deal with laws which are not controlled by his emotions or influenced by his promises. He is the representative in a court of those laws which caused the hills to be weighed in a balance. The further he moves out of this, the further does he leave his province; but he is also a man, and must never be expected to alienate himself from what is human. The cases in which a well-regulated mind finds it impossible to be both scientific and human (in the above sense) are very rare indeed.

A barrister deals with human wants, feelings, and circumstances. If he become a merely scientific man he leaves his province, but he is obliged to become to some extent scientific, because his duties are wonderfully mixed. He represents mankind suing for justice, as well as fighting against injustice; he represents all knowledge that can be brought to bear on his side; he is compelled, like the judge, to take the legal bearings of the case, and like the jury, to take the non-professional view, whilst he sums up in himself every witness.

To assist the scientific man in retaining his true position, I proposed the plan mentioned of making him entirely independent of the barrister. I think this a most important point. I consider it essential that he should deliver his evidence entirely unobstructed and without interference, the judge of course regulating the proceedings.

Some persons have proposed to acknowledge the scientist at once as an advocate, and to have in fact scientific advocates; as one barrister is best known for certain cases, so, say they, let the scientist be known. At first sight this may appear just, but it will not bear examination. Independently of the reasons already given, there are technical difficulties. No case is entirely scientific, legal knowledge and that kind already known to be peculiar to a barrister, is essential. The frequent or constant attention to law would rapidly remove even a devotee of science, except in rare examples, from the normal scientific state of thought and action. The law is of itself a sufficiently great and engrossing study. If a barrister makes himself familiar with one branch of science besides law, he must labour beyond the average of his class. Although some barristers are now found with scientific knowledge even in a high degree, and are able to use it consistently with the mixed character of their duties, this is no example to the scientific man, whose duties can be minutely and strictly defined.

The only use of law is to support man in rectitude. Is the scientific man expected to act free of all blame, supported without the assistance of law, by his own innate dignity? If so, he is much honoured. Some, and many in proportion, have attained this power, but even for them it is well to make the struggle less severe.

In advising the barrister, is he not also after his examination compelled to some extent to assist in advocating, as the barrister is not to be supposed capable of replying to scientific objections?

This is a most important part of the subject, and many interesting examples might be given, but I prefer at present to speak on principles, which are also sufficient to occupy all the time. Meantime, to this question I answer—Yes, guided chiefly by his conscience.

6. As Witness.—Nominally, the scientific man is at present a witness. The first question that occurs is what is a witness? Now I am not a lawyer, and I do not know if there be any fully recognized definition of a witness. I have not examined works on jurisprudence, although I have seen the matter abundantly discussed in other works on evidence, but I know this for a certainty, and it is enough for the purpose, that at least two most contradictory opinions are brought into courts, and both are acted on. The leading-ground idea of a witness in the legal mind is, one who speaks as to facts that he has seen, blindly and without an opinion. In some trials this idea is rigidly kept in view. In other trials again the question is continually put, What is your opinion? In practice then the law recognises this function of a witness to give an opinion, and so much the more, according as the subject is out of the range of ordinary observation. This is especially so in scientific cases. The facts may be given, but it requires the scientific man to draw the conclusion. The court, therefore, acts, whether against rule or not, from an absolute necessity, and the opinions become in reality the facts to be dealt with. Dr. Christison has already shown, clearly, fully, and at length, that "medical evidence consists partly of facts and partly of opinions." My argument goes to show that it is a necessity of the case in all scientific evidence, and not a matter of choice, that opinion should be taken as evidence. It is time that this subject were minutely examined, and the practice settled as far as possible. I believe a few rules would include nearly all the cases, but they do not come within the scope of this paper.

When the barrister wishes to draw a different conclusion from that drawn by the scientist, he will not listen to the scientist's opinion; and this shows, as it appears to me, that the idea of speaking as to facts only, is the fixed position of a witness in the mind of the legal profession.

The reason for asking the scientist's opinion is that the barrister is unable to draw the suitable conclusions from the facts of the case; if so, he does not understand the subject, and has no right to control the evidence. It is the conclusion that the barrister is technically supposed capable of understanding; as a barrister he does not understand the force of the scientific reasoning. He confesses this by asking for opinions instead of facts; and yet he will control the method of giving these opinions and facts. He has a right to hear the reasoning, because there is an opponent who reasons also and the two reasons must be compared, but on their reasonings he hinks as a jury, the representative of common sense, not

as a judge, the representative of formal law. On this point it is exceedingly curious to see the method in which barristers and judges also act. If they understand the scientific reasoning well, they go over the facts, and draw the conclusions in a most scientific manner, and it would almost appear in their speeches as if the facts only of the scientists were used, but when the reasoning is too purely scientific, they bring only the result of the reasoning forward, and use the scientist's opinions as facts given in evidence. Theoretically the law recognises this in the maxim —*Cuilibet in sua arte credendum est.* "Every one must be believed in his own art," or "every one is supposed to know his own profession best." The subject is interesting, and may be viewed from many points.

It may also be clearly shown that opinions which are not inferences from facts which can be fully proved by the witness must be taken, and are taken in scientific and in all evidence.

When ordinary facts are spoken of, conclusions are at once drawn by every one, and from a simple and ordinary fact the conclusions are frequently made undisputedly. This is done by the common sense of mankind. If a witness says that he saw a person giving another that root (*bitter cassava*), from which we obtain tapioca, and he that ate it soon died, the common sense of mankind does not perceive the relations and consequences of the action. There is, however, a common sense of certain countries as well as of classes of individuals, which concludes at once that if the root were not washed and pressed the result would be as stated. This common sense arises from abundant experience and general acknowledgment of the properties of the substance.

A similar common sense exists among scientific men; certain things are well enough known; every man may not have seen them proved, but they are part of the common stock of knowledge, and as much belong to science as the undeniable principles that belong to the common sense of mankind. No man can prove all the facts that are needed to build up a science, any more than he can prove, by his own experience, all the principles required to form a great state. The cultivators of every science have a common sense which has arisen out of that science, and it must be taken as evidence of the science. It is the best known part of the science—that which all believe. For this reason it is clear that evidence must be taken which does not depend on the observation of the individual giving the evidence. This is acted on occasionally or frequently, perhaps generally; but when it is hurtful to a party in a suit he objects to it, unless he has some similar evidence to give himself. The fact that he can object shows that the law is, at least verbally, in the opinion of many, against evidence of the kind. I know that this objection is valid only if made in a certain method, but I have seen it made successfully. It seems to me that legal practice is irregular in this, but it may be that I am wrong.

As the common sense of mankind is amongst the surest of data, so also the common sense of science is the surest part of it, though both are subject to change. As science changes, or as men know more of it, the common sense changes. A portion of science rises high, and is looked up to, forming speculations. Another remains as a foundation, and generally becomes so familiar as to be connected with common sense. Instead, therefore, of rejecting such evidence, merely because not proved by the individual observation of the witness, it is to be sought as the best of all.

This of evidence, however, is a digression, and would need a long paper for itself.

There are many peculiarities in scientific evidence to be remarked. I believe that scientific men ought to be allowed to give their evidence in writing, and to read it in court. Facts in nature must be given exactly, and truth must be rigidly adhered to without feeling. It is, perhaps, impossible to tell circumstances relating to individuals without giving some moral tinge; even if every tinge were absent, the want of it would act as one; the most natural tinge will probably come out when giving evidence *viva voce.* In such cases few men can completely control all feeling, and its expression is valuable in a court. But the scientific man should study carefully at home, and, weighing every word, bring it carefully prepared. In general the memory sinks under such exactness, not so written matter. Scientific facts may be given in writing with no moral feeling, but they are not easily expressed without some expression of individual character, which tinges them with some moral reflection. I prefer written evidence for these reasons, confining it, however, to the examination in chief. This examination, instead of a slow, wearisome, and most imperfect extraction of an opinion by a barrister, after systematically distorting it, may become a short clear statement of the witness's opinion and reasons. Examination and cross-examination must of necessity follow. The moral tinge obtained by examining will be found valuable for ascertaining the credibility and consistency of a witness. We gain by this means a clear and full statement wherein the scientific man will be upon his honour. He will not be stopped conveniently at every dangerous spot, but will either tell the truth, the whole truth, and nothing but the truth, or take his chance of receiving the character of a perjured.

At present the form of swearing before giving evidence is made almost useless by the interference of the barrister, whom, of course, we cannot blame. Evidence being written at home, will not have the tact of ready oral evidence. Part of this result would be gained by oral evidence given independent of the barrister, but exactness is gained by writing. This is almost proverbial. This plan would not lengthen but shorten a trial. I by no means propose to have replies written, and I believe it would be impossible to make writing compulsory, even for the examination in chief, for reasons too long to enter on.

Professor Christison, in a letter to the Rev. W. Vernon Harcourt says, that "in almost all criminal inquiries of a professional or scientific character (in Scotland), written reports are required by the law authorities, and in general they are fully detailed, and with exceptions they are produced on the trial. If to be produced, the prisoner must have access to them at least fourteen days before the day of trial. It is found by experience that this provision does not prevent the conflict of scientific evidence—they become nothing else than so many levers to upset the truth."

When written evidence is given instead of examination in chief, it becomes an additional mode of obtaining a plain, manly, open statement without loss of time, instead of sneaking or wriggling through a wearisome examination.

Again—I consider that the scientific man should be allowed to support his opinion if it is misrepresented, this being controlled by the judge, as chairman of the court more than as judge, and not by any interested party.

I wish in reality to obtain for the scientific man such a position in a Court of Law as befits his true position before the country, so that he may be recognised as representing science, and as such have reflected from him the character of science, as the clergyman, lawyer, and others gain from the dignity of their profession.

The principle of written evidence is anything but novel. It is allowed in many cases, because essential. Figures and exact statements, where the words themselves are required as well as the meaning, must be given in writing or read. In the Court of Chancery affidavits are written evidence. In scientific cases, the refusal of it is, I imagine, an inconvenient formality, frequently a mere farce, because the evidence generally consists of a large portion of matter that cannot be remembered with sufficient minuteness.

Written evidence, however, without oral examination, may, I think, be shown to be inferior. Numerous replies are needed to end a controversy. Perhaps no number of written replies can finish it, when subtle well-matched minds are ready with evasions. But when the reply must be given by the voice, and when it is driven on by the

living eye of the living questioner, a few hours bring out that which years might never otherwise have elicited.

The point I seek is, that the barrister shall examine and cross-examine after a full statement made by the scientific man uncontrolled, the statement being written or oral.

Everything which tends to make men exact should be encouraged.

7. As Assessor.—It has been said that the judge does not see clearly, at all times, the reasonings of the scientific man. It must be so with all not engaged in science. It may be said that this is not needful; after hearing the reasoning, he can judge of the bearing of the arguments generally, and take an average of the effect which they have on his mind. But this is going into the region of instinct and of unexplained and unconscious reasoning, which is not the province of the judge but of the jury, although, of course, all men are influenced by it more or less. The judge must be a lawyer of the highest class. How can he cope with science of the highest class? Only by being made into a scientific man, or having a scientific adviser. This was first proposed by Professor Christison. A scientific adviser or assessor would act as a scientific mind to the judge. In drawing out a clause for a possible bill, the Rev. W. Vernon Harcourt has proposed that these assessors shall be appointed by the Secretary of State for Home Affairs. This would render him independent in his position. He is also proposed to be called in when the judge sees that he is required. He would sit with the judge, hear the evidence, and examine when he thinks fit. He should inform the judge as to the scientific bearings of the evidence.

It has been proposed that the court should appoint the advisers, but the plan of Mr. Harcourt gives a better position to science, and probably would cause the assessor's advice to be better attended to, and would also enable the assessor to speak less as an inferior or an employed of the judge. At the same time, if my reasoning has been at all clear, it will go to show that the judge shall not be interfered with, or supposed to be morally compelled to take the assessors opinion. Speaking of this subject, the *Saturday Review* says:—"If the court had to name them (the advisers), the fundamental principle of English criminal justice, that the crown is neutral, and that the crown and prisoner should each manage their own case, would be given up." The article refers to a discussion at the Juridical Society which had also taken up the subject, and supported the position of the jury against the German, French, and Dutch method, which I have called the commissions plenipotentiary and recommendatory. But this is a lawyer's question.

The appointment of assessors commends itself to many minds; its advantages are explained in the general views advocated here, but there is no time to show how they apply, and the numerous cases in which the assessor would be valuable.

8. As Scientific Man.—This paper has been in favour of giving the scientific man an independent position in a court of law. He becomes a court of appeal in himself, used equally by both plaintiff, defendant, and judge. On the one side, the plaintiff has the advantage of his knowledge and opinion, having made him well acquainted with the case, and been instructed in all its relations to science. The same advantage is given to the defendant, whilst an adviser, able by his education to encounter that class of reasoning, is given to the judge. Scientific men are bound together by mutual beliefs in a stronger manner than the community at large, and if placed in this honourable and independent position, they will act according to their knowledge and character, and cause to cease much unnecessary contradiction and opposition. Being bound to speak the truth, the whole truth, and nothing but the truth, they will feel in honour bound to do so when an opportunity offers. This opportunity rarely occurs in the present confusion.

My belief is, that no class of men will so fully agree with each other as the scientific, if not kept separate by the present corrupting system, and no class will spread a more beneficial influence over society if not contemptuously treated by counsel, as they often are, in a witness box. Perhaps this expression is too strong, but it has a side of truth; and I have seen barristers speaking to a scientific witness in a box in such a way as to show that a witness was to them always an inferior personage. This, too, happens even in cases where the word of the scientific man must of necessity decide the whole case, and where the duty of the barrister is a mere simple formality.

I think a scientific man may well claim for himself such an exemption from insult. You may say that his own character and bearing ought to command respect, but there are few men, if any in this world, whose treatment by others is entirely unaffected by position.

We have now gone through the main points to be discussed according to this view of the case, and concluded that:—

1st. The scientific man shall not take the place of judge; the study of physical science does not fit a man for that office.

2nd. He shall not take the place of a jury, because the jury represents the instincts and impulses of intelligent freemen acting out the common sense of the community, an element essentially distinct from any physical science.

3rd. He shall not act as a plenipotentiary commission, absorbing judge and jury, for the above reasons.

4th. He shall not act as a recommending commission, as such is apt to become too powerful, and really does become so in practice. Nos. 3 and 4 are plans of despotic states.

5th. He shall not act as advocate, because he represents fixed law, not the interests of individuals.

6th. If he acts as witness he must be allowed to express his opinion independently of the advocate, or the plaintiff and defendant. Put upon his own honour, he will be able and willing to speak the truth, the whole truth, and nothing but the truth, which is now not permitted him.

7th. He shall assist the judge in examining scientific witnesses, or obtaining scientific evidence, as assessor.

8th. That instead of witness he may appear in his own character of scientific man, whose evidence is different from ordinary witnesses, and whose position is capable of being made, to a great extent, independent of the parties in the suit. This allies itself with No. 6.

The Remedies Proposed.—1st. To have a scientific assessor on the bench beside the judge, who shall examine the witnesses, if needful, and who shall advise the judge. That this assessor shall be appointed by the Crown. He shall not be questioned as a witness, but sit as assistant judge.

2nd. That a position be given to the scientific man independent of the barrister. I am not a lawyer, and do not pretend to adjust the mode of doing this, but I believe it is essential, and must be done sooner or later.

3rd. That scientific men giving evidence on scientific points shall be allowed to deliver their examinations in writing. The reading and elucidation to be controlled by the judge, examination and cross-examination by the barrister to follow.

The subject is now arranged ready for your examination. It may be viewed in many ways, indignantly, humorously, and comically. I have endeavoured to view it calmly. The purely legal view must be left to the legal profession. Minute particulars, and any reference to the practice of foreign states, are necessarily left out.

Professor Christison has forwarded me the following remarks:—

"We ought all to keep in view that there are two distinct objects to be aimed at, both necessary, but not both to be attained with equal facility.

"First. We ought to make sure that no scientific inquiry in a criminal or civil case shall be undertaken unless either entirely by, or at all events in conjunction with, one or more scientific inquirers, who have in some way or

another a public nomination, and are therefore to be considered as unbiassed and independent of party.

"Now, in Scotland, we have this object attained, or at least always attainable, already, by means of the ramifications of our Crown department in criminal procedures; that is to say, criminal prosecutions are undertaken by a Crown-appointed officer, our county sheriff, who is always a lawyer of repute. He may appoint any one he pleases, and in cases of any importance he appoints the best, not unfrequently applying to Edinburgh, Glasgow, or other principal places for the purpose. This practice could easily be methodised by order from the Lord Advocate, who is equal to the English Attorney-General, and a good deal more.

"I cannot tell how such a system can be organised in England, but I am decidedly of opinion that no material improvement can be attained without some such organisation.

"In regard to civil cases my view is, that when first an action is raised involving scientific investigations, the first court before which the action is brought should appoint, either absolutely, or perhaps subject to the objections of either party, a scientific inquirer, or more if this be judged necessary. This person would of course report to the court, and would be subject to examination and cross-examination. Let the parties produce their own scientific inquirers if they choose, but I feel confident that in time parties would save themselves the expense of such witnesses.

"But there comes a grand difficulty. Are the law authorities in such criminal and civil cases to choose for themselves, or are they to be restricted to certain individuals who have a public nomination, say, by the crown? I think we should have lawyers' advice upon that head. If the nomination is to be restricted to particular individuals, each would become something like the "Kreis-Physicus" of Germany, whose functions you probably know.

"Secondly, comes the question of scientific assessors for our courts, criminal as well as civil. I think it clearly necessary, for the improvement of scientific evidence, that courts should have it in their power to appoint such assessors. It is also indispensable that the assessors should hear every part of the case which is heard by either judge or jurymen. They must learn the scientific facts of the case for themselves, and not through the intervention of either judge or any one else. I refer to my pamphlet for the reasons. I think that their opinion should be delivered in writing. I also think that they ought to be subject to examination by the judge on their opinion and their reasons for it. My impression is that lawyers will also insist on the assessors being further subject to examination and cross-examination, as witnesses, by the counsel on both sides. If our yielding this condition would facilitate the adoption of the assessorships, I think we ought to yield it. I am even inclined to think it would be right in itself, but I do not insist upon this.

"The assessors should of course be men of high standing. It is perhaps best that they should have a permanent appointment from the crown. But it may be enough to leave the nomination in each case to the judge."

The following is the Rev. Vernon Harcourt's proposal, in the form of a bill for regulating scientific evidence:—

PREAMBLE.

WHEREAS, &c., &c.

BE IT ENACTED.—That it shall be lawful for Her Majesty's Secretary of State for the Home Department to appoint certain persons, skilled in Arts and Sciences, to act as Assessors to Her Majesty's Judges, in cases wherein it may appear to the Judge, presiding in any Court, that the assistance of a Scientific Assessor is required.

That the said Assessor, when called in, shall, conjointly with the Judge, hear the evidence, and if need be, under his sanction, examine the witnesses on scientific points, and advise the Judge as to the scientific bearings of the evidence.

That the scale of fees, for the attendance of the said Assessor, shall be fixed by Her Majesty's Secretary of State for the Home Department, and the fees shall be paid in criminal causes out of the County or Borough rates of the County or Borough liable to the legal expenses of the prosecution, and in civil causes according to the usual liabilities of the parties to the suit.

And be it further enacted that if any witness shall be called upon to give evidence on a question of scientific opinion, it shall be lawful for him to deliver his opinion expressed in writing, on which written opinion he may be examined and cross-examined, as if it had been given orally.

DISCUSSION.

Mr. WILLIAM STEERE would ventuie to throw out a suggestion upon this subject. Patentees were in the greatest difficulty, under the present state of the laws. The question of infringement of a patent was very frequently a matter of science. He would suggest that when a case of infringement of patent arose, previously to its being tried in one of the courts, it should be referred to the Society of Arts, and that a committee of that body should be appointed to investigate the matter, and to certify whether there had been an infringement of the patent-rights or not. All that would be required in such a case would be to produce before such a committee, composed of three, five, or seven men, possessing high qualifications in the particular branch of science or art to be referred to them, the patentee and his opponent, with some of their workpeople. The present position of a patentee who wished to defend himself against infringement was this,—he had to instruct solicitor, counsel, judge, and jury in the facts of his case. Surely the time was come when courts, both of law and equity, should be relieved from the consideration of scientific questions *simpliciter*; because a committee of this Society, so constituted, would, upon seeing the machinery, and understanding the subject matter before them, and eliciting explanations, be at once able to say whether there had been an infringement or not. The Court of Chancery, upon a certificate that there had been an infringement, might issue its injunction and order the payment of the small costs thus incurred. In order to carry out that plan it would be necessary to have an Act of Parliament, because parties must be bound by such jurisdiction. If some plan of that kind were adopted, to what an extent would the courts of law and equity be relieved.

Mr. E. CHADWICK, C.B., said that his friend, Dr. Angus Smith, had well stated the difficulties of the true scientist, but there were, on the part of the public, considerable difficulties in ascertaining who the true scientist was, or who, if he were qualified for that designation by science, had also the qualification by morals—who, in fact, was not a mere trading witness, letting out his testimony for hire to any side that could pay for it. A trade in scientific evidence had arisen, in consequence of the increase in the cases affected by it, and this nefarious trade required legislative and administrative arrangements for the protection of the public, as well as of the character and position of science. The largest theatres for trading evidence were parliamentary committees. The following passage from an official report was descriptive of the practice:—

"The continuance of the mischievous duplication of separate works, and the wasteful multiplication of capital in one field, for a science which would be the best rendered by one establishment, were attended by the moral evil of increased numbers of professional witnesses engaged in the promotion of separate works and opposing their consolidation. Thus, the evidence of the same professional witness has been given before one parliamentary committee in favour of a constant water supply, and before another against it, advocating in the latter case an intermittent system. Another witness has, in different committees during the same session of Parliament, given evidence in favour of a supply obtained by pumping from the red sandstone, and even from limestone, in preference to a collection from gathering grounds, and in another committee he appears as a witness for a scheme of supply by gathering grounds, as opposed to one for

pumping, and opposed, not according to any essential or real variations in the necessities of the case, but according to the incident of the retainer. We have had the decided testimony of a chemist on the unfitness and insalubrity of the water of a particular stream, and afterwards, on a retainer from a trading company, that same chemist has tendered an unqualified certificate to the fitness and salubrity of the water of that very stream, only taken some way further up, but of the same essential qualities. Another professional witness frankly stated to us, as the reason for his intimate acquaintance with the subject of gas works, that he had been engaged as a chemist to give evidence sometimes for them and at other times against them; that is, at one time to prove, and at another time to disprove, that they were nuisances. The real nature of this class of testimony is only more clearly displayed to persons who have some acquaintance with the subject, by plausible selections of immaterial and non-essential incidents, to justify diametrically opposite testimony in respect to works essentially the same."

He remembered that a Parliamentary barrister once designated to him the late Mr. Smith, of Deanstone, as a bad witness, who in respect to land drainage works was at that time a first-rate authority. On inquiring wherein his badness consisted, it appeared that having been engaged to examine and report on some district which required drainage, and which was under litigation as well as under water, he reported in favour of the truth, which was with neither side. The true scientist, in the large sense, was deemed, an "unsafe" witness, safe for the truth, but unsafe for the particular cause. An excuse was made for the trading witnesses, that the whole of the facts were often not placed before them, but that did not avail to those acquainted with the subjects, and who could perceive the use made of the non-essential incidents to frustrate large conclusions, nor would it avail for evidence given on both sides. The practice had become the opprobrium of science, and true scientists went with extreme pain and reluctance to give evidence, under the apprehension of receiving a taint as participators in it. The conditions which favoured its continuance, were the arrangements, which gave the examination of special subjects to persons new to them and ignorant of them. Although he (Mr. Chadwick) agreed with Mr. Bentham in the general principle of the *omne competence* of the Courts, yet when any species of business became large enough to occupy the attention of one authority, it was of great public advantage to constitute a special authority to deal with it. This would be found to be the case with respect to the preliminary examination of claims for the exercise of public privileges now referred to Parliamentary Committees, —hitherto virulently opposed by precisely the class of persons, trading scientific witnesses as well as agents, who made profit out of the existing system, and who well knew that the trade in such "either side" testimony as had been described, could not continue, as it was, before a tribunal conversant with the special subject, and by whom the "either side" trading testimony must needs be seen through and appreciated. So again with respect to the granting of patents. Some nine thousand pounds per annum were now paid as fees to officers for doing what, as regarded the protection of the public or the inventors, appeared to be really worse than useless. This was evidenced by the grant of several patents for the same thing (an instance had been shown to him of six patents granted for substantially the same invention) to different inventors, who each fancied himself paying for what pretended to be an exclusive privilege, when all that was given was a temptation to ruinous litigation and conflicts of trading evidence. The state of the protection to the public was shown before the committee on the adulteration of food, by the display of the fact of the concession to a man, by Royal Letters Patent—no doubt with the usual grandeur of recital of the consideration of the public benefit—of the privilege of using a machine for making, out of old elm wood, and it was understood out of old coffins and in other ways, sham coffee berries. Now surely the money so mis-spent would abundantly suffice for the constitution of a special and responsible tribunal—occupied exclusively, not with private practice, but with the public service — for examining and reporting on applications for patent rights. Such a special authority, responsible for reporting on the concession of privileges, might also most advantageously serve at all events as a tribunal of the first instance, for the examination of and adjudication on, complaints of their infringement. Before such a tribunal the true scientist might befittingly and confidently appear, and the trading witnesses could not repeat the "either or both sides" testimony which now had its market in different parts of the country before ignorant juries. As supplementary even to such a tribunal, and in its absence to the ordinary tribunal, the practice under the French jurisprudence was to refer cases for examination and report to experts—not trading witnesses—but to men of the highest position, conversant with the branch or subdivision of science or technology to which the matter in question related. Such references would often be to the true scientist, and evolve his testimony in writing, after hearing not one, but both sides, and with most of the advantages which Dr. Angus Smith claimed for him. He (Mr. Chadwick) did not agree with the notion which had found favour with scientific bodies, of fixed assessors, for it implied omniscience in science and art — a false notion, in which was the foundation of an immense amount of mischievous quackery. As labour in science and art was constantly being subdivided, each one engaged in the exclusive pursuit of one subdivision was, to the extent of his pursuit, excluded from the knowledge of others, and was, as related to them—if upon success in his subdivision he presumed to give an authoritative opinion upon those others—an ignorant quack. Experience had shown, that men highly advanced in mechanical or railway engineering were grossly ignorant of hydraulics, as shown by the works for the drainage of their own railways, and the same remark applied to other specialties. The theory of omniscient assessors, like that of omniscient engineers and technologists, was fraught with grievous error. The proper experts were those whose qualifications were made manifest by success in the particular branch or subdivision to which they applied themselves; and even they were less reliable, as abundance of examples might prove, and were more blinded by prejudice than other people, when the question was a new discovery, or an improvement, by which the branch in which they had obtained profit and social eminence was affected. For the promotion of progress in general science and art, however, advances must be made in the special science and art of legislation and administration, which might be said to be the most backward of all.

Mr. S. C. Homersham said he was unwilling to allow this opportunity to pass without thanking Dr. Angus Smith, the author of the paper just read, for bringing this subject before the Society. The qestions treated of in the paper were of great public importance, and although by the title of the paper the subject was limited to "Science in our Courts of Law," yet the remarks in the paper were equally applicable to scientific evidence on private bills before committees of the Houses of Lords and Commons. He could bear testimony that it was certainly true, as stated in the paper, that "men, even in scientific matters" at least often endeavoured to "weigh each other down by great names," and that "thousands of pounds are given to men to support an opinion by their name and their cunning, when men of less name know it by experiment to be false." He (Mr. Homersham) could give some curious recent instances to this purport, but that the recital would almost necessarily lead to personalities. Indeed, it would not be too much to say that some men, when they somehow had succeeded in bringing their names before the public, were in the habit of trading upon the reputation thus gained. It had frequently happened, in his experience, that a purely honest and scientific witness, under the present system of examination in our courts of law, either from want of practice in giving oral evidence, or

from constitutional temperament, was found to be no match for such a witness as he had just described. Practice, it was said, made perfect, and no doubt a practised witness obtained the habit of so delivering himself as to command the attention of the judge or jury, when perhaps the substance of his evidence little deserved that any weight should be attached to it. As to the proper remedy for this state of things, it was with great diffidence that he offered his opinion, but still, having given some consideration to the subject, he had long been of the opinion expressed in the paper "that scientific men, giving evidence on scientific points, should be allowed to deliver their evidence in writing;" indeed that scientific evidence on all the main points at issue should be delivered in writing, and placed in the hands of the opposite side in proper time to admit of its being answered, as this would prevent the surprise which a novice often experienced in listening for the first time to the evidence frequently given by those who traded, and often successfully, upon their name. He also agreed with Dr. Angus Smith, that after the delivery of the written evidence, examination and cross-examination by a barrister should be allowed to follow. With respect to Dr. Angus Smith's recommendation, that the judge should, in scientific cases, be assisted by a scientific assessor, he did not feel so certain that any good practical result would follow from the judges having such assistance, but he would speak very reservedly on this point, not having given any close attention to the suggestion. He felt certain, however, that if leading scientific evidence, as proposed in the paper, was in the first instance delivered in in writing, under proper regulations, the ends of justice would be much furthered by such a course.

Mr. Campin said, having taken part in the late amendments of the patent laws, he would offer one or two remarks. It was pretty generally acknowledged that the present system of bringing science to aid in the discussion of questions before courts of law was bad, and the question was, how was it to be improved. It appeared to him that there was no insuperable obstacle to the Commissioners of Patents making out a list of scientific men qualified to act as umpires or referees in cases of disputed patents. They had a large fund of something like £90,000 at their disposal, which might be used for this purpose, or a small sum might be deposited by each of the disputing parties to meet the expenses of the investigation. With regard to the working of the patent laws, Mr. Chadwick had referred to a subject which ought to be better understood. The law officers of the crown in connection with patents did not take their fees without doing the work. It was not the principle of the English patent law that there should be a sifting as to the propriety or the legality of granting a patent for an invention. The course to be pursued by the officers of patents was, upon application being made for a patent, merely to read over the specification of the invention, and to see that it met the requirements of the law, and he believed in that respect the officers had properly performed their duties.

M. Thomas Webster, F.R.S., said, whatever difference of opinion might be entertained with regard to the subject matter of the paper, they must all feel grateful to Dr. Angus Smith for having brought it so prominently and boldly before them. He said "boldly," because, scientific man as Dr. Smith was, he (Mr. Webster) thought he had rather taken a liberty with his brethren. The current of his observations went to this—that in the majority of cases, half-a-dozen scientific men might be found who, if they were paid money enough, would swear to anything. He was not prepared to say that some discreditable cases did not occur, but it always appeared to him that this important point was overlooked—(in fact Dr. Smith had so stated in his paper)—that a great proportion of this evidence was not evidence of fact, but evidence of opinion. As persons of experience, they knew that in any particular case, the facts being given, there were classes of minds, some of which drew their inferences dealing with similarities, and others drew their inferences dealing with dissimilarities. Therefore, upon scientific questions, they had the same conflict of testimony resulting from honest differences of opinion as upon any other subject. Another difficulty, not noticed in the paper, was, where the line was to be drawn between scientific men and non-scientific men. A man who had experience in shipping or judging of cotton,—a man who acquired a particular kind of knowledge by long training—was just as much a scientific man in his particular art as the man who contributed to those wonderful discoveries of science at which we all so much rejoiced. Therefore it was incorrect to speak of scientific men as a class, to the exclusion of such skilled witnesses as he had just referred to. Men—of whatever class—who were placed above their fellows, either by education or instinct, in any special matter in which their testimony was required, came within the category of scientific men. They had the same difficulty in every question where opinion was involved. They must investigate opinion, and how could they do that except by a system of examination, cross-examination, and re-examination. He would now say one word upon the question which had been so often discussed before this Society—viz., the infringement of patents. If the arrangements had been made which the Vice-Chancellor in the chair had so much exerted himself to bring about, and which only fell through owing to official routine, then they would have had something like a preliminary inquiry in cases of infringement of patents. To what extent that preliminary inquiry would have been carried, he could not say; but no one would be inclined to carry it to the extent which had been done in America, and which had there broken down. They would, however, have had some tribunal which could have adjudicated in the majority of these cases. But there was another question—that of juries. He approved of the suggestion of assessors. They had them in Trinity-house cases, and in other cases of that sort, but in cases in which they required to have an assessor, he thought they ought to get rid of the jury. He thought nothing could be more absurd or more unsatisfactory than the present system of submitting questions of patent right to the arbitrement of juries. He did not know a case within his own experience in which, where a simple question of infringement arose, and the decision was left to the jury, they did not find that an infringement had taken place. Giving full weight to the observations of Mr. Chadwick, with reference to the system which obtained in France, he (Mr. Webster) thought that perhaps the best way of dealing with that class of cases would be to leave the selection of the assessors with the judge himself. The assessors should not be permanent officers, but scientists in a particular vocation,—men selected either by the court, or, what he thought would be preferred in some cases, mutually by the parties themselves. A tribunal would thus be constituted which would combine in itself both judge and jury, the assessors having the same knowledge of science as the judge had of law. He thought that in Dr. Angus Smith's observations upon scientific men, as a body, he had hardly done them justice.

Mr. P. H. Holland said, having attentively followed the reading of the paper, he could not detect a single sentence which could be regarded as derogatory to really scientific men. Experience showed, no doubt, that many witnesses distorted the truth in giving their evidence, and the purport of the present paper was to show that there was a growing tendency towards that danger. Would any one who was acquainted with scientific evidence in the courts of law, and especially in parliamentary committees, deny that there was this tendency on the part of witnesses? It was a fact that, year by year, men were increasing in number who gained large incomes by being witnesses for whoever would employ them—advocate-witnesses as he termed them. He did not say that such witnesses went into court positively to state that which was untrue; but they were too often employed as advocates of a cause under the guise of witnesses. They

must all see the danger resulting from this partisan feeling and anxiety for victory on the part of the witnesses. It was a notorious fact that there were men to be had who would sustain a particular case by their evidence one day, and the next day would give diametrically opposite testimony. He did not say that this was a common occurrence. It was happily uncommon; but still the fact existed. The great question was, how they were to guard against it? One way would be to employ assessors—persons competent to judge of that particular kind of evidence, and to advise the court upon it. There was another difficulty to guard against. They had been told by one gentleman that there was no real difference between scientific evidence and ordinary evidence; but they all knew that practically there was very little difficulty in distinguishing what was called scientific knowledge from ordinary knowledge. They could not prevent the selection of witnesses for a particular purpose; all they could do was to check, as far as possible, the distortion of the truth, which could best be done by the appointment of an "expert" in the particular branch of knowledge, to check the distortion which partisan witnesses might make. In that case he thought the appointment of scientific men, selected for their knowledge in special cases to act as assessors, would operate beneficially. The other part of the question, viz., the mode in which scientific evidence should be given, was still more important. They knew how difficult it was to give a lengthened statement of mixed facts, if allowed to do so uninterruptedly; still more difficult was it when interrupted by constant questions. How often did it happen that the peculiar knowledge of a scientific witness was not fully brought out to his own satisfaction. In such a case, evidence must be volunteered, or it must pass imperfectly expressed. The way to obviate that in a great measure would be to give the evidence in chief in writing, and if cross-examination were added, they would thus combine all the fulness of a written statement with the searching ordeal of *viva voce* evidence, and, in his opinion, a great deal of the time of the court would be saved by the adoption of such a course. Upon the whole he would say, that he did not think Dr. Smith had laid himself open to the accusation which had been made against him by the previous speaker. He believed that the plan suggested in the paper would be beneficial in elucidating the truth, and would prevent the growth of witnesses who were paid merely to advocate particular cases. One reason why lawyers would not approve of these suggestions might be, that it would probably make a difference in the amount of their fees.

Dr. Alfred S. Taylor, F.R.S., had listened with great pleasure to the paper read by Dr. Angus Smith, and quite concurred in many of the views he had expressed. There could be no doubt that scientific men, in courts of law in this country, occupied a disagreeable position to themselves, and an unsatisfactory position to the public. He thought, as a general principle, it had been correctly stated by Mr. Webster, that the differences amongst scientific men were rather those of opinion than of fact; and from his own experience, which had been considerable, he knew that facts were often laid before them in such a manner that they had not a half even—if they had a quarter—of the truth of the case. It had occurred to himself upon many trials, both in cases of patent rights and of murder, involving questions of the greatest importance to society, that, for the first time, he heard in the court facts which would have materially altered his opinion, so that scientific men were entirely at the mercy of those who instructed them. The remedies suggested by Dr. Angus Smith were three in number. First, the appointment of assessors to the judge; secondly, that a position should be given to the scientific witness independent of the barrister; and thirdly, that scientific evidence should be allowed to be given in writing. With regard to the two latter suggestions, he believed they were already practically allowed. With reference to being independent of the barrister, he considered a witness was as independent in that respect as he required to be in this country. From his own experience in the witness-box, he would say he had found that the legal advocates were not only willing to hear more than the question they asked involved, but where a witness could throw any light upon the case the court never hesitated to give him an option to express his opinion in addition to answering the question that had been put. With regard to written evidence, he could state that it was very much the practice of scientific men to draw up a statement of their evidence, according to the facts presented to them, which they were either allowed to read or to give the substance of in evidence, and he believed it was a saving of time, both in the examination in chief and in the cross-examination, so that he thought the only question upon the suggested remedies applied to the appointment of assessors. Upon that point he agreed with Dr. Smith, that there should be one or more assessors to aid the judge upon scientific matters in both civil and criminal cases. Scientific men would then probably give their evidence with more caution and care. They would be careful how they made statements before persons whom they knew to be authorities on the subject; and he was afraid he must say that, trusting occasionally to the general ignorance of the court or the jury, evidence was sometimes given which ought not to be put forward, and probably would not have been put forward in the presence of scientific assessors. The difficulty in dealing with this question of assessors was that there were six circuits of the judges, and in each circuit there were both civil and criminal cases. It would be necessary to have assessors for each—men of honour and integrity, and men of information, and with all that there would be the difficulty to find a man possessed of knowledge which would enable him to assist the judge in most of the cases which came before the court. In cases of death by poison, or wounds, or child murder, a scientific man, sitting by the judge, might point out certain fallacies in the scientific evidence, so that he looked upon this as an important suggestion. It was not altogether a new one. He (Dr. Taylor) had brought it before the attention of Lord Wensleydale more than a year ago. His lordship then expressed himself that he thought it was excellent in theory, but that it would be difficult to work out in practice. Upon the other points in the paper he had nothing particular to detain them, but he would say he thought the character of the scientific witness would be elevated by some such arrangement as had been suggested. The public would be more satisfied; they would feel that they had a judge in science as well as in law; whereas now they might feel that they had good law but imperfect science to determine between the oaths of conflicting witnesses.

Mr. William Hawes remarked that a considerable portion of the discussion had taken a direction somewhat wide of the subject of the paper, and tended to illustrate the bearing of particular laws rather than the effect of the general principles which guided our courts of justice in all the important cases which came before them. He believed that no mode of giving evidence was so likely to arrive at the truth as that which was at present in use. If they put a third party between the contending witnesses—if, independently of the judge, they put a scientific man upon the bench—and his opinion disagreed with the evidence given, was the judge to decide upon that opinion, or upon the evidence given before him upon oath? It appeared to him quite impossible that a person in that position ought to influence the judge in evidence given upon oath, upon which the witnesses were cross-examined—a plan which all practical experience led them to suppose arrived, with few exceptions, at the truth. How did assessors act? They had assessors in the Admiralty Courts, and he believed the swearing in those courts was as contradictory as in other courts where no assessors sat. The assessor in the Admiralty Court gave his assistance to the judge upon

nautical points elicited by the evidence, but his presence did not prevent witnesses swearing as strongly in support of their case as in other courts where there was no assessor. He believed the great difficulty of the question was, that science itself was advancing so rapidly, that the best man they could find might be a very bad witness in a particular case. He would feel how little knowledge he had, and how constantly that knowledge was changing. He might allude to the fact that one of the most distinguished men of the present day (Dr. Faraday) had never been seen as a witness in a court of justice, he having been content to yield the emoluments which might have accrued to him from that source, rather than appear in the character of a witness upon scientific matters. He (Mr. Hawes) believed the great difficulty was not in the courts, but in the witnesses themselves. If scientific men would simply investigate every point brought before them purely as scientific men, and not as witnesses in special cases, they would overcome many of the difficulties which now existed; but he believed, in the great majority of cases, a safe and proper conclusion was arrived at, and that little practical mischief was done under the present system of evidence. He thought they had better put up with such inconveniences as existed rather than run the risk of those great changes which had been suggested that evening.

Sir Thomas Phillips, F.G.S., observed, that the paper before them opened out three considerations:—First, what was admissible as evidence under the law as it stood? In the next place, in what form the evidence should be given? And, thirdly, who ought to be the judges of the value of the evidence so given? He would state that, as far as his experience went (and that was not inconsiderable), the widest door was open to every opinion that could be fairly offered in evidence. Then came the question, How the evidence was to be given? Upon that point he could not help thinking that too much value had been placed upon the suggestion that the examination in chief should be given in writing, and that it should be read in court. He did not see any particular objection to that course, but he thought the reading of the evidence would tend very much to weaken the effect of it upon a jury. No man who had seen the difference between the effect of reading evidence given upon a former trial, and that which was elicited from the witnesses by the questions put to them in court, could fail to be struck with the force with which the *parol* evidence came to the mind of the jury. They then came to the remaining question, viz., who was to judge of the value of the evidence. He believed, with Mr. Webster, that if they had assessors they must dispense with the jury, as the two would be wholly inconsistent. He also believed that under the present system—the examination being conducted by an intelligent lawyer, and the cross-examination being also conducted in the same manner—it was rare that any miscarriage happened. He was fully sensible of the interest which surrounded this question, and also of the extremely frank manner in which Dr. Angus Smith had dealt with it, though he differed from him on several points.

Mr. J. A. Rose argued that if the suggestions which Dr. Angus Smith had so eloquently advocated were carried out, with regard to the appointment of scientific assessors and the admission of written scientific evidence, there would be, in addition to the speeches of the counsel on both sides, the speeches of the scientific men, either written or oral, which would occupy much valuable time. He agreed with Mr. Webster that the appointment of assessors must necessarily be followed by the abolition of juries. He thought, however, the appointment of such officers could have no beneficial result, owing to the diversity of opinion which prevailed amongst scientific men. With regard to the suggestion of Mr. Steere, that cases of infringement of patent rights should be determined by a Committee of this Society, he (Mr. Rose) was quite sure that a very small minority of patentees would be in favour of that proposition.

The Chairman said, filling as he had the honour to do the office of a judge, it had been interesting to him to hear the views which had been expressed by gentlemen who had had great experience upon this subject; and he was particularly gratified to hear the opinions of a scientific man of the high standing of Dr. Taylor, as well as those of others who were unconnected with science. There were one or two points in connection with the law as it at present stood, which had not been touched upon by Dr. Angus Smith, from the fact—as that gentleman had stated—that he was wholly unconnected with the law, but which ought not to pass unnoticed. In the first place he would remark, that the case of Parliamentary Committees was entirely distinct from cases of inquiry in the courts of law—for this reason—that every inquiry before a committee was founded mainly upon opinion. For instance, in the case of a railway bill, the promoters must prove the plan of their line, and the amount of traffic which the district yielded; but when those matters of fact had been proved, then came the evidence of opinion as to the expediency or inexpediency of granting powers to construct that line of railway, and upon that point it was pretty certain that a great discrepancy in professional opinion might fairly exist. On the occasion when he last appeared in that room, he took the opportunity of expressing his views as to the value of evidence of opinion, and at the same time he expressed his high estimate of the late Mr. Robert Stephenson as a scientific witness. He would apply the same remark to the late Mr. Brunel, and he would refer to both those distinguished men as having invariably an honest opinion on whatever side they might have been retained; although he might remark that those gentlemen more generally appeared as the engineers of the companies which they respectively represented. He might point to those two men as being in themselves models of the manner in which scientific evidence ought to be given. Some witnesses were much better in the box than others, and he might say of the late George Stephenson that, although an equally honest witness with his son Robert, yet he was one of the worst witnesses in the box. He could never keep his temper under cross-examination, and when he lost his temper he lost his head, consequently counsel kept him out of the witness-box as long as they could, and if they could avoid it, they would not put him there at all. This brought him to another difficulty with regard to scientific evidence, for where a selection of such evidence was to be made, the legal gentlemen who conducted the case would naturally select the person who would make a good witness, and who had a cool head and a calm judgment. The great difficulty of all was the evidence of opinion. Men might honestly entertain different opinions upon the same facts. He might say, as a judge, he had come to the conclusion that he could set very little value upon evidence of opinion given by witnesses brought forward either for a plaintiff or a defendant, and in many cases he had availed himself of the privilege which was accorded to the judges of the Chancery Courts, of calling in disinterested witnesses in matters of opinion. Without speaking in the least degree to the discredit of the parties concerned, there were these difficulties with regard to evidence of opinion, and such evidence being for the most part derived from witnesses chosen by the parties themselves, that he had had recourse to witnesses who were not so selected. In illustration of the diversity which prevailed amongst professional men in matters of opinion, the learned Vice-Chancellor mentioned the fact that, in a case which came before him, six of the most eminent members of the Scottish bar gave evidence upon a question of Scottish law, three on one side, and three on the other. The question referred to a matter connected with the Free Kirk, and diametrically opposite opinions were given, as to what the Scotch law was; the opinion, in each case, coinciding with the particular religious views of the witness, and yet in this case perfectly honest opinions had been given. An observation had been made by one gentleman (Mr. Holland)

which he (the Chairman) could not allow to pass unnoticed. It was insinuated that opposition might be given by the legal profession to proposed remedies, because a difference would be made in their fees. If, however, they looked at every amendment of the law which had taken place, they would find that it had been effected by the lawyers themselves. In illustration of that statement he might mention the sweeping away of ten offices in the Court of Chancery, with an emolument of £2,500 per annum each, in the patronage of the Lord Chancellor, which involved one day's more work in a week for the present judges; and in a case which came before him it was shown upon oath that the gross receipts of one solicitor had fallen off 33 per cent. in consequence of the reforms which had taken place in the Court of Chancery. All those reforms, he repeated, were effected by lawyers, and were cordially seconded by the whole of the profession. Then upon the question of the reception of scientific evidence and the mode in which it should be given. It was a great mistake to suppose that a witness had difficulty in making a clear connected statement upon scientific matters in the witness-box. A witness, after having been examined by counsel, wishing to make any additional statement, was always allowed by the judge to do so. He would mention what he considered was a disadvantage in written scientific evidence. The witness gave his evidence as a whole before any of the points, which might be suggested on the other side, were brought forward. He might have altogether omitted to consider many important points thus introduced, and those points might shake the value of his testimony from beginning to end, and the counsel might say, "This gentleman has come with his opinion cut and dried, when he was not acquainted with half the facts." But having heard all the points of the case on the other side, the witness would be in a better position to make a request to add to his statement—a request which a judge would always accede to. It was quite true, as had been remarked by Mr. Hawes, that some men most eminent in science had a repugnance against giving evidence in a full court. In such cases the party had the remedy in his own hands, inasmuch as it was competent for him to decline giving his scientific opinion under such circumstances; and on the other hand, scientific men who were ready to facilitate justice might take their own position. The remaining question was with regard to the appointment of assessors. That was the principal point to be considered in this paper. As he had already stated, in the Chancery Courts the judges had the power to call in witnesses upon matters of opinion, who might be regarded in some degree in the light of assessors, although they were not bound by the opinions so given. Any assessors that were appointed should be appointed on these conditions. He thought it might be beneficial, in strictly scientific cases, to appoint assessors to sit with the judge, who should be bound to give their opinion in public, as well as the reasons upon which that opinion was formed. But he wished to see the responsibility always remain with one man. Let the judge who tried the case be responsible for the decision, but let him have such assistance in forming that decision as he could derive through the medium of an assessor. The learned Vice-Chancellor concluded by moving a vote of thanks to Dr. Angus Smith for the paper he had read.

The vote of thanks having been unanimously passed.

Dr. Angus Smith begged to say that he regarded it as a bold step on his part to venture to introduce this subject before the eminent members of the legal and scientific professions whom he saw around him. He had not interfered with any settled practice of law, or rather he had only taken up the actual position of the scientific man; and he still adhered to his opinion as to the disabilities under which he laboured in court. He begged to say, however ignorant he was of the law, he was well aware of the important position of the scientific man. At all events, he repudiated the notion that he had done any injustice to men of science by any expression he had made use of in his paper. He was glad he had brought the subject before them, because it had led to an important discussion, and if his own plan were not carried out, it became the lawyers of the country to suggest better plans than could be expected to emanate from one who had not been a student of the law. As usually happened in such cases, objections had been brought against points which he had not advocated, and suggestions made which had been included in his paper. To purely legal objections he would not attempt to reply. He had said that law of every kind was inclined to look upon itself as a complete expression of truth, and he believed that the changes desired must be made to appear needful, by the dissatisfaction felt by the spirit of man with legal forms. The question should be argued not merely from a legal point of view. Many or all improvements in law had arisen from the clear expression of the wants of a people or of a class. There was no class of men whom he could wish to honour more than the scientific class. He would only repeat more strongly than ever, his belief that they laboured under needless disabilities, which injured both them and the public.

The Secretary announced that on Wednesday evening next, the 26th inst., a paper by Mr. P. L. Simmonds, "On the Rise and Progress of Steam Navigation in the Port of London," would be read.

The following letters have been received by the Secretary:—

Sir,—Having had the privilege of perusing copious notes of Dr. Angus Smith's paper on "Science in our Courts of Law," I am enabled to "speak by the card." The title of the paper appears to me to invite discussion on a far larger subject than the paper itself embraces, and from the probable extension of the discussion, it is to be feared that diverse and unsatisfactory conclusions will be drawn. As treated by Dr. Smith, the subject of Science in Courts of of Law relates solely to Science in our Criminal Courts, and as all his arguments take their colour from that circumstance, so his proposed remedies are logical deductions therefrom. But if other and different circumstances are assumed how can these remedies apply? In the trial of a prisoner for the administration of poison (for example), it would be manifestly wrong, or contrary to the received ideas of justice, to decide the case without a jury, for the question at issue is not whether the prisoner is believed to be guilty, and still less is it to establish his innocence, that the trial is instituted (for his appearance in the dock is now-a-days good presumptive evidence of his guilt), but to determine, as the Scotch have it, whether the case is proven. Here all the facts are in dispute, or, rather, nothing that would tell against the prisoner is admitted by his advocate, and it is, therefore, the duty of some independent authority, like the jury, to be satisfied that the points sought to be established are rendered indubitable. But how different is this from civil cases, where special knowledge is brought to bear in forming an opinion on admitted facts? Take, for example, a patent cause. The plaintiff alleges that his patent is infringed, and the defendant meets the allegation by a denial of the similarity of his plan to the plaintiff's. Here is no fact in dispute but such as can be determined only by a comparison of the two processes. What they are respectively is evident enough, but their likeness or difference is a matter of opinion, and the correct opinion is that which is the most logically deduced. Can a jury, ignorant of the manufacture in question, determine this point? Were they all phrenologists, one might imagine the possibility of their coming to a right conclusion, but not otherwise. They decide in the most natural way. "The plaintiff comes here to seek redress; he knows more of the merits of the case than we can hope to do, and had he nothing to complain of it is not likely he would have had recourse to this costly mode

of gaining redress. Therefore, to right a wronged man, we give our verdict for the plaintiff." The exception to this course is when the presiding judge has formed a strong opinion in favour of the defendant's case. This does not, however, always prevent the jury from following their favourite course. With a long experience of such decisions, it is not surprising that the Lord Chief Justice should have recently admitted the insufficiency of the present tribunal for trying patent causes, asserting that "one mind conversant with the subject is infinitely better than twelve or thirteen who are not."—(This was spoken in reference to the case Crossley *v.* Talbot.) The questions to be decided are rarely other than those of mixed law and science; and that the tribunal should consist of men combining the qualifications for considering such subjects, is a very obvious conclusion. When the tribunal is able to deal with scientific evidence properly, and not till then, will it take the proper shape. It is now often designed solely to tell upon a jury, not to elucidate the case in hand; but when the jury is relieved of the duty of sitting in solemn state for the purpose of being bamboozled, the man of science will be no longer trammelled in giving his evidence, for, having an audience able to appreciate his remarks and follow his conclusions, he will no longer be under the fear of being misconstrued. His evidence will consequently gain in perspicuity, and a proper estimate will the more readily be set upon his opinions. At present it is frequently deemed necessary not merely to withhold explanations, but even facts, to prevent a jury being mystified. In what possible sense, then, can a jury facilitate the administration of justice, when the power of appreciating the merits of the case submitted to them is confessedly wanting? This is a point well worth consideration, as distinct from the cases which Dr. Angus Smith appears to have had in mind in the preparation of his valuable paper. In patent cases, at least, we have the evidence of the Lord Chief Justice, quoted above, as to the inutility of a jury, to which may be added that of Baron Bramwell, who, on a recent occasion, prefaced his remarks to the jury empannelled to try an action for the infringement of a patent for purifying gas, by a statement that "a more inconvenient tribunal could not have been provided for the consideration of a case of that description." With such authorities in favour of relieving juries from considering one class of scientific questions, it would be well to accept Dr. Smith's conclusions rather in a limited than in a general sense.

I am, &c.,

A. V. NEWTON.

Sir,—Although continued indisposition will prevent my attending the meeting of the Society to-night, I may perhaps be permitted to give, in a brief manner, my views upon "Science in our Courts of Law," through the medium of pen and ink. In the first place, a friendly critique of Dr. Angus Smith's able paper—a proof of which now lies before me—may not be amiss; the subject of which it treats is of a very wide and important—even national—character, and naturally possesses a peculiar interest for those of my profession and tastes. But few, I should imagine, will be inclined to dispute the truth and justice of Dr. Smith's remarks upon the evils of the present system of taking scientific evidence, where the opposing counsel, unable or unwilling to appreciate the intrinsic value of a chemical analysis or a material law, simply endeavours to throw discredit not only upon one particular statement of a witness, but upon that witness himself at the outset, thereby biassing the minds of the jury, and causing them to pass lightly over his after-evidence, although, perhaps, of much real importance. Then again, the question of what may and what may not be brought into court as evidence is deplorably unsettled, albeit it is often a very momentous one for the accused; and when this applies to matters of science, a verdict frequently depends upon it. It is, unfortunately, but too notorious that in several of the more important trials of the last few years, the scientific witnesses specially retained by the prosecution were allowed to bring forward written statements of other persons, analytical specimens, and books, while little or no such license was permitted to the defence. On these and other allied points, I feel sure we must concur with Dr. Smith; and let us now consider the remedies he proposes. The list commences thus:—1. "To have a scientific assessor on the bench beside the judge, who shall examine the witnesses if needful, and who shall advise the judge. That this assessor shall be appointed by the Crown. He shall not be questioned as a witness, but sit as assistant judge." Now this arrangement would undoubtedly remove some obstructions; but others still remain, which are far more difficult to cope with; for example, suppose a scientific man were definitely appointed by the Crown, for each court; at first, his influence would be extremely beneficial, but after a time he would become upon all occasions part and parcel of the prosecution, and his presence therefore would merely perpetuate the evils now complained of. This objection might, it is true, be partly got rid of, if it were vested in the Home Secretary to appoint a scientific assessor for each special case, and for such case alone; but still an argument might be raised that it would then be only fair and just to allow of a scientific counsel for the defence, whose function should be the cross-examination of the witnesses for the Crown. "That a position be given to the scientific man independent of the barrister," is a very evident necessity, and should be the first point accomplished in the way of reform. The third and last remedy proposed by Dr. Smith is:—"That scientific men giving evidence on scientific points shall be allowed to deliver their examination in writing, the reading and elucidation to be controlled by the judge, examination and cross-examination to follow." The advantages to be derived from this are sufficiently obvious, but (in the writer's opinion) a scientific witness should certainly be present at the reading of his report, and should be permitted to give such additions or explanations as he may consider desirable, before any others have commented upon the same. Were these several suggestions carried out something would yet remain to be done, for it must be remembered that a scientific jury is not to be thought of, and one composed of ordinary individuals is somewhat apt to forget (as being partly beyond its comprehension) in consultation various scientific points that have been impressed upon it while in court, or, at least, does not accord to them their full moral power. A very glaring instance of this was exhibited in the late trial of Dr. Smethurst, for (in the opinion now, I believe, of the country at large) if due weight had been given to the chemical and medical evidence, and the same had been properly considered, the verdict would have been different. Now, I would humbly suggest, for the consideration of those who are interested in the subject, that this defect might be remedied in one of the two following ways, viz., either (in all cases likely to require the same) by appointing as one of the jurors a scientific man, capable of giving to the said points their real and just value, and of explaining the same to his colleagues, or by allowing such a person to have access to the jurors, who may gain from him the information they require, while he is restricted to the simple answering of queries, without referring to his personal opinions on the case. Furthermore, if I were present at the Society's house to-night, and if the idea had not been previously brought forward by abler heads than mine, I should be inclined to suggest that a special committee be formed from the members of this Society for the purpose of more fully considering the subject of "Science in our Courts of Law," and that the barrister, the chemist, and the physiologist be equally represented amongst its members. The functions of such a committee would be various and important; some of the most prominent would be to consider and digest the whole subject in its legal bearings as it now stands; to point out in detail the defects of the present system, and the manner in which these might be most readily and conveniently done away with; to consider carefully the various methods of detecting poisons

and adulterations now usually employed, noting the practical desiderata apparent therein; and, finally, to draw up a comprehensive report on the whole, calculated to serve as a basis for a parliamentary bill for amending the position of "science in our courts of law," to be brought before both houses by some members of the Society.

I am, &c.,
WENTWORTH L. SCOTT.

MANCHESTER SHILLING ART UNION,

The drawing of prizes for the Manchester Shilling Art Union took place in the theatre of the Royal Institution, on Thursday, the 30th December. The Mayor of Manchester presided; and amongst those present were Mr. E. Potter, president of the Chamber of Commerce; the Town Clerk; Messrs. S. J. Stern; A. Fonblanque; E. Salomons, the hon. secretary to the Institution; Mr. R. Aspden, secretary to the Art Union, &c. It appears that 23,071 tickets had been sold, and those principally among the working classes. There were 60 prizes, representing a sum of £900, two prizes of 100 guineas each, one of £80, one of £50, two of £30, three of £20, seven of £15, 23 of £10, and 21 of £5. The drawing took place under the charge of Mr. Edward Potter and the town clerk.

The paintings forming the first three prizes had been selected by the Committee; and they consisted of works by Boussét, Duffield, and Raven, respectively.

The winners of the other prizes would be at liberty to select a work or works of the value of their prizes, from the Exhibition now open, the choice being made at the holder's pleasure, whether amongst the paintings, the water-colour drawings, or the sculpture.

INSTITUTION OF NAVAL ARCHITECTS.

The Council of the Society of Arts granted the use of the Society's great room for a meeting, which was held on Monday evening last, the 10th inst., and consisted principally of private shipbuilders and the shipbuilding officers of her Majesty's dockyards, the object of the meeting being the establishment of an Institution of Naval Architects. This Institution has, it appears, been in course of formation for several months past, during which period it has obtained the support of many eminent persons. Sir John Pakington, while First Lord of the Admiralty, accepted a vice-presidentship, and with him are associated the Earl of Ellenborough, the Earl of Hardwicke, Sir Francis Baring, Sir James Graham, Mr. Sidney Herbert, Lord Clarence Paget, and Mr. H. T. L. Corry, all of whom have likewise accepted vice-presidentships. With these noblemen and gentlemen are also associated as vice-presidents several professional and scientific gentlemen, including Messrs. Watts and Lloyd, of the Surveyor of the Navy's Department of the Admiralty; Mr. Abethell, master shipwright of Portsmouth dockyard; Mr. John Laird, of Birkenhead; Mr. Scott Russell, the Rev. Dr. Woolley, and the Rev. Canon Moseley, the two latter gentlemen being the authors of valuable writings on the theory of naval architecture; and Mr. John Penn, the marine engineer. The Managing Council of the Institution consists principally of professional gentlemen, and comprises the master-shipwrights of all her Majesty's dockyards and several of their assistants, Messrs. Martins and Ritchie, the principal surveyors of Lloyd's Shipping Register Office; Mr. John White, of Cowes; Mr. J. R. Napier, of Glasgow; Mr. Grantham, late of Liverpool; and some others. Mr. J. D'Aguilar Samuda, shipbuilder, of Millwall, has been nominated treasurer. With the Council are connected Mr. Joseph Maudslay, the marine engineer, and Mr. J. MacGregor, of the Temple; and to these names have been added those of Sir W. Armstrong, Captain E. P. Halsted, R.N., and Captains Sullivan and Walker, of the Board of Trade, who will be invited to become associates of the Council. A resolution was unanimously adopted requesting his Grace the Duke of Northumberland to accept the office of president of the Institution. Mr. E. J. Reed, the naval editor of the *Mechanics' Magazine*, and the author of a paper on the "Ships of the Royal Navy," read at the Society of Arts in December, 1858, who has acted as the organising honorary secretary of the Institution, was unanimously elected secretary. The following is the substance of an explanatory statement which was made to the meeting by the secretary:—

"The want of an Institution which should have for its exclusive object the improvement of ships and of all that specially appertains to them, has long been felt by many professional men. Indeed for some years past this want has been a subject of conversation among such persons, and many of those now present have doubtless heard it frequently deplored. But the utter failure of all previous attempts to establish such an Institution seems to have cast so black a shadow of distrust before every newly-conceived project of a like nature, that until very recently no one has been found confident enough to hope for success in such an undertaking. Early last year, however, when the Royal Navy was a subject of much anxiety to the public, and when it was felt that if the establishment of such an Institution was ever to be effected that was the right time to set about it, the matter was again revived. Without, at this stage of our proceedings, entering into any minute statements, I may say that several gentlemen, some of them without and some within her Majesty's service, took up the subject, quite independently of each other at first, and resolved to bring about, if possible, the result which is now before us in the present meeting. It was from the first felt that for such an Institution as that which we contemplate to be successful, it must be directed towards what I have before designated the improvement of ships and of all that specially appertains to them. No Institution which should have for its object only the improvement of the forms of ships, or of the actual building of ships, or of the fittings of ships, or indeed of any single branch of the naval architect's study, could ever be successful; because, in the first place, there is not a sufficient number of persons to constitute an effective Institution engaged in any one branch; and secondly, because no single feature or portion of a ship can be properly studied apart from others. Hence it was seen that the scope of the Institution must of necessity be wide enough to embrace the consideration of all that is part of, or belongs specially to, a ship. This being so, it was felt that the naval architect—to whom alone the ship as a great complex whole is a subject of study—was the only proper person to give designation and character to the society; and consequently it was decided that naval architects should constitute the body, and that its title should be the 'Institution of Naval Architects.' But naval architects alone do not produce ships. With them must be associated—and closely associated, too—the shipbuilder, the man of science, the seaman, the engineer, the mast-maker, the rigger, the sail-maker, the smith, and others, or no ship could ever be built and equipped. Hence, it was concluded that for the Institution of Naval Architects to become a vital and vitalising body it must draw into association with itself persons from all such classes. This it is proposed to do by the establishment of the class of Associates—a class which it is believed will become very numerous, and will render most invaluable aid to the Institution. In consideration of the great advantges which will doubtless be derived from the associates, it has been thought right to give them a share in the governing council of the Institution, and accordingly, while the council had been mainly nominated from among naval architects (as it doubtless should be), a few seats have been opened to eminent naval officers, engineers, and other gentlemen. With the same view, and in order to secure the greatest possible amount of influence for the Institution, it has been thought desirable to solicit the services of a number of noblemen and gentlemen of great ability and eminence, who are, or have been, closely connected with either the

royal or the mercantile navies, and who might be willing to act as vice-presidents. It is hoped that, in course of time, the Institution will exert a beneficial influence upon those great and ever-changing fleets on which we, as a nation, are so much accustomed to rely; and that this hope is shared by those who are most competent to judge of the matter is proved by the list of the vice-presidents who have thus far accepted office. In view of the national interests likely to be advanced by the Institution, it was likewise thought better to waive the idea of a professional president, and to prevail, if possible, upon his grace the Duke of Northumberland—who has been First Lord of the Admiralty, has for long taken a most deep and generous interest in the system of coast lifeboats, and is also an eminent officer of her Majesty's navy—to accept the office. Although his grace has not yet accepted the presidentship, it is hoped that a new appeal to him may be attended with success. In conclusion, I will very briefly recapitulate our proposed objects, and mention our contemplated modes of operation. The objects of the Institution of Naval Architects are wholly comprised under three heads:—First. The bringing together those results of experience which so many shipbuilders, marine engineers, naval officers, yachtsmen, and others are acquiring, quite independently of each other, in various parts of the country, and which, though almost valueless while unconnected, will doubtless tend much to improve our navies when brought together in the printed transactions of the institution. Secondly. The carrying out by the collective agency of the institution of such experimental and other inquiries as may be deemed essential to the promotion of the science and art of shipbuilding, but are of too great magnitude for private persons to undertake individually. Thirdly. The examination of new inventions, and the investigation of those professional questions which often arise and are left undecided because no public body to which professional reference can be made now exists. The means by which it is proposed that the first of these objects shall be effected consists of the reading and discussion of papers at periodical meetings of the institution, the exhibitions of drawings and models, the publication of reports of the proceedings of the institution, and the establishment of a professional library and museum. The means by which the second object is to effected will, of necessity, vary with the nature of the inquiries to be instituted. The objects embraced under the third head will be carried out either by the council or by special committees appointed by it."

IONIAN ASSOCIATION.

A meeting was held at Corfu on Friday the 28th October, at the house of Mr Drummond Wolff, Secretary to the Lord High Commissioner, for the purpose of considering the bases of an Ionian Association for the Promotion of Science, Literature, and Art in the Ionian Islands. The most illustrious Sir Andrea Mustoxidi, K.C.M.G., Archon of Public Instruction, took the chair, and Mr. Giacomo Pollilà, librarian of the University, was named secretary.

The result of the meeting was the formation of a society, under the title of the Ionian Association for the Promotion of Science, Literatnre, and Art.

The scope of the Association is to collect information on Literature, Art, and Science generally, to encourage the energies of the Ionian citizens and others, by the distribution of prizes and certificates of honour; to institute inquiries into the past history, and the present physical resources and condition of the Islands and the adjacent continent. It will, as far as possible, collect works of value from other countries, and open correspondence, and interchange information and courtesy, on literary, artistic, and scientific subjects, with institutes, universities, and other learned bodies of foreign nations. The members will investigate any proposition brought before them for the development of the resources of the country, and likewise endeavour to introduce into circulation works for the diffusion of useful knowledge.

The Association will, from time to time, publish transactions in which shall be contained all papers read to the Association, reports of commissions, interesting correspondence with individuals or learned bodies, and all such literary conpositions written in the Islands, in whatsoever language, as are not of sufficient bulk to be published in a separate form, and which, on being submitted to the Association, shall appear to possess adequate merit.

It will be the endeavour of the Society to establish a library, museum, and other scientific institutions at Corfu; and it is to be hoped that as the Association progresses, it will be enabled to establish similar institutions in other Islands, which will offer to the traveller and scholar a means of pursuing with facility their studies in Cephalonia, Zante, Santa Maura, Ithaca, Cerigo, and Paxo.

EARTH BORING.

At Forbach, a shaft was bored, by Kind, a few years ago, of a diameter of fourteen feet, to a depth of 100 yards, by means of chisels fixed on iron arms worked by a 12 horse-power engine. At the Paris Exhibition, in 1855, M. Mulot exhibited a boring cutter for a similar operation. At Ruhrort, in Westphalia, a short time since a shaft was in course of boring of the diameter of 20 feet.

Home Correspondence.

THE "MULE."

Sir,—Mr. Charley, in his letter on Flax, in the last number of the *Journal*, p. 126, seeks the origin of the term "mule," as applied to spinning machinery. The machine was first called the "Hall-in-the-Wood wheel" (the residence of Crompton, the inventor), or "muslin wheel," because its capabilities rendered it available for yarn for making muslins; and finally it got the name of the "mule," from its partaking of the two leading features of Arkwright's machine and Hargreave's spinning-jenny. *Vide* Gilbert French's Life of Crompton.

I am, &c.,

NEMO.

FIGURE WEAVING BY ELECTRICITY.

Sir,—Having read in the *Journal* of the 6th instant, an account of M. Bonelli's "remarkable invention," viz.:—his magneto-electric substitute for the ordinary cards used in the Jacquard loom, I hastened to accept his invitation to the members of the Society of Arts, and witnessed his loom in absolute working order.

It appears to me that the arrangement of the loom now introduced by M. Bonelli, can scarcely be placed second to any invention in connection with the production of figured fabrics since the invention of the Jacquard loom itself. If I understand rightly the power residing within the magnetic arrangement of M. Bonelli's loom, it appears to me to be destined to entirely alter the character of the designs produced in our woven fabrics, and this it will the more readily accomplish, inasmuch, as artists of power, who have no technical knowledge of *mise en carte* drawing, are by its means enabled to dispense with technical knowledge, the only requirement being that the design to be woven must be drawn to scale upon a metallised paper, or rather the ground of the pattern to be woven must be stopped out with a non-conducting varnish, and the tracers at once arrange the warp threads in the loom, without any cards, card-punchers, or other subsidiary labour, other than that of the weaver.

If my statement be correct, what a field is now about to

open up to our great decorators and the students of our schools of design.

It has been urged over and over again that our schools of design have been of little use to the manufacturers of this country, owing to their having failed, among other things, to teach the technicalities of the weaver's art. Under certain conditions it may now be said that design is set free from the old trammels of the loom, and almost any extent and character of design may be produced both expeditiously and economically. If design has been set free by the extended power given to the loom by M. Bonelli, what an enormous extension of the field is thrown open both to artists and manufacturers, and for what results may we look in the woven fabrics which will be exhibited in the Exhibition of 1862. Instead of having here and there an extraordinary specimen of unlimited costly ugliness, upon a limited scale as to its capability of reproduction, as we had in 1851, we may look forward to 1862 as a time when the loom will have reproduced designs, in every style and character, without monotony and wearying repetition—when nature in all her beauty and freedom will have been copied and applied—and why ? Because M. Bonelli's invention does not necessitate the construction of a new plant on the part of manufacturers, it simply requires that a new, efficient, and expeditious arrangement, of almost unlimited power, be substituted for the present costly, tedious, and limited Jacquard arrangement.

And here I fear I may be met with the old and stereotyped objection made to the introduction of all improvements in every department of trade, and not the least frequently by weavers, viz.,—that to adopt the magnetic arrangement of M. Bonelli would necessitate the throwing out of employment a large body of persons at present occupied in reading off patterns, and preparing cards for the looms as at present used. Doubtless to some extent such would be the case; but we cannot expect the new system to be taken into such universal and immediate use as to largely affect that class of artisans; and, in many cases, it may still be found desirable to use the Jacquard looms as at present.

I feel so strongly the importance of the present invention, that I cannot but hope that our manufacturers will at once look carefully into the question of its capabilities, and not allow it to be taken up by foreign manufacturers, as was the case with the Lyonnese weavers when Jacquard invented his loom; and hereafter, when trade has been diverted into another channel by its adoption elsewhere, then take it up and work it at a disadvantage and from mere necessity. As its adoption would doubtless affect a class of operatives, they should be reminded that opposition on their part to its introduction will as certainly be attended with defeat, as was the attempt to prevent the introduction of the power loom invented by Dr. Cartwright, by burning the mill erected at Manchester, in 1791.

I would not however have it supposed that I entirely agree with all the statements advanced as to the amount of saving effected by M. Bonelli's loom. I think that he takes rather a high estimate of the cost of producing a design, when he sets it at 12s. and 15s. per hundred cards. Moreover, he overlooks the inventions of such men as Mr. Laforest, who substituted endless paper bands for the ordinary cards, and was enabled to work a pattern requiring, say 3,000 ordinary cards, at a cost of not more than 30s., such bands being capable of being cut from a design previously perforated at a rate which was equal to 3,000 cards per hour.

I do, however, see so many and great advantages attending the adoption of M. Bonelli's system, that I trust manufacturers will at once make the necessary arrangements with the inventor for giving the magneto-electric loom a fair trial; and if the *Journal* could be furnished with an outline woodcut of the model, showing the arrangement of the tracers, magnets, and pistons, I think it would be all that would be necessary to enable manufacturers to understand the simplicity of its construction.

I have not alluded to the pentagraphic arrangements connected with this loom, which give to the manufacturer a power of enlarging or reducing the design from the original drawing. Moreover, an entire design can be woven from only half a pattern, where the entire design is simply a reversal of the pattern drawn; and in geometric patterns a small portion of the design only need be executed, as the magnetic arrangement affords facilities for reversing or multiplying the repeats of any given design. There are many other points to which I would desire to allude, but I fear to trespass longer on your space, and must, therefore, conclude by returning my thanks to the inventor for his courtesy in inviting the members of the Society,

I am, &c., T. U. E.

THE NEW HORTICULTURAL GARDEN.

SIR,—So many members of the Society of Arts are interested in the New Horticultural Palace and Garden that we are to have at South Kensington, that I venture to call your attention to a serious mistake which I hear that it is not impossible that the persons in authority may make, if they are not prevented by an expression of opinion.

I hear that is is under consideration whether the trees now standing on the ground, or at least a large portion of them, shall not be cut down.

The garden, with Mr. Cole's terraces and Italian arcades, and other enchanting structures which his Prospero's wand will certainly raise, is likely to be very beautiful; but it can scarcely fail to be wanting in the shade of trees which will be necessary both for the comfort of promenaders and for the relief of the architecture and statuary.

I hope, therefore, that whenever anyone proposes to cut down any of the trees now standing, Mr. Cole will whisper in his ear, "Woodman, spare that tree."

I am, &c.,

HARRY CHESTER.

63, Rutland gate, S.W. Jan. 18, 1860.

MEETINGS FOR THE ENSUING WEEK.

MON. .....London Inst., 7. Mr. Joseph Towne, "On the Organs and Phenomena of the Senses, Intellectual Powers, and Memory."
Entomological, 8. Anniversary.
Brit. Architects, 8. Mr. W. Papworth, "The Superintendents of English Buildings in the Middle Ages; with especial reference to William of Wykham."
Geographical, 8½. 1. Mr. William Wheelwright, "Proposed Railway Route Across the Andes from Caldera to Rosario, *via* Cordova." 2. Dr. George Buist, "On the Curia Muria Islands."
Medical, 8½. Dr. Gibb, "On the *Sanguinaria Canadensis*; its History, Composition, Properties, and Medical Uses."

TUES. .....Royal Inst., 3. Prof. Owen, "On Fossil Birds and Reptiles."
Civil Engineers, 8. Mr. F. C. Stileman, "Description of the Works and Mode of Execution adopted in the construction and enlargement of the Lindal Tunnel, on the Furness Railway."
Medical and Chirurg., 8½.
Zoological, 9.

WED. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Society of Arts, 8. Mr. P. L. Simmonds, "On the Rise and Progress of Steam Navigation in the Port of London."
Archæological Assoc., 8½.

THURS. ...Royal Inst., 3. Professor Tyndall, "On Light."
Philosophical Club, 6.
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.

FRI. .....United Service Inst., 3. Mr. J. Craufurd, "On the His- of the Horse, and his Comparative Value for Military and other purposes.
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Prof. Owen, "On the Cerebral Classification of the Class Mammalia."

SAT. .....Royal Inst., 3. Dr. Lankester, "On the Relations of the Animal Kingdon to the Industry of Man."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January 6th*, 1860.]

Dated 27th December, 1859.

2948. W. Hudson and C. Catlow, Burnley, Lancashire—Certain imp. in looms for weaving.
2949. F. Levick, Blaina Cwm Celyn and Coalbrook Vale Iron Works, Monmouthshire—Imp. in puddling and other reverberatory furnaces used in the manufacture and heating of iron, and for other like purposes, and in economizing the waste heat of the said furnaces.
2950. T. S. Truss, 53, Gracechurch-street—Imp. in the mode of packing or cushioning railway chairs, pillars, pipes, girders, and engines, by the use of animal and vegetable fibre-packing chemically prepared.
2951. W. E. Tayler, 4, Russell-place, Montpelier, Bristol—Fastening the hairs in tooth brushes and other brushes.
2952. J. J. House and H. A. Martin, 1, Watson-walk, Sheffield—An improved method of application and arrangement of indexes to account and other books.
2953. X. Carrère de Nabat and A. Carrère de Nabat, 41, Rue d'Angouleme St. Honoré, Paris—An apparatus to shear domestic animals.
2954. W. B. Johnson, Manchester—Imp. in steam engines and boilers, and apparatus connected therewith.
2955. W. Maryon, 9, Stanhope-street, Hampstead-road, Middlesex—Imp. in ladders, and in machinery to be used in making them.

Dated 28th December, 1859.

2957. A. V. Newton, 66, Chancery-lane—An imp. in the treatment of stricks or bundles of fibres, and the conversion of the same into slivers or ribbons. (A com.)
2959. C. J. Rooney and D. Renshaw, New York—An imp. in spring door hinges.
2961. F. P. Tanniard, Beaume, France—An apparatus indicating the time in music, and which can serve as a diapason.
2965. A. J. Melhuish, Holborn-bars—Imp. in cameras.

[*From Gazette, January 13th*, 1859.]

Dated 6th December, 1859.

2762. W. E. Newton, 66, Chancery-lane—An improved mode of treating gums, such as india-rubber or gutta-percha, for the manufacture of various articles. (A com.)

Dated 7th December, 1859.

2766. R. W. Sievier, F.R.S., London—Imp. in the method of and apparatus for regulating the speed of steam engines connected with the propelling of steam boats or ships.
2774. J. Combe, Belfast—Imp. in the mode of and machinery for hackling, carding, and preparing flax and other fibrous substances, part of which improvements is applicable to transmitting power generally.

Dated 14th December, 1859.

2834. W. Hulse, Birmingham—Imp. in the manufacture and ornamentation of metallic bedsteads and other articles of like manufacture, and in apparatus and machinery employed therein.

Dated 28th December, 1859.

2963. W. A. Gilbee, 4, South-street, Finsbury—A new manufacture of colouring matter for replacing lokas or Chinese green. (A com.)

Dated 29th December, 1859.

2967. S. King, Edwards-street, Portman-square, Middlesex—Imp. in spirit lamps.
2969. J. S. Crosland, Johnson-brook, near Hyde, Chester—Certain imp. in steam engines and boilers, and in the mode of applying steam engines.
2971. H. B. Barlow, Manchester—Imp. in machinery or apparatus for stripping or cleaning the drums and rollers of carding engines and other machines in which rollers covered with card teeth are employed. (A com.)
2973. T. R. Russell, Liverpool—The application of certain metals or materials to the manufacture of the movements of watches and other time-keepers.
2975. T. S. Cressey, Burton-on-Trent—Imp. in trussing casks, and in apparatus employed therein.
2977. J. Cliff, Wortley, near Leeds, Yorkshire—An imp. in cleansing wool and woollen waste.
2979. J. Cliff, Wortley, near Leeds, Yorkshire—An imp. in the manufacture of clay retorts.

Dated 30th December, 1859.

2981. W. Smith, Kilmarnock, Ayr, N.B.—Imp. in the manufacture of fire clay gas retorts.
2983. T. Auchincloss, Glasgow—Imp. in machinery or apparatus for beetling and washing textile fabrics.
2985. T. L. Ball, New York City, U.S.—Imp. in show cases for the containing of fancy articles.
2987. W. Robertson, Manchester—A new method of dragging boats by the power of the water passed through canals or rivers, or otherwise attainable.
2989. W. E. Gedge, 4, Wellington-street South, Strand—A new system of paddles for steam boats or other vessels. (A com.)
2991. J. Slack, Hyson green, Terrace-street, Nottingham—Imp. in water and steam guages for steam boilers.

Dated 31st December, 1859.

2995. T. C. Gregory, Glasgow—Imp. in railway carriages.
2997. H. Munster, Brighton—Certain imp. in billiard and other tables.
2999. J. Ridsdale, Stoke Newington-green, Middlesex—Imp. in the construction of syphons.

Dated 2nd January, 1860.

1. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved brick-making machine. (A com.)
3. W. Simons, Glasgow—Imp. in the construction of ship's or other floating vessels.
5. W. Jackson, Worsley, Lancashire—Imp. in coupling apparatus for hoists for the prevention of overwinding.
7. S. Rowbotham, Putney, Surrey, and T. Gratton, Derby—A composition for rendering uninflammable linen, cotton, silk, or other inflammable fabrics and substances.

Dated 3rd January, 1860.

9. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in furnaces and fire-places for the better consumption of fuel. (A com.)
11. L. B. Ollivier, 29, Boulevart St. Martin, Paris—Imp. in ploughs.
13. D. Hulett, 55 and 56, High Holborn—Imp. in apparatus for measuring gas, and in apparatus for indicating the pressure of gas.
15. F. Hudson, 227, Blackfriars-road—Imp. in gas meters.
17. J. Wheatman, Sheffield—Imp. in machinery or apparatus for grinding saws and other similar articles of metal.

Dated 4th January, 1860.

19. P. Grimaldi, 60, Boulevart de Strasbourg, Paris—Improved steam generators not liable to bursting.
21. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. applicable to nibs or burners for gas. (A com.)
23. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved fertilizing compound for agricultural purposes. (A com.)
25. J. Walls, Farington Mills, near Preston—Improved arrangements of compound steam engines.
27. C. Gammon, 9, Cloak-lane, London—An improved churn.
29. L. A. Le Blanc de St. Just, 1B, Welbeck-street, Cavendish-square—An improved machine for cutting soft and hard stones in open quarries.
31. A. Chambers, Bow, Middlesex—Imp. in the mode of working junction signals on railways.
33. S. Perkes, Clapham, Surrey—Imp. in presses and modes of pressing, applicable to cotton, hemp, wool, coir, hides, hay, fibres, peat, linen, thread, piece goods, extracting oil, and other useful purposes.
35. T. Procter and T. Walker, Derby—Imp. in sewing machines.
37. O. J. T. Gossell, Moorgate-street—Imp. in the construction of locomotive engines. (A com.)

Patents Sealed.

[*From Gazette, January 13th*, 1860.]

January 11th.

1648. J. Dible and W. H. Graveley.
1657. C. S. Walker and R. Hoyle.
1666. J. Atkinson.
1670. R. Longstaff and A. Pullan.
1672. W. Clark and W. Williams.
1676. J. P. Farrar.
1696. W. E. Newton.
1700. J. Shanks.
1714. C. Tapp and J. B. Tapp.
1894. A. V. Newton.
2263. W. E. Newton.
2283. W. E. Newton.
2334. W. Prosser.
2540. J. Thomson.
2599. R. White.

January 13th.

1682. J. Bernard.
1686. O'D. Grimshaw.
1689. T. Carliell.
1691. J. Bernard.
1703. J. Erskine.
1716. P. A. Viette.
1935. D. Russell and J. Russell.
2413. J. Avery.
2539. C. Green.

[*From Gazette, January 17th*, 1859.]

January 17th.

1692. H. C. M. Cramer.
1694. A. Phillips.
1724. J. Broadley.
1732. C. F. Vasserot.
1750. W. Kent.
1758. I. M. Lindley.
1784. H. Fletcher.
1862. W. Clark.
1882. C. Glassborow.
2208. A. W. Williamson and L. Perkins.
2362. W. K. Hall.
2536. A. Templeton and J. Lawson.
2576. A. Applegath.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, January 13th*, 1860.]

January 9th.

79. J. H. Johnson.

[*From Gazette, January 17th*, 1859.]

January 12th.

104. A. Bower.
126. F. Watkins.

January 13th.

130. M. A. Muir & J. M'Ilwham.
211. P. A. Balestrini.

January 14th.

478. J. Moule.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, January 13th*, 1860.]

January 10th.

71. H. C. Jennings.
82. J. Arrowsmith.

Journal of the Society of Arts.

FRIDAY, JANUARY 27, 1860.

EIGHTH ORDINARY MEETING.

Wednesday, January 25, 1860.

The Eighth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 25th inst., Captain Sir Edward Belcher, R.N., in the chair.

The following Institutions have been taken into Union since the last announcement:—

Andover, Library and Reading-room.
Belfast, Young Men's Christian Association.

The Secretary called attention to a model of an apparatus, invented by Mr. Francis Pichler, to be used in place of a rudder for ships, for steering continuously in either direction, with or without the vessel being under way, and also capable of being employed as a propeller.

Specimens of a new application of the Electrotype, for the manufacture of ornaments suitable for producing water-marks in paper, executed by Mr. Frederick Exter, of Vienna, were exhibited by Mr. Paul Pretsch. They are formed of silver deposited in moulds of metal, produced by etching with acids.

The Paper read was—

ON THE RISE AND PROGRESS OF STEAM NAVIGATION IN THE PORT OF LONDON.

By P. L. Simmonds.

There are some subjects and things with which we gradually become so familiarised, that we come to look upon them as matters of course, and take little heed or note of their progress and improvement, and in this class may probably be ranked the Steam-Shipping Interest. We have become so accustomed to the advantages of frequent, regular, and speedy steam communication to all parts of the world—we see the steamers on our rivers and seas in so many forms, whether as the passenger boat, the ocean mail boat, the steam-tug, the screw collier, the steam-yacht, the steam-ferry, the steam-frigate, liner, or gun-boat, that few of us pause to look back upon the commencement of this advancing era of progress. Even those who could carry their recollection back to the early stages and struggles of Steam Navigation on the Thames, have almost forgotten the details, while others have neither time nor opportunity to investigate the history; hence a glance at the rise and progress of Steam Navigation in the port of London may be the means of eliciting, by discussion or communications, some interesting particulars, which so many of our members have the means of furnishing, and in which so many persons are specially interested.

The influence of Steam Navigation on the trade and commerce of the country, and its active competition with the sailing branch of the Mercantile Marine, have been very much overlooked.

The steam vessels owned in the United Kingdom now constitute one-tenth of the entire mercantile tonnage, and if we add the river steamers they form a still larger proportion. While the sailing tonnage registered in 1858, as compared with that registered in 1850, exhibited only an increase of 30 per cent., the steam tonnage registered in the same year shows an advance of 264 per cent. over that of 1850; and it must be remembered, that one steam vessel performs at least the work of four sailing craft, while the proportion of casualties is much less in steamers than in sailing vessels.

The total number of steamers owned and registered in the United Kingdom, exclusive of the colonies, on the 1st of January, 1859, was 1854. London, the true empire city, stands, as might be expected, at the head of the list, having a fleet of 510 steamers, of 282,403 collective tonnage, and 68,951 horse-power. But many of the steam vessels registered here scarcely belong to the *navigation* of London, as they sail from other ports. Many are running on distant stations, such as those of the Calcutta and Burmah Company, the Calcutta Navigation Company, the Borneo Company, the Hudson's Bay Company, the Inter-Colonial Steam Company, and the Magdelena Steam Navigation Company. Others, again, sail from Liverpool, such as the African Steam-ship Company's boats. Some from Southampton, as the Peninsular and Oriental, and Royal Mail Company's vessels, while the South Eastern Railway Company's boats run from Folkestone, and the Eastern Counties Railway boats from Harwich. But to counterbalance these, there are very many steam vessels registered at other ports which trade regularly to London, while several foreign steamers are also constant traders to the Thames.

Folkestone and Dover and Southampton may almost be looked upon as outports of London, connected as they are by railway with the metropolis, and the passenger, specie, and goods traffic all passing to and from London. The West Indian, American, Indian, Peninsular, and Brazil trades, have given a vast commercial impetus to Southampton. Thus the steam tonnage that entered that port last year was 561,000 tons against 95,000 tons of sailing vessels, and 57,000 packages of specie were shipped from thence and 12,400 brought in by steamers.

In 1858, 2,254 seagoing steamers entered the Thames, registering 736,365 tons. Of these 2,200 vessels and 700,761 tons were engaged in the home and foreign trade, and 54, of 35,604 tons, in the colonial trade.

On the 31st of December, 1842, the number of steamers registered in London was:—

	No.	Tons.
Under 50 tons	73	2,255
Above 50 ,,	166	45,010
	239	47,265

Sailing vessels in same year:—

Under 50 tons	629	20,607
Above 50 ,,	2254	577,493
	2883	598,100

Newcastle in that year was the second principal steam port, there being registered at Newcastle 123 steamers, of 2,557 tons in all, two only being above 50 tons. Glasgow owned but 67, of these 50 averaged 200 tons, while in London the average of those above 50 tons was 271 tons.

On the 31st December, 1844, there were owned and registered in the port of London:—

86	steamers	under 50 tons =	2,744 tons
174	,,	above 50 ,, =	46,103 ,,
260			48,847

Ten years subsequently, the total number of steam vessels in the kingdom had increased to 480, and the tonnage to 142,590; 352 of the vessels being above 50 tons.

On the 1st of January, 1847, there were registered in this port:—

			Tons.
90	steam-vessels	under 50 tons measuring	2,825
197	,,	above 50 ,,	53,085
287			55,910

Glasgow had, at the same period, 65 steam-vessels of 10,659 aggregate tonnage, and Liverpool 60 steamers and 7,154 tons.

On the 1st of January, 1859, there were registered in this port :—

		Tons.
154	steam-vessels under 50 tons measuring	4,677
391	" above 50 " "	190,588
545		195,265

Comparing other ports with London from the last return of steamers, we find they own respectively the following numbers :—Liverpool, 210 vessels, 91,411 tons, and 21,000 horse-power ; Glasgow, 164 vessels, 95,116 tons, and 25,632 horse-power ; Shields, 115 vessels ; Newcastle, 107 ; Sunderland, 74 ; Hull, 67 ; Dublin, 48 ; Leith, 41 ; Bristol, 37 ; Stockton, 34 ; Greenock, 30 ; Cork, 29 ; Southampton, 27 ; Aberdeen, 14 ; and Dundee, 11.

Of the entire number of British steamers, 992 (or more than half) are of iron, 861 of wood, and one, the *Rainbow*, of steel. 1,263 are propelled by paddles, 589 by screws, and one, the *Great Eastern*, by combined paddles and screw.

The largest and the smallest steamer belong to this port, the *Great Eastern*, of 18,915 tons, and the *Disowned*, f 4 tons.

The importance of steam transport to the metropolis may be estimated by the fact that, exclusive of the larger imports, the declared net value of the exports of the produce of the United Kingdom, from the port of London, in 1858, was close upon 29 millions. Rather more than one-half of the whole of the customs duties received in the United Kingdom is collected in London, for out of the £24,155,852 gross duty received in 1858, £12,332,061 was paid in London, and £3,622,503 in Liverpool.

When we find that we own in the United Kingdom and Colonies at the present time 2,239 steamers, of 488,415 gross tonnage, and consider that other commercial countries are fast availing themselves also of steam power for their shipping, this cannot but tell materially upon the existing sailing tonnage, with which, by repeated and rapid voyages, it comes into such direct competition. 13,681,762 tons of steam tonnage were employed in the coasting trade of the kingdom in 1858, and 4,505,652 tons in the foreign trade, these vessels must necessarily have displaced a large amount of sailing tonnage formerly employed. The progress, too, of steam tonnage is so rapid, that in the words of a recent writer, "It requires no great faith to believe, that the time is not far distant, when every ship which navigates the ocean will use steam as a prime or auxiliary power."

About the year 1795, Lord Stanhope constructed a vessel, which was tried in Greenland Dock. The paddles were made in imitation of the feet of a duck, and were placed under the quarters of the vessel, but the mechanism did not answer his lordship's expectation.

George Dodd, in his "Dissertation on Steam-engines and Steam-packets," published in 1818, states, that "on the Thames there are seven steam-packets, two of which run to Richmond, two to Margate, one to Gravesend, and two that are unemployed, and without destination." The *Richmond* had then been plying for two years above bridge to Richmond and Twickenham.

Dodd purchased, in Scotland, the *Argyle* steamboat, built by Messrs. Wood, of Greenock, which used to ply between Glasgow and Greenock. She was 90 tons burthen, 79 ft. keel, 16 ft. beam, had an engine of 14 horse-power, and her paddle-wheels were 9 ft. in diameter. The engines occupied the middle of the vessel, the boiler being placed on the starboard side, and the cylinder and fly-wheel on the larboard. The smoke was carried off by a funnel, which also did duty as a mast and carried a large square sail. It seems, indeed, to have been the anxious wish of the constructors of the early steam-boats to disguise the ugly smoking chimney, under the designation of a mast, and some even went so far as to raise up a topmast in the thick folds of the dense smoke. In coming up the river, Dodd's vessel passed every thing on the Thames, astonishing all the fast sailing boats on the river. She was regarded with no little wonder by all the Londoners. She had run 758 miles in five days and two hours, and experienced, during that time, some severe weather and heavy seas. This proved incontestably the superiority of the steam-boat over the sailing vessel. When we consider that she was the first steamer that attempted the seas, and was only 14 horse-power, it must be allowed that some courage was requisite to embark in so frail a vessel for so long a voyage.*

At the commencement of 1815, nine steam vessels in all had been constructed in the Clyde, three of which had been disposed of, one to the Mersey, the *Margery*, which ultimately went to the Seine, and the *Argyle* for the Thames—her name being altered to the *Thames*. The latter arrived in the river in January, 1815. She commenced the passage to and from Margate that season, and although fear and prejudice acted against her, she realised a fair remuneration to her owners, and reduced the passage to a certainty within 12 hours, which was considered a marvel. This was a great gain of time for that period, although contrasting strangely with the speed which has been since attained. The *Prince of Wales*, belonging to the General Steam Navigation Company, made the run, on one occasion, from Margate to London, in 4 hours and 2 minutes.

In the same year the first steamer running to Gravesend was started, the *Margery*, built in Scotland, of 70 tons burden and 14 horse-power. She had uncovered wheels, projecting from the stern, which were compared at the time to duck's feet, and the boatmen and river sailors, who were by no means favourable to the new comer, cracked their jokes most mercilessly at the frequent mishaps to the duck's feet. The average passage by the *Margery* was 5 or 6 hours, and the fares 4s. and 2s.

She made her first trip the 23rd January, 1815, in conformity with the following announcement :—

"The public are respectfully informed that the new London steam engine packet *Margery*, Capt. Curtis, will start at ten o'clock, on Monday morning, the 23rd inst., from Wapping Old Stairs, near London docks, to Milton, next below Gravesend, and will return from thence at the same hour, on the succeeding day, to the same stairs. The said packet having superb accommodation, passengers and their luggage will be conveyed with more certain speed and safety than by any other conveyance by water or land, and on reasonable terms. Passengers are requested to be punctual."

She continued to ply on the station for a few months, during which it was occasionally requisite to lay her up for the repairs of her machinery, and sometimes for ten days together. The longest period of her working without interruption was three weeks.

Upon her failure, another company started the *Thames*, a rather faster boat, with covered paddle wheels, which went and returned in the same day.

Among the inducements held out to tourists in the advertisements, were the following :—

"Ladies accompanied by gentlemen, in large parties of pleasure, *passage free*, Sundays only excepted. Refreshments provided ; tea, bottled porter, &c. Passengers bringing refreshments will be assisted with boiling water, and milk provided in readiness on board."

At the time when the steamers started there were 26 sailing passage boats between London and Gravesend, varying from 22 to 45 tons burden. They gradually declined after the introduction of the steamers.

Previous to the introduction of steam, eleven sailing packets (celebrated hoys) used to convey passengers to and from Margate, making the passage in 20 to 36 hours. In two years after the introduction of steam, the visitors had increased from 20,000 to 25,000. The greatest number taken down by the *Thames* was 240, the fares being

* Macfarlane's History of Propellers and Steam Navigation : New York.

then 15s. and 11s. At one time (in 1847) four companies ran boats to the Isle of Thanet—the General Steam Navigation Company, the Herne Bay Company, the Old Margate Company, and Mr. Napier's boats. The *Royal William* earned in one summer (May to November, 1829) £15,000.

Returning from this digression, I will proceed with the early history of river boats.

The success of the *Thames* led to the construction of the *Majestic* and *Prince Regent* for the same station. The latter was unfortunately burnt on the 2nd of July, 1817, on her passage from Margate.

The circumstance of the *Prince Regent* being consumed by fire, led Mr. Watt to adopt a water case round the chimney, to lessen the chance of accident, and to reduce the expenditure of coal, by considerably increasing the temperature of the feed water before it entered the boilers. This was afterwards followed in all vessels fitted with engines from Soho, and copied by others.

The *Thames*, which cost £2,500, was first placed on the Margate station for about two years, and afterwards became a Gravesend boat, leaving Tower Stairs every morning at 8, and returning the same day.

The *Prince Regent* was introduced to the public by the following advertisement:—

"STEAMBOAT.—The admirers of this description of conveyance may enjoy a high treat, by taking a trip to Margate in the *Regent* steam-packet, which starts from off the Tower every Wednesday and Saturday, at 8 o'clock, beating every other vessel of this description, as was evinced on Monday last, by her passage from Margate to London."

Then followed the *Sons of Commerce*, *Favourite*, *Eclipse*, *Albion*, *Dart*, and *Margate*.

About the time when the *Sons of Commerce* was employed between London and Margate, another party introduced the *Majestic* on the same station, and subsequently the *Victory* and *Hero*, but they were not successful, and the vessels were sold. In 1815, the *Britannia*, of 70 tons and 15 horse-power, was built for running between London and Southend.

The *Caledonia*, from the Clyde, arrived during this season, and made a few passages to and from Margate, but was afterwards laid up on account of defects in her machinery. This vessel was purchased by Mr. James Watt, and fitted with two engines of 14 horse-power each, for the sole purpose of making experiments. One of these embraced the ascent of the Rhine, as far as Coblentz, in the autumn of 1817.

In 1817, the *London*, of 70 tons, 80 feet between perpendiculars, and 11 feet beam, with one engine of 14 horse-power, commenced running between Richmond and the City, while the *Sons of Commerce*, belonging to the same proprietors, plied to Gravesend. The engines, of 20 horse-power, were made by Butterley and Company. The dimensions of the latter vessel were—

	ft.	in.
Length between perpendiculars ...	85	0
,, of keel for tonnage	75	6
Moulded breadth.....	13	8
Extreme breadth.....	14	0
Depth of hold.....	8	1
Flat bottom, round bilge—		
Builder's tonnage	$77\frac{24}{94}$ tons.	
Breadth over gangways	25ft. 3in.	

An average of 6 trials at the mile, gave the velocity of the boat at 7·77 miles per hour. Consumption of coal, 2·2 cwt. per hour.

The following are the descriptive particulars of some of the early steamers referred to:—

	Length. Feet.	Beam. ft.	Beam. in.	Horse power.
Thames	79	16	0	14
Majestic	81	16	6	25
Regent	80	15	0	24
Caledonia	94	15	3	36
London	80	11	9	14
Sons of Commerce.....	85	14	0	20
London	85	12	0	14
Richmond	62	11	9	8

The next steam-packet that plied between Gravesend and London, for public accommodation, appears to have been the one started by a Mr. Dawson, in 1818. Previously, however, Mr. Lawrence, of Bristol, had transferred a steam-boat to London to ply on the Thames, but the watermen of the river successfully opposed the innovation.

In 1818 the following vessels were set afloat. The *Favourite*, of 80 feet long, 18 feet beam, with two engines of 20 horse-power each, from Soho, of a form of construction which was closely copied by the best makers. The *Victory*, 80 feet long, and also 18 feet beam; power, two 25-horse engines, by Dixon. The *Engineer*, of 315 tons, 120 ft. by 24 ft. beam, with two engines of 25 horse-power, by Maudslay. This vessel made no passages during the year. Owing to the peculiar construction of her machinery, the paddle-wheels working in air-cases below her bottom, which was not found to answer, the scheme was abandoned, and common wheels applied outside, commenced first in 1819.

The *Eclipse*, of 111 feet between perpendiculars, and 21 feet beam, with two Soho engines of 30 horse-power each, was the only vessel constructed on the Thames this year.

In 1820, the Leith and London Steam Packet Company was formed, and arrangements made for building two vessels, the *City of Edinburgh* and *James Watt*. The former was launched in March, 1821, and made her first passage on the 20th of June, 1821; length between perpendiculars 134 feet 9 inches, beam 25 feet 10 inches; two engines of 40 horse-power each. This was the largest and most powerful vessel constructed at this period, her tonnage being 401 tons. The circumstance of the water having saturated during the first passage, and injuring the flues of the boiler, led to the adoption of an extracting pump for changing it at pleasure. Mr. Field, apparently not aware of this, subsequently took out a patent for the same invention. The bilge injection was also first applied to this vessel, so that in case of springing a leak, the engines might be supplied from within, and clear the hold at the rate of 150gallons per minute.

The *James Watt* was built at Port Glasgow, by Messrs. John and Charles Wood, and launched in August, 1821; length between perpendiculars, 141 feet 9 inches; beam, 25 feet 6 inches; tonnage, 420 tons; power, 2 engines of 50 horse-power. She made her first passage in 1822. In this vessel the water was changed in the boiler by what are now called blow-out pipes and cocks, performing every two hours, and this was gradually followed by other makers. The mechanical performance of this vessel gave great satisfaction, her speed in still water was 10 miles, with 10 bushels of coal per hour. The feed-water was made to surround the chimney, and acquired a high temperature before entering the boiler. This year, vessels had their paddle-wheels on the second motion, a construction for river navigation which possessed considerable advantages for obtaining the best performance out of engine and wheel.

During 1821, the following vessels were built on the Thames, those for the Post-office being the first steamers belonging to that establishment:—

Royal Sovereign ...	Post-office.....	Holyhead Station.
Meteor	,, ...	,,
Dasher	,, ...	Dover Station.
Arrow	,, ...	,,
Venus.....		Margate Station.
Eagle		Ramsgate Station.
Swiftsure.....		Gravesend Station.
Hero		Margate Station.

All the engines were made by Boulton, Watt, and Co., except those of the *Hero*, which were by Dixon.

In 1822, the Government launched their first steam-vessel, the *Comet*, fitted with Soho engines of 40 horse-power each; her length was 115 feet, beam 21 feet. She was chiefly employed in towing and transporting the Navy Board from one yard to another.

In 1823, the private yards sent forth the *Lord Melville*, to run between London and Calais, the *Sir James York* for Southend and Sheerness, the *Royal Sovereign* for Ramsgate, the *Sovereign*, the *Union*, and the *Medusa*, for Dover and Boulogne, and the *Medina* for Southampton and Cowes.

In 1829, the Gravesend and Milton Steam-Boat Company was formed, which placed upon the station several fast and commodious vessels. Shortly after this followed a new association, the Star Gravesend Company, which also placed upon the river several first-rate packets, but these have been driven out of the field by the competition of railways on each side of the Thames.

From this period the increase of steamers built became so rapid, that even the register of their names would exceed ordinary limits.

One of the oldest seagoing steamers, the *Soho*, a great favourite in her day, was only last month converted into a coal hulk on the river, a depot for the Woolwich steamers.

The *Soho* was built in 1823, to ply between London and Edinburgh, with the *James Watt* and *United Kingdom*, being the property of the Leith and London Steam Company. They were purchased some twenty years ago of that company, by the General Steam Navigation Company. The *United Kingdom* was lost, and the *James Watt* re-sold.

The *Endeavour*, a small boat, built to ply between London and Richmond, commenced running in May, 1829, and remained on the station till September, 1840.

She was fitted with two improved vibrating engines of 10 horse-power, by Messrs. Maudslay and Field, the adaptation of the slide valve to the oscillating engine having only been patented about a year previously.

Maudslay was the first to open steam navigation above bridge. He put a pair of oscillating engines in the *Sylph*, running to Woolwich, in 1836, and made the little *Fly* with oscillating engines in the same year. The *Dover Castle* was also fitted by him in 1837.

The *Shamrock* was fitted by Spiller in 1838.

Cavé, of Paris, had however oscillating engines in the *Courier*, Dover boat, in 1835.

The *Black Eagle*, 260 horse-power, had the largest oscillating engines then used, in 1843, and the *Sphynx* had oscillating engines of 500 horse-power, in 1845. Both these were government vessels.

The building of steamers for foreign governments has long proved a very large and profitable business to our London builders. As early as 1814, Messrs. Boulton and Watt began to furnish engines for vessels to run on Lake Ontario, the Elbe, Po, Danube, &c.

Out of 68 steam-vessels, of 26,956 tons, built for foreigners in our ports, in 1858, 15, registering 7,350 tons, were built in London.

The introduction of the improvement of feathering wheels, Morgan's Patent, deserves notice, from the enormous saving of fuel and other advantages. It was fitted to the *Media* about 1836. On its first introduction it was hastily abandoned, from being badly proportioned, and the great expense attending it, but by placing wooden bushes in the arms, and other modifications, an important increase of speed was gained, as well as a considerable saving of fuel. The result of twelve passages to and from Rotterdam, with each kind, gave the following results:—

	Common wheel.	Feathered wheel.	Gain.
Time, full speed, hours	252·12	212·30	39·40
,, on passage ,,	266·40	231·20	35·20
Coals burnt, on full speed, tons	242	180	62
,, ,, on voyage ,,	282	222	60

The gradual and extensive introduction of the screw in place of the paddle is another noticeable feature. For tidal harbours, and for comfort in conveying passengers, cattle, &c., on short voyages, paddle steamers are still preferred, but for long voyages, screw steamers are undoubtedly the best, and hence we find that nearly the whole of the long seagoing steamers are fitted with the screw. Even the General Steam Navigation Company have added a dozen screw vessels to their fleet.

The first person who went into the building of steamers on the Thames was Mr. W. Evans, of the King and Queen Dock.

The *Sophia Jane* was one of the vessels built by Evans, a Rotherhithe, and she was constructed of bent planks instead of timbers. She was navigated by Lieut. Biddulph, R.N., who was indicted by the Waterman's Company for an infringement on their rights of plying on the river, not being free of the company. Lieut. Biddulph, however, carried his cause, although at a cost of several hundred pounds law expenses, for the Acts cited in favour of the Waterman's privileges had never contemplated the introduction of steam propulsion on the Thames. Following on this innovation came the Milton and Gravesend, or Diamond-boats, the Star Company, the Sons of the Thames, Iron Steam-boat Companies, and others.

About the year 1823, Messrs. Green, Wigram, and Green, began steam-ship building in London, and turned out the *Queen of the Netherlands*, the *King of the Netherlands*, the *James Watt*, and other vessels, but they were not exclusively steam-ship builders.

Soon after 1830, the struggle became intense between the rival companies which ran steamers between London and Margate, and also between the river Gravesend Companies. The result was, that one establishment became celebrated for having produced the fastest boats. One anecdote may be mentioned. The *Royal George* had been built at this establishment, and made her passages from and to Margate with unprecedented speed. The *Magnet* was opposed to her, but was beaten every day. The two boats belonged to opposing companies. The proprietors of the *Magnet* applied to the builder of the *Royal George* in their trouble, and he undertook to alter her bow and enable her to beat the *Royal George*, and this was accomplished. This builder became so celebrated that he was called upon to operate upon the following vessels in very quick succession, viz:—*Kent, Lord Melville, Sophia Jane, Magnet, Fame, Columbine, Harlequin, Ferret* (Post-office), *Arrow, Star, Ocean, Albion.* Several others were altered, and the consequence was the establishment of fine parabolic lines in the fore bodies, and the entire abrogation of the "cod's head and mackerel tail" principle, as far as steamers were concerned.

This fact at once manifests the absurdity of formulæ for the measurement of steam-ship resistance, which have a factor representing either the midship section or any function of the displacement, as the exponent of that resistance; for in every case of lengthening the vessel and sharpening the bows, the area of immersed midship section was a constant quantity, yet speed was improved a mile or a mile and a-half per hour with the same horse-power, and, while displacement was increased, resistance was diminished.

Much ingenuity was displayed in the construction of these vessels, struggling for superiority on the surface of Old Father Thames. These were what were designated "Lath-and-plaster Boats." The *Ruby*, one of the most successful, was of this description. Two diagonal and two longitudinal thicknesses of board were the whole thickness of bottom and top sides, with the exception of a few stiffening timbers, which were very sparingly introduced to prevent the fragile structure from collapsing. The *Star*, I believe, was built with one thickness of plank only, rebated at the edges and trussed inside. The *Red Rover* and *City of Canterbury* were certainly built with one thickness of plank, tongued, bolted edgewise, and no frame timbers whatever, but trussed inside with two planks, forming a curvilinear truss, and iron plates upon them. The "lath-and-plaster," or diagonal system, has been

employed for the Woolwich Company's boats. The *Garland*, a most successful Dover packet, was built on that principle, and as well as numerous vessels for foreign steam companies, and one of Mr. O. Lang's most successful vessels is constructed in the same way.

At length iron came to be introduced, and some of the most graceful forms that ever glided on the river's surface were constructed of that material.

The *Vesper*, I believe, was the last wooden boat built for the Star Company; she was a beautiful and a very fast little packet. Subsequent to her there has been a whole constellation of Stars built of iron.

The first iron river steam-boat built on the Thames was, I believe, the *Daylight*, in 1838, by Messrs. Ditchburn and Mare, at Rotherhithe, for the Iron Steamboat Company, followed by the *Eclipse*, *Rocket*, and *Isle of Thanet*, for Messrs. J. and F. Napier, in 1840-42, and some of the vessels built about this period are still running.

Mr. Ditchburn had commenced building steam vessels about the year 1822. He was the first builder who materially improved the dimensions, form, and speed of steamboats, and so successful were these improvements that in the course of a few years the speed attained was increased from 8 to 14 miles per hour.

Seeing however that little more could be effected with safety by timber as a material, he turned his attention in 1836 to the application of wrought iron, and found it a most fitting material for shipbuilding. At the time, however, he was supposed by the profession to be labouring under an hallucination. He persevered in his experiments and produced the fastest and most convenient boats on the Thames and other rivers.

He built a little fleet for the Iron Steamboat Company, for the Watermen's Company, the Sons of the Thames Company, Gravesend, Herne Bay, Southampton, General Steam, Peninsular and Oriental, and other Companies, and in a period of ten years built nearly 400 iron vessels.

In 1844, Mr. Ditchburn was consulted by the First Lord of the Admiralty as to the best mode of conveying the Queen and Royal Family from Whitehall wharf to her steam yacht *Victoria and Albert*, off Woolwich. He suggested a small iron screw vessel, of suitable draught of water, with masts to lower when passing under the bridges, &c. His plans being approved, the little screw yacht *Fairy* was the result.

The first seagoing iron steam-vessel that put to sea from the Thames, was the *Aaron Manby*, built near Birmingham in 1829, and put together in the Surrey Canal Dock. She conveyed a cargo of rape seed and iron castings from the Thames to Paris, without trans-shipment, and was under the command of Capt. Sir Chas. Napier, R.N. The engine was put together and worked by Mr. Chas. Manby, the propellers being the feathering paddles invented by the late Mr. Oldham.

The *Rainbow*, iron steam-boat, built in Liverpool for the General Steam Navigation Company, in 1838, seems to have been the the first seagoing iron steam-boat introduced into the river, although iron boats have now become rather the rule than the exception, combining, as they do, the advantages of cheapness, increased speed, durability, and enlarged carrying power.

The following actual comparative results attained, show the great commercial advantage, on different points, of an iron over a wooden steamer, with the same engines:—

	Wooden vessel.	Iron vessel.	Gain.
Time on passage, full speed, hours	411·30	320	91·30
Total time on passage, hours	519 30	460	59·30
Coal consumed, full speed, tons	382·50	337	45·
Total do. do. on passage	430·15	396·15	34·
Cubic contents of hold for cargo	272	567	295

Comparison on voyage between London and Edinburgh (Granton):—

Time on passage, full speed, hours	484	389	95
Total time on passage, ditto	500·30	393	107·30
Coals consumed, full speed	566·10	446·10	120·
Ditto on voyage	620·10	490	130·10
Cubic contents of hold for cargo	461	567	106

The introduction of steel for building vessels was another novelty, which dates in London from 1857, when a vessel was built by Messrs. Samuda, Brothers, for the Russians, to be employed in carrying troops on the Circassian rivers, and she answered admirably. The largest seagoing steel vessel yet built has also been constructed by the same firm, the *Jason*, of 450 tons and 120 horse-power, for the Russian Steam Navigation Company. This vessel, though built much lighter than an ordinary iron vessel, was found to be thoroughly seaworthy in every respect, and though a very light draft vessel, she was found to agree perfectly in this respect with the original intention. Some small steel gun-boats have lately been constructed for the Spanish government by Messrs. Rennie and by Messrs. Samuda, and have the peculiarity of being driven by two screws, one at each quarter, the shafts being supported by two wrought-iron brackets, bolted through the skin plates.

I may mention here as a curious fact that, about a century ago, the grandfather of the present Marquis of Anglesea had a yacht built of copper, made from ore raised from his own mines.

About 16 years ago an experiment was made in the construction of a vessel for the Woolwich Watermen's Company, built partly of wood and partly of iron, the frames being of iron (that being the most expensive part of a wood vessel) and the planking of wood. This plan proved unsuccessful, as the skin of the vessel worked loose on the frames, and the oakum was found to caulk through in consequence of the great distance between the frames. After one or two other vessels had been tried on the same principle, the plan was abandoned. The *Little Western* was built on this plan.

One of the first steamers built by Ditchburn and Mare was the *Father Thames*, a river steamer, 141 feet long, 19 feet broad, 9 feet 3 in. deep, in 1840. The number of hands then employed at their works was 200 to 250. At present the number of hands employed in the Thames Iron Ship-building works in the same locality approaches 2,000.

The size of iron vessels has since that time greatly increased. The *Himalaya*, built in 1853, was 339 feet long. The *Paramatta*, built in 1859, for the Royal Mail Company, was 330 feet long, 43 feet 9 in. broad, 35 feet deep, 3,092 tons. Another vessel, the *Seine*, of the same disions, was launched a few months ago for this company, and is now being fitted out for sea.

Great improvements have been made in the form of seagoing vessels, and the length in proportion to the breadth (which contributes greatly to the speed) has been much increased.

A striking example of the advantages gained by improved form has been furnished by the *Delta*, launched last year at the Thames Iron Ship-building works. She is a vessel 1,935 tons, 314 feet long, 35 feet 3 in. broad, 24 feet 6 in. deep. The engines of the *Valetta*, a vessel of 983 tons, were taken out and put into the *Delta*, being 400 horse-power. The *Valetta*, with 50 tons of coals on board, had a speed of 14 knots an hour, and the *Delta*, with 400 tons of coals on board on trial trip, made 14¾ knots. No alterations were made in the engines.

They are both sharp vessels, built for a high rate of speed. The experiment showed that steamers can be over-powered. The capacity for stowage and passenger accommodation is very great in the *Delta*, more than double that of the *Valetta*. Both ships belong to the Peninsular and Oriental Company. Another instance of over-powering steamers I may mention, was in the *Ruby*, Gravesend boat, where they had to be taken out, and smaller ones put in, when better speed was attained.

At present there are fitting out at the Thames shipbuilding yard two vessels, one the *Lye-E-Moon*, of 1,000 tons, 270 feet long, 27 feet 3 inches broad, 18 feet deep, intended for the China trade, engines 350 horse-power; the other the *John Penn*, 340 tons, intended for the Dover mail service, her proportions being 8½ of length to one of breadth, viz., 170 feet long, 20 feet broad, 11 feet 3 inches

deep; engines 120 horse-power. To both of these vessels a superheating apparatus is to be attached, and results are expected from them beyond any that have yet been reached.

Fairbairn, Miller and Ravenhill, Joyce and Wigram have built steamers, but have discontinued, and do not now carry on the business.

Scott Russell builds on the yard at first occupied by Fairbairn; and besides the Thames Iron Shipbuilding Company, the other principal builders at present on the Thames are Samuda, Mare, Langley, Rennie, and Westwood and Baillie. I may add that Messrs. Wigram still build wooden vessels, having only discontinued the building of iron ones.

It is scarcely possible to give a very accurate estimate of the number of persons employed in the various steamship building yards on the river, but the following may be regarded as a pretty close approximation to the number employed, varying, of course, with the amount of work on hand:—

The Thames Iron Works	2,000	men
Samuda, Brothers	1,000	,,
Westwood and Baillie	1,000	,,
J. Scott Russell	600	,,
C. J. Mare and Co.	600	,,
Langley and Co.	400	,,
Joyce and Co.	200	,,
G. Rennie & Co. in the ship department	200	,,
	6,000	

In order to show the rapidity with which work can now be turned out of the shipbuilding yards, I may state that, at the commencement of the Russian war, a mortar float of 100 tons burthen was delivered within two weeks from the receipt of the order. At the beginning of the year 1856, the iron-cased battery *Thunderbolt* was commenced by Messrs. Samuda, Brothers, and finished in three months. It may be remarked that this battery had to be constructed, firstly, similar to an iron vessel of ordinary construction, and afterwards, the whole of the hulk above the water line was cased by 6-inch teak planks, and outside the planks by 4-inch armour-plates of wrought iron.

As showing the gradual increase of speed attained, it may be mentioned that the *Albion* made the passage to Margate in 7 hours 55 minutes, and the return passage in 6 hours 45 minutes. From the result of various experiments made under the most favourable circumstances, I find that while, in 1820, the *Sons of Commerce* made but 8 miles per hour at her best speed, in 1821 the *Sovereign* reached 9·67, the *James Watt* 10·17, the *Eclipse* and the *Dolphin* 10·25 and 10·48 respectively, and the *Dart* 11·45 and 11·66, in 1830-31; the *Magnet* 11·75, in 1831. In 1835, the *Red Rover* attained a maximum speed of 12·31 miles, and the *Canterbury* 12·35. In 1844, the steamer *Wonder*, built by Mr. Ditchburn, accomplished a speed of 18 miles per hour at the measured mile.

The *Sons of the Thames*, the first iron passenger boat, on several occasions made the passage from Blackwall to Gravesend pier, with the tide and cutting off corners, under the hour. Hearing of the repute of this vessel for speed, Mr. Asheton Smith, the owner of the *Glowworm* yacht, built at Liverpool, sent up a challenge to run her, which being accepted, and the *Glowworm* docked and blacked, she was distanced hand over hand, and turned back beaten, and sneaked off to Liverpool early next morning.

It is curious to note the comparative time taken by sailing vessels and by steamers then and now on the principal routes from the Thames:—

	Miles.	Sailing Packets.	Steamers. 1822.	Steamers. 1859.
London to Margate...	84	20 hours.	8 hours.	6 hours.
,, to Dublin ...	610	16 days.	84 ,,	76 ,,
,, to Leith	429	120 hours.	55 ,,	48 ,,
,, to Woolwich.	9		3 ,,	1 ,,

On the afternoon of the 26th of January, 1845, the *Great Britain* arrived from Bristol and moored at Blackwall. This great experiment in iron shipbuilding naturally attracted much attention. The dimensions of her hull and other general particulars of her build, are so well known, that I need not repeat them here. Suffice it to say, that she was nearly 3,000 gross tonnage, or 3,444 tons builder's measurement.

On the 1st of January, 1851, there were only 8 or 9 screw vessels in London, but after the *Great Britain*, the most successful example of screw-propelled commercial ships, was the fleet of steamers belonging to the General Screw Steam Shipping Company, established by Mr. A. Laming, commencing with the *Earl of Auckland*, in 1848, and followed by the *Bosphorus*, *City of London*, *Propontis*, and others in 1849-50, which were built to trade between London and Holland. The *Earl of Auckland* was 147 ft. long, by 24 ft. beam, and her gross tonnage 296 tons. By the year 1854, the number of screw-steamers for commercial purposes registered in the kingdom exceeded 200, and now there are nearly 600.

The most successful screw-steamer yet constructed is the *Himalaya*, built by Mr. Mare, in 1853; she measures 3,505 tons, and about 457,332 cubic feet, being 341 ft. long, 46 ft. broad, and 34 ft. 4 in. deep; the ratio of her length is thus 7·413 breadths.

Displacement proportion to 1 H.P.	Mid section.	Indicated H.P.	Actual speed.	Pitch of screw to dia.	Revolutn. per min.
4½ ...	560 ...	2050 ...	15·85 ...	1·55 ...	59

Velocity of piston 6.41. Engines by Penn.

The introduction of screw colliers was a subject which occupied a considerable degree of public attention some eight or ten years ago. In 1853, 13 screw colliers, in 123 voyages, brought 70,403 tons of coal to London. In the early part of 1855, there were as many as 60 working from different ports of England. The large quantity of coal annually required for the consumption of the metropolis, on land and sea, gives to the question of ready transport from the north a considerable degree of interest. A valuable paper, on the comparative cost of transit by steam and sailing colliers, by Mr. E. Allen, was read at the Institution of Civil Engineers, in February, 1855. In that paper it was shown that the question of profit must entirely depend upon obtaining a screw collier, purposely so designed, and fully fitted for the trade, otherwise loss was inevitable. Many of the so-called screw colliers were built with proportions, shapes, and arrangements intended for, and suited to, some other purposes, but afterwards employed in the coal trade, under the notion that anything was good enough for a screw collier. Again, some had been built even by the best contractors, under the impression that a screw collier was only a kind of screw sailing vessel, and that any good screw sailing vessel would make a good screw collier. Vessels built for passengers, on which no expense had been spared, had been converted into screw colliers, and yet, for want of proper proportions, had turned out unfavourably. Properly constructed screw colliers can carry double the cargo of sailing vessels, and can make three voyages to one as compared to the sailing vessel. But looking to the greater outlay on the cost and working of the one vessel, it is doubtful after all if she will make so good a return on capital as the old hulk, which, slow and sure, brings up its cargo at a much lower rate of transit.

The *Haggerston*, an iron screw steamer, of 57 horse-power, was the precursor of a large fleet of a similar and even larger class employed in the conveyance of coals. She was capable of carrying 600 tons of coals, at a speed of 8½ knots per hour under steam alone, or 10 knots with steam and sails.

Companies in this trade do not succeed so well as individuals. Thus, the fleet of the General Iron Screw Collier Company, of 12 vessels, of from 500 to 560 tons, were disposed of last month for £60,000.

To be successful, it has been found necessary to enlarge their tonnage, which ranges from 500 to 700 tons, while one, the *William Cory*, is about 1,200 tons. The

owner of this vessel, Mr. Hugh Taylor, M.P. for Tynemouth, also owns the *General Codrington*, *Sardinian*, *Earsdon*, and *Samuel Laing*. To make screw colliers profitable, they must be run quickly, carrying a large cargo, and be owned by parties having a connection for the prompt disposal of the coal, and securing a return cargo. The telegraph now affords great facility in advising the arrival of vessels in the Downs and Gravesend, and hence every preparation can be made for their immediate discharge and reloading.

An important innovation was introduced in 1858, in a jointed steamer named the *Connector*, started by the Jointed Ship Company, which made a voyage to Hartlepool, and discharged a cargo of coals from Hull in the Regent's Canal Dock. She was 109 feet 3 inches long by 18 feet 1 inch broad, 5 feet deep, and of 36 tons, worked with an engine of 10 horse-power. The vessel was built in three distinct sections or compartments, on the plan patented by Mr. Mac Sweeny. One section contains the engine and screw, and the other two the cargo. The coupling joints are easily disconnected, and the advantages assumed by the projectors were the facility of transferring the engines and staff, instead of detaining them during the period of loading and unloading. As a commercial enterprise it failed, and the vessel is now for sale in the docks, at one-third the original cost.

The steamers that entered the river in 1858 were, 1706 British, measuring 560,823 tons, from Foreign ports; of which all but 5 of 1,465 tons brought cargoes, 494 Foreign owned steamers, measuring 139,938 tons, of which two came in ballast. Besides these, 54 vessels of 35,604 tons, came from the Channel Islands, India, and the Colonies, only one of these being in ballast. This makes a total of entries of 2,254 vessels, and 736,365 tons, but this, of course, includes repeated voyages, and does not correctly give the number of steamers employed. The total clearances from the port, in the same year, were rather less, being 2,068 vessels or voyages, and 644,045 tons. To this we have to add the coasting trade, and there were 2,609 steamers, measuring 898,596 tons, which entered coastwise, and 1,761 steam vessels, and 563,412 tons, which cleared coastwise.

We have thus an aggregate traffic of entries and clearances, foreign and coastwise, at this port, in 1858, of 8,692 steam vessels, and 2,842,418 tons, irrespective of the river steam-boats, steam-tugs, and vessels of war.

The largest steam traffic from London is with France, 634 vessels, and 150,134 tons; the next, with Holland, 553 vessels, and 185,490 tons. After these follow Belgium, 332 steamers, and 105,760 tons; and the Hanse Towns, 296 steamers, and 109,896 tons.

It may be interesting to compare the steam navigation of the other principal ports of the kingdom for the same year. In Hull, the foreign entries were 1,187 vessels, and 357,002 tons; the coasting entries, 577 vessels, and 105,305 tons. Liverpool, foreign entries, 500 vessels, of 354,217 tons; coastwise, 3,810 vessels, 1,056,073 tons. Southampton, foreign entries, 621 vessels, and 263,506 tons; coastwise, 92 vessels, 33,221 tons.

Captain Ericson (who subsequently introduced the screw into the United States) in 1837, with a small screw vessel, only forty-five feet long and eight feet wide, towed the Admiralty barge, with their lordships on board, from Somerset-house to Blackwall-wharf, at the rate of ten miles an hour.

In July, 1839, the Ship Propeller Company was formed, and having purchased the patent of Mr. F. P. Smith, they built the *Archimedes* screw wooden vessel, which made her first trip down the river on the 14th of October, 1839, and at the measured mile her speed was ascertained to be 9·64 miles per hour. This vessel was of 232 tons burden, about 9½ or 10 ft. draft of water, and 80 horse-power. Captain Chappell, R.N., took her round the island, calling at the principal English and Scottish ports. The company expended about £50,000 on this vessel and their experiments, and the screw propeller has of late years, dating from this practical test, come into great use.

Although the trial of the *Archimedes* was very satisfactory, it was evident that there was a great deal of what is termed *slip* by such a screw, and this fact was always made manifest when the vessel was backed.

Early in July, 1848, the *Minx* steam vessel, 100 horse-power, went down the river from Woolwich, fitted with as many as thirteen different modifications of screw propellers, to test their relative advantages, and the preference was given to that patented by Mr. Bennett Woodcroft.

The steam fleet of the Peninsular and Oriental Company comprises 55 vessels, of about 75,000 tons, and 18,151 collective horse-power. Estimating these to have cost about £23 per ton for hull, and only £50 per horse-power for the engines, we have a total expenditure of £2,632,550 on their running fleet, exclusive of the vessels they have lost, repairs and outfits, &c. There are more than 600 commanders, officers, and engineers employed in this fleet, exclusive of the seamen, stokers, and innumerable persons employed both on land and on sea, at home and abroad, in connexion with the company's operations.

A new addition was made to the Peninsular and Oriental Company's fleet a week or two ago, in the launch of the *Massilia*, of 1919 tons measurement tonnage, from the yard of Messrs. Samuda. She is 310 feet long on deck, 36 feet beam, and will have engines of 400 horse-power. The number of steam vessels turned out by this firm last year was 19, of 10,500 aggregate tonnage, exclusive of vessels repaired.

The Royal Mail Steam Packet Company, with a paid-up capital of about one million, has a fleet of 25 vessels, of 47,000 aggregate tonnage, and 12,230 horse-power. All their last built vessels, some nine in number, are of iron.

The *Great Western*, although not built here, was fitted in Curling's Dock, and tried on the river, and registered here, and ultimately came back, and was sold and broken up on the river.

The General Steam Navigation Company, one of the oldest and most important of the London Steam Companies, owns a fleet of about 44 effective steamers, registering 21,500 tons, and of 7,000 horse-power.

The *Sir Edward Banks*, built in 1824, is one of their oldest steamers; she has been lengthened and repaired from time to time. The *Sir William Jolliffe*, after being lengthened with a hollow bow, then had it filled up, but this made such a difference in her speed, that it was soon removed.

The *Trident*, built by Wigram and Green, in 1841, was another of this company's vessels that obtained some notoriety, from the circumstance of her having been engaged to bring the Queen home from Scotland, in 1842. Her dimensions were :—length, 197 feet 5 inches; breadth, 31 feet; registered tonnage, 645; gross, 971; load draught of water, 14 ft. 6 in.; horse-power, 260; beam engines and tubular boilers. Her reputed speed under steam is 10 knots, and with steam and sails 11½ knots. Her Majesty had gone down to Edinburgh in the *Royal George* yacht, towed by the *Shearwater* and *Black Eagle*, and she was accompanied on the voyage by the *Trident* and *Monarch*, steam-vessels of the General Steam Navigation Company, engaged in the trade to Granton. Observing the ease and rapidity of their movements, her Majesty suggested that a steamer might be engaged to take her back, and hence the *Trident* was chartered and furnished for the purpose, and the Queen and the Royal party landed at Woolwich, on the 13th September, 1842. The Company sent down the vessels of their fleet, then in the river, to meet and receive her, dressed out with flags, &c. The great convenience of this steamer subsequently led to the building of a Royal steam-yacht for excursion trips.

The *Rainbow*, iron vessel, built for the General Steam Navigation Company, by Mr. John Laird, of Liverpool, to run between London and Antwerp, made a great stir when she first made her appearance, performing the run in fifteen hours, then considered a rare occurrence.

Her dimensions were :—

	ft.	in.
Length between perpendiculars	190	0
,, ,, decks	198	0
Beam within paddle	26	0
,, over all	49	0
Depth of hold	12	8
Tonnage	582	
Depth of water, with coals and stores,...	5ft. 6in.	
Steeple engines by G. Forrester and Co., Liverpool	170 h.p.	
Diameter of cylinder	50 inches.	
Length of stroke	4ft. 6in.	
Diameter of paddle-wheels	21	6
Length of float	10	0

The *Rainbow* cost £13,000 complete. She was intended for the river trade, but being found too large for this, was placed on the Continental line. The builder stipulated in his contract that, if her speed reached 13 miles an hour, he should be paid £14,000, and £1,000 more for every increased mile of speed. After repeated trials, she only averaged, however, 12 miles, being badly formed, with a parabolic bow; indeed, her after-part would have made the best cut-water.

This vessel was followed by the *Prince of Wales*, built at Blackwall, in 1843; the *Triton* and *Magician*, at Bow, in 1845, fitted with oscillating engines, by Penn and Son; the *Albion*, in 1848; the *Rhine* and *Seine*, in 1849; the *Ravensbourne* and *Panther*, in 1851; and the *Moselle*, in 1852, all built at Bow, and these have beam engines.

The Woolwich Steam Packet Company was established in 1834, by a few gentlemen in Woolwich, with a capital of £5,000, and the success which attended their first exertions encouraged them to extend their capital to £15,000, an amount at which it has remained ever since. The first vessel built for this Company was the *Sylph*, a small flat-bottomed steamer, which plied between Hungerford pier and Woolwich, calling at Queenhithe and Greenwich. The speed of this vessel was such, compared with that of the old coaches and lug-boats, that the public were delighted; nevertheless it took her about an hour and twenty minutes to reach Hungerford with the tide, and often three hours against it. The success of the *Sylph* stimulated the Directors to build other boats, and the *Fairy*, *Naiad*, and *Nymph*, vessels of larger tonnage, were speedily added to the fleet. Of these the *Fairy* and *Naiad* still exist, though the former is no longer used, and the latter will soon be consigned to oblivion.

This Company now has 16 boats. For a great length of time their boats, which are all, with one exception (the *Sybil*), of wood, were built by Mr. Thompson, of Rotherhithe, and the engines by various engineers; but encouraged by the successful example of the Watermen's Company, the directors of the Woolwich Company have recently established a steam factory and a slip, and during the early part of last year launched their first built vessel, the *Doris*, and they have now another on the stocks.

The shipbuilding establishments and engineering works on the Thames have increased with the progress of steam navigation. We have steam shipbuilding yards all along the banks of the river. At Long Ditton, Battersea and Nine Elms, Rotherhithe, Southwark, Greenwich, Woolwich, Deptford, Northfleet, Poplar, Blackwall, Millwall, and Limehouse, and from these, steamers ranging from 20 up to 3,000 tons, are launched. About 40 steamers were built on the river last year.

The majority of the river companies now execute their entire work, both of construction and repairs, for themselves. The General Steam Navigation Company has an extensive factory at Deptford, under the superintendence of resident engineers, where their boats are built, and the engines made. The Watermen and Woolwich Steam-packet Companies have factories at Woolwich, where they employ a large number of shipwrights and engineers, and the Citizen Company has its factory at Battersea. The boats turned out by these companies and their engines, are inferior to none of those constructed by professional firms, either in strength, speed, or durability.

The following companies run boats to London:—The London and Edinburgh Steam Ship Company, the Hull Steam Packet Company, the London and Liverpool Steam Ship Company, the Cork Steam Ship Company, the Belfast Screw Steam Ship Company, the British and Irish Steam Packet Company, the Waterford Commercial Steam Navigation Company, the Aberdeen Steam Navigation Company, the Dundee, Perth, and London Steam Shipping Company.

The pecuniary interest invested in the river Steam-packet Companies which ply upon the Thames, amounts to about a quarter of a million of money. Averaging the dividend paid by the various companies at 7½ per cent. per annum, the profits thus divisible amongst the shareholders, amount to £18,750. The loss sustained by these companies during the past two years, owing to the offensive condition of the river, cannot have been less than £50,000 per annum, hence, irrespective of the sanitary question, there are pecuniary interests seriously affected.

The steam-boats boasted of carrying 27,000 passengers between London and Gravesend in 1821; in 1833 the number had risen to 290,000 in the year. In 1840 the steam-boat passengers had reached a million, and now the number is probably double this.

In 1840, owing to a feud, arising from the Woolwich Steam-packet Company having discontinued calling at the piers of the watermen, a company, under the title of the Waterman's Company was formed, with a capital of £37,500, which started with four steamers, ultimately increased to twelve.

To Maudslay, as I have before observed, is due the honour of opening the traffic, with the steamboat *Endeavour*, in 1829, and to that firm is due the honour of starting the oscillating engines which were fitted in this boat. The boat plyed between Hungerford and Richmond. Closely following this boat were the *Richmond* and *Laurel*, side lever engines by Boulton and Watt, and the *Minerva*, with angular engines designed by Joyce. These boats were of wood, and continued to work the Richmond traffic.

In 1835, a small wood boat, called the *Fly*, was fitted with oscillating engines, by Spiller, of Battersea, a very great improvement on those of the *Endeavour*. This boat ran from Putney to London Bridge, and was purchased by the London and Westminster Steamboat Company, in 1836. The next year a great stir was made in engineering. The London and Westminster Company having contracted in 1836 for four boats, built by King, and fitted with direct-acting engines by Spiller, and tubular boilers, (water in the tubes, the first tubular boilers used and patented by Mr. Spiller). These vessels started early in 1837, between Westminster and London Bridge, and were followed the next year by others. The engines being constructed by Penn, for the *Violet* and *Primrose*, and by Gordon for the *Myrtle* and *Snowdrop*. These engines were precisely the same in construction as those in the other boats by Spiller; in fact they were copies. In the same year Humphreys was busy, in a small shop at Lambeth, constructing two pairs of high-pressure engines for two boats, the *Cygnet* and *Swallow*. They were tried, but unsuccessfully. The *Era* was also turned out by Spiller, with direct acting engines—high and low pressure, with surface condenser. This boat was placed on the Richmond station, and answered well.

The traffic produced by these vessels induced the London and Westminster Company to purchase other vessels, and to extend the traffic to Chelsea. It also induced other people to form a company calling themselves the Iron Steam-Boat Company, and to give Penn an order for four pairs of oscillating engines (the first he made), and Ditchburn an order for four iron boats, the first iron boats constructed in this port. These boats, the *Twilight*, *Moonlight*, *Starlight*, and *Daylight*, were placed on the Chelsea station, in opposition to those of the London

and Westminster Company, and being much lighter, with more powerful engines, were, of course, much faster. While this strong opposition was being carried on, Spiller sent out the *Thunder and Lightning*, with oscillating engines and better constructed slide gear; and Gordon sent out the *Eclipse* and *Vivid*, with oscillating engines, for the Richmond station. Miller had, during this time, constructed two single side lever engines, and fitted them to the *Pink* and *Jasmine*, for the London and Westminster Company. Penn evidently had gained the day for speed and good construction of engines, and Ditchburn for the hulls. In 1843, the London and Westminster Company built their first iron-boat (by Miller, designed by Pascoe), and put in the old engine out of the wood *Pink*, with return tubular boiler. This was followed by the *Blue Bell*, in 1844; hull and machinery by Miller; one 20 side-bar engine. This boat beat all others, and the Iron Steam-boat Company had to pick their best boat (the *Matrimony*) to compete with her. By this time, 1845, the London and Westminster Company had lost all their money, and the Iron-boat Company, still building new vessels, compelled the first company to relinquish the Chelsea trade, and in the early part of 1846 to fall back to their starting-point, Westminster to London. In 1840, a boat called the *Echo*, similar in construction to the *Era*, was turned out by Spiller, and did remarkably well on the Richmond station; and in this year a boat called the *Locomotive* was built by Ditchburn, and fitted with an old locomotive engine, by Braithwaite and Milner, and was the first steamer to Hampton Court. This boat was followed by the *Cardinal Wolsey*, fitted with a single direct-acting engine, by the same people and for the same station.

In the early part of 1846 the London and Westmister Company took up their old station, and commenced by charging 2d. from Westminster-bridge to London-bridge (when first opened the charge was 6d., then 4d.), but a short trial proved they were going from bad to worse, the charge was then made 1d., and a very few weeks proved that it was the right fare—as they not only paid their debts, but were in a position to order two new boats. During this year another company was formed, under the title of the Citizen Steam-boat Company, the engines were by Penn, and hulls by Ditchburn and Mare. Of course they commenced by opposing the Iron Boat Company. Whilst this was going on another Company started, calling themselves the Halfpenny Company. Their boats, the *Ant* and *Bee* (high and low pressure engines, by Joyce) took up the station between the Adelphi and Dyer's Hall Wharf. Up to this time (1846) no accident of a serious nature had occurred, although the Government this year passed an Act for the better regutation as regards safety of *seagoing* steamers. This was on account, I believe, of the two serious explosions of the boiler of the *Victoria*. In 1847 another vessel was added to the fleet of the Halfpenny Company, called the *Cricket*, engines by Joyce, on the same plan as the *Ant* and *Bee*. In August 1847, the boiler (one of the two) burst. This serious accident caused the Government to extend the Act for examining steamers to all steamers carrying passengers. This Act came into operation in 1848, and was the means of clearing away some of the old boats, such as the *Richmond* and *Laurel*.

The *Cricket's* was the only accident causing loss of life, either before or since the passing of the Act of Parliament.

In 1848 the London and Westminster Company had added to their fleet the *London Pride* and *Sunflower*, and were carrying passengers by millions, about 3½ millions yearly, instead of about 100 thousand when first started; the Iron-boats and Citizens between them carrying about 4 millions. They had by this time come to an arrangement. Since 1848 no very great improvements have taken place; the speed of the boats have increased (the best) about two miles per hour. The old *Ant* and *Bee* are now called the *Endeavour* and *Perseverance*, still on the same station. The Iron Boat Company and the Citizen Company have each a vessel constructing, but instead of attention to speed, the vessel is made chiefly to suit the station, and the old engines being used, very little improvement can be looked for.

From careful inquiries and practical information from those best competent to form an opinion, I think it will be found that, with proper care and attention a boiler, will last twelve years, the engines thirty, and the hull twenty or more years.

I have now done with the above-bridge boats. The only question remaining concerns all vessels, viz., building them of good material. It is not quantity but quality that is required, but I am afraid this is not always properly considered. Lloyd's rules require certain dimensions for plates, angle-iron, keel bars, &c., without one word as to quality. The iron used for ship building purposes now is said to be far inferior to that used twenty years ago. The *Rainbow*, built by Laird, of Liverpool, in 1837, belonging to the General Steam Navigation Company, I have already alluded to. Although this vessel has been constantly employed in crossing the North Sea, that the angle-iron frames are spaced two feet, while the thickness of plates is much less than required by Lloyd's rules, yet the hull has the appearance of being as good as when it was first launched. This I believe to be attributable solely to good materials and workmanship.

The Citizen Steam-boat Company was established in 1846, and has a paid-up capital of £13,500. It at present possesses a fleet of 14 vessels, all built of iron, each of 24 horse-power, now averaging from 57 to 75 tons register. They have another boat about to be launched. Owing to omnibus competition, the fares were considerably reduced last year, but the largely developed traffic created will probably enable the low tariff of charge to be maintained.

There are six steam-towing companies in London, namely, the Thames Steam-Tug and Lighterage Company and Lloyd's Steam-Tug Company, which have each six tugs, and the Caledonian and United Steam-Towing Companies, which each own eight tugs, the Star and the Iron Towing Companies. The Shipowners' Towing Company was dissolved a few years ago, and their vessels sold to other parties. The towage of ships from the East and West Indies, China, Australia, Brazils, Cape of Good Hope, or West Coast of America, is paid by the dock companies from Gravesend to the docks, at a fixed rate according to tonnage. All other towage is a matter of special agreement with the shipowners.

There are also several private owners of steam-tugs which ply on the river. Mr. D. Barker has five tugs; Mr. H. Lee, two or three; Mr. W. Watkins, eight; Messrs. Mace and Jones, two.

The large and beautiful iron packet building by Messrs. Samuda for the Holyhead line, which I inspected a few days ago, is expected to realize a speed of 24 miles.

Besides the iron-cased frigate, *Warrior*, which will be completed about the middle of the year, Messrs. Westwood and Baillie, of Millwall, have contracted with the government to build one of 3,668 tons, builders' measurement, in twelvemonths, at the rate of £44 per ton, or £161,392, while the larger one of 6,000 tons, now building in the river, will cost upwards of a quarter of a million. These sums are for the hulls alone.

I ought not to pass over without mention, the fact that there are six or eight steam yachts owned in the port of London, the application of steam to these pleasure craft being of comparatively recent origin. They include the *Pleiad*, of 265 tons, belonging to W. Beaumont, Esq., M.P.; the *Meriel*, of 210 tons, owned by Mr. Hans Busk, the author of a popular work—the "Navies of the World;" the *Norseman*, of 200 tons, owned by Mr. A. Anderson; the *Dragon Fly*, of 33 tons, belonging to Mr. J. Maudslay; the *Hazard*, of 18 tons, to Mr. H. Ayckbourne; and the *Nora Creina*, belonging to Mr. James Hartley. Another London steam yacht, the *Fox*, belonging to Captain M'Clintock, recently sold, has attained great notoriety from her successful voyage to the Arctic

Seas. The last expedition of Sir John Franklin, and subsequent government searching vessels, fitted with steam power, were also sent out from the Thames.

According to a parliamentary return, the number of steam-vessels registered in London, on the 1st of January, 1851, was 333, of 72,386 aggregate net tonnage, that is exclusive of engine-room, for as the gross tonnage was not given in all the cases, no total estimate could be formed; of these 74 vessels were of iron, and only five or six screws. The largest steam vessels then registered in the port were, the *Hindostan*, 2,017 tons; *Bentinck*, 1,974; *Ripon*, 1,926; *Medway*, 1,896; *Thames*, 1,889; *Avon*, 1,881; *Tay* 1,858; *Trent*, 1,857; *Dee*, 1,849; *Precursor*, 1,817; *Teviot*, 1,793; *Oriental*, 1,787; *Indus*, 1,782; *Great Western*, 1,775; *Haddington*, 1,648; and *Great Northern*, 1,515.

In the "Report of the Committee appointed by the Board of Ordnance to Inquire into the Capabilities of the Mercantile Steam Navy for purposes of War," submitted, in the close of 1852, it was stated that there were then 238 steam-vessels of 23,895 aggregate horse-power trading to the port of London; of these one was a wooden screw vessel of 40 horse-power; 116 were wooden paddles of 18,725 collective horse-power, three of these being above 800 tons; and 122 were iron vessels of the collective horse-power of 11,230. All of these iron vessels but one were paddle steamers.

The comparative number of boats held by companies and individuals then was as follows:—

Sea-going Boats.

	Vessels.	Total h.p.
General Steam Navigation Co.	38	6,148
Aberdeen Steam Navigation Co.	5	1,665
Dundee, Perth, and London Steam Ship Co.	5	970
British and Irish Steam Packet Company	6	1,300
London, Leith, Edinburgh, and Glasgow Steam Packet Co.	2	500
General Screw Steam Shipping Company	4	160
South-Eastern and Continental Steam Packet Co.	8	1,250
Cork Steam Shipping Co.	10	2,284
Hull Steam Packet Co.	11	1,485
St. Petersburg Steam Ship Co.	11	1,031
Limerick Steam Shipping Co.	2	126
Thames and Clyde Screw Ship Company	1	130
Waterford Commercial Steam Packet Co.	6	640
Vessels belonging to individuals	11	711
Herne Bay Steam Packet Co.	3	310

River Boats.

City Steam Boat Co.	13	312
Diamond (Gravesend) Steam Packet Co.	5	460
Star ,, ,,	5	368
Commercial Steam Packet Co.	4	430
Woolwich Steam Packet Co.	10	324
London and Westminster Steam Boat Co.	7	148
London, Westminster, and Vauxhall Steam Packet Co.	13	284
Waterman's Steam Packet Co.	11	358
Steam Tugs (companies and individuals)	47	2,501
	238	23,895

Compared with the present time, the numbers stand as follows:—

Sea-going Boats.	Vessels.	Gross Tonnage.	H.P.
General Steam Navigation Company.	44	21,500	7,000
Gibraltar and Cadiz Line	5	3,938	670
Peninsular and N. African	2	1,250	175
Greek and Oriental Steam Navigation Company	15	12,000	5,000
Netherland Steam-boats	2	850	...
North German Lloyd's	4	2,400	400
Gothenburgh Line	2	...	...
Spanish Line	3	...	...
Waterford Commercial Steam Navigation Company, and Malcomson Brothers	24	11,824	3,097
S. Eastern and Continental Boats	8	1,915	1,110
East of England Screw Collier Company	2	1,743	930
H. P. Maples, Channel Boats	7	2,025	800
Aberdeen Steam Navigation Company	2	1,273	600
Dundee, Perth, and London Shipping Company	2	2,334	1,118
British and Irish Steam-packet Company	5	2,462	560
London and Limerick Steam-ship Company	5	3,887	1,214
Cork Steam-ship Company	7	7,856	1,800
Coasting Vessels belonging to individuals	18		
River Boats.			
Citizen Steam-boat Company	15	974	360
Woolwich Steam-packet Company	16	1,378	554
London and Westminster Steam-boat Company	6	471	188
London, Westminster, and Vauxhall	7	364	152
Waterman's Company	12	1,112	482
Halfpenny Boats	4	230	150
Trinity Corporation	2	337	190
Steam Tugs (Companies and individuals)	48		
Total*	265		

The appended list shows the steam vessels of 1,000 tons and upwards, gross tonnage, registered in the Port of London, from which it will be seen that there are 51 vessels above 1,000 and under 2,000 tons; 28 from 2,000 to 3,000 tons, and three above 3,000 tons. The fact, that there are owned here 82 vessels of 133,880 tonnage, and 34,012 collective horse-power, is certainly a remarkable circumstance in connection with the progress of Steam Navigation:—

	Tons.	H.P.
Great Eastern	18,915	2,600
Atrato	3,467	750
Parana	3,071	800
Magdalena	2,943	800
Orinoco	2,901	800
Golden Fleece	2,768	300
Jason	2,668	300
Simla	2,441	640
La Plata	2,404	1,000
Indiana	2,365	300
Oneida	2,285	530
Calcutta	2,261	300
Tasmania	2,253	550
Hydaspes	2,249	300
Argo	2,249	300
Lady Jocelyn	2,242	300
Queen of the South	2,221	300
Southampton	2,208	350
Indian Empire	2,201	750
Bengal	2,185	464

* Owing to the deficiency of returns of private boats on different stations, it is impossible to summarise this table.

	Tons.	H.P.
Tyne	2,185	400
Princess Charlotte	2,168	360
Alma	2,165	450
Nubia	2,096	450
Avon	2,069	440
Adelaide	2,060	448
Leopold	2,028	500
Ceylon	2,021	450
Nemesis	2,018	600
Hindostan	2,017	520
Pera	2,014	450
Candia	1,982	450
Prince Albert	1,978	400
Bentinck	1,974	520
Tamar	1,964	400
Indus	1,950	450
Malta	1,943	500
Ripon	1,925	460
Medway	1,896	440
Thames	1,889	450
Severn	1,886	440
Victoria	1,878	450
Colombo	1,865	450
Trent	1,857	450
Precursor	1,817	460
Solent	1,805	400
Teviot	1,793	450
Oriental	1,788	420
Dee	1,699	450
Orissa	1,647	300
Behar	1,603	300
Sir Wm. Peel	1,536	300
Benares	1,491	400
Salsette	1,491	400
Pacific	1,480	200
Melbourne	1,450	300
Germania	1,400	420
Ionia	1,388	210
Clyde	1,371	430
Tynemouth	1,364	80
Pottinger	1,350	450
Northam	1,330	400
Istamboul	1,311	100
Undaunted	1,245	100
Robert Lowe	1,225	80
Singapore	1,190	470
Ganges	1,190	470
Bombay	1,186	274
Madras	1,185	274
Pekin	1,182	400
William Cory (collier)	1,168	120
Euxine	1,165	400
General Williams	1,153	160
Sultan	1,125	200
Asia	1,093	120
Hope	1,084	180
Fiery Cross	1,059	30
Athenian	1,057	200
Lancefield	1,055	300
Indomitable	1,042	80
Christina	1,019	110
Admiral Kanaris	1,018	220

Steam vessels, and their tonnage, employed in the trade with the port of London, and their repeated voyages, distinguishing those employed in the Coasting Trade from those in the Foreign Trade.

	Coasting Trade.		Foreign Trade.		Total.	
	Vessels.	Tonnage,	Vessels.	Tonnage.	Vessels.	Tonnage.
1830	185	48,100	176	25,534	361	73,634
1835	699	181,740	377	84,944	1,076	266,684
1843	1,472	653,772	1,503	382,850	2,975	1,036,622
1853	3,157	877,957	3,177	877,905	6,334	1,755,862
1858	4,370	1,462,008	4,322	1,380,410	8,692	2,842,418

I have thus traced down, as fully as time would permit, the rise, progress, and present condition of the Steam Navigation in the port of London, from the insignificant early boats launched, to the construction and floating of the *Great Eastern*. The description of this vessel, her mechanical properties and capabilities, have been so recently brought before the Society, in the interesting paper of Mr. W. Hawes, that I have not thought it necessary to touch upon them.

The immense importance of the Steam Shipping Interest to this port and to the country must be self-evident, from the statistical details I have laid before you. The improvements that have already been made within a few years are many and great, and I see no limit to the progress which experimental science and practical experience may bring about. The introduction of iron, the adoption of the screw, of superheated steam, and the economy of fuel and working are evidences of the advance which Steam Navigation is gradually making; and the enterprise of our builders and engineers, will, I am sure, always command for us the supremacy in this important branch of the mercantile marine.

Steam and the telegraph have greatly changed the face of Commerce. All our transactions are now on a gigantic scale, even as compared with but ten or twenty years ago. The class of vessels—their build and speed have been improving year by year—and there is no reason why this progress should not be continuous.

The very general adoption of iron as a ship-building material is a matter of great satisfaction, both as regards our war fleets and our merchant navy.

It has been observed that—"He who plants an inconsiderable acorn has reason to hope he is providing for the principal plank of a mighty ship, destined to maintain the greatness and carry abroad the glory of his country." But this hopeful prospect is greatly diminished when we learn that the acorn's shoot must remain in the soil some 60 to 100 years before it can be so converted.

It requires 50 years to produce an oak of 10 inches diameter, and a century to raise one of 20 inches, which is about the average size of timber trees used for the navy.

For the last two centuries the cultivation of the British oak has been culpably neglected by our Government, insomuch that at the present time all the Royal forests would not supply sufficient timber to build one line-of-battle-ship annually. Hence we are driven, by our neglect, to ransack every country for timber suitable to construct our navy. This has lessened the durability of our ships by at least one-half.

The introduction of inferior foreign and mixed material has brought down the servitude of our ships of war from 30 to 15 years. As we may calculate a load of timber, at least, required for every ton of mercantile tonnage, the great economy of timber, from the general use of iron, may be well conceived.

Of the durability and economy of iron vessels, we have an instance in the *Rainbow*, already instanced, belonging to the General Steam Navigation Company, built in 1838, which has been constantly at work as a seagoing and iron boat for now nearly twenty-two years, at a comparatively nominal cost (scarcely £2 a year) for wear and tear of the iron hull, and without requiring any repairs. No straining or depreciation has been yet detected in her, and she retains her original draught of water, which is one of the many great advantages which iron vessels possess over wood.

Few persons are aware of the vast amount of absorption in a heavy timber-built vessel, and the consequent diminution of speed and other drawbacks from this cause alone. Had this vessel been constructed of timber, she would, after about three years afloat, have added to her original weight, by soakage, from forty to sixty tons, and increasing her draught of water some six to nine inches, thereby indirectly increasing the positive resistance and reducing her speed.

We have thus seen some of the benefits conferred by steam:—

To increase and carry, over every sea,
Steam bears the fruits of arts and industry.
To increase and carry, everywhere we see,
Steam marks the road where Progress is to be.

To increase and carry—linking place to place—
Steam, through all lands, keeps up the eager chace.
To increase and carry—ruling time and space—
Steam is winner in the world's restless race.

DISCUSSION.

Mr. Varley referred to various experiments which he had personally witnessed, in the earlier methods of propulsion of vessels by mechanical means—including the duck-feet paddles and propellers placed at the bow of the ship. He also mentioned the case of a vessel named the *Engineer*, which was regarded as a beautiful model in that day, but in the propulsion of which the designers fought a battle against the laws of nature. The vessel was constructed with a large cavity under the keel, so that the paddle-wheels were out of sight, but the water being forced up the cavity by the churning action of the paddles, the vessel became water-logged. The experiment, as might have been expected, was a failure, and the vessel was sent away to some foreign port.

Mr. John Grantham had listened with much pleasure to Mr. Simmonds's interesting paper, which was an encouragement to those present to add to the history which had been presented to them such information as they each possessed, because it was impossible that one man could collect all the data which would complete so important a history as that which Mr. Simmonds had commenced. It could not be denied that the paper opened out a wide field of interesting inquiry. He should have liked to have informed Mr. Simmonds beforehand of one important feature in the history of steam navigation in the Thames; that was, with respect to the most important steam navigation company in existence—the Peninsular and Oriental Company—whose ships were registered in London, and whose business was managed in London. It was a curious fact that that great company owed its origin to an Irish connection. A few years ago, in the important port of Liverpool only about 2,000 tons of steam shipping were registered, although the port swarmed with steam vessels from all parts of the kingdom. The reason of that was, that most of those vessels originated with either Irish or Scotch companies. About the year 1824, Captain Robert O'Brien, a very clever man, originated the company known as the London and Dublin Steam Navigation Company, by which company the vessels the *Thames* and the *Shannon* were built. He was interested in that matter, from having, when a boy, written out the particulars of the specifications of these vessels, which were drawn up by his father, with the aid of Captain O'Brien. Those vessels trading to London necessarily had a London office, and Captain Richard Bourne, who was well known as the contractor for the Irish inland mail service, and who was largely interested in those two vessels, came to London, and, in conjunction with some other enterprising gentlemen, originated the Peninsular steam-boats, which finally resulted in the establishment of the Peninsular and Oriental Company. They were all aware what important results had followed that small commencement. One of the vessels he had named was lost on the Scilly Rocks, and the other was lately broken up in the Thames. The engines were constructed by Messrs. Boulton and Watt. These facts were interesting as connected with the rise and progress of steam navigation in the port of London, because, as they all knew, Southampton had only lately sprung into existence as a great steam shipping port. There were one or two points of importance which he wished to correct in Mr. Simmonds's paper. A strong impression had gone abroad that the iron now employed in the construction of vessels was of a quality inferior to that which was used when that material was first adopted for shipbuilding. That was not his own opinion. The cry of "bad iron" was as rife twenty-five years ago as it was at the present day, and perhaps with more justice. No doubt bad iron was frequently put into ships, but he did not think that many of the accidents that had lately occurred were to be attributed to the inferiority of the iron. The catastrophe to the *Royal Charter* caused a talk of that kind. Mr. Simmonds had alluded to screw colliers, which were a very interesting portion of the subject, and as the screw colliers came first to London, they properly belonged to the history of that port. He was largely interested in that project, inasmuch as he acted as the engineer of the company, and the whole of their vessels were built under his superintendence. He quite agreed with Mr. Simmonds that companies which required active management, had not, as a general rule, prospered, and that such undertakings were better suited to individual enterprise and management. They were quite within the reach of individuals, because the outlay was not very large. The steam-colliers themselves were a success, and they opened out a new era in the history of steam navigation, because they had shown a capacity for carrying large quantities of cargo at less cost than had been accomplished by any other class of vessels. In the Thames, as elsewhere, steam-colliers had not unfrequently been merely converted vessels. A steam-collier, more than any other ship, required to be made specially suitable for the purposes for which she was intended. There were many fine vessels, no doubt, which could be successfully converted into steam-colliers; but those built specially for the purpose had been, on the whole, more successful. That was opening out a field where the steamer would more than ever come into competition with the sailing vessel. He was very glad to hear Mr. Simmonds bear the testimonp he had done to the high character of his friend, Mr. Ditchburn, in relation to the progress of steam navigation in the Thames, inasmuch as that gentleman was the first to prove that steam vessels could be constructed of iron with great success.

Mr. Corbett, as manager and owner of steamboats for the last twenty-five years, wished to testify to the accuracy of Mr. Simmonds's historical facts. With reference to the application of steam to shipping, he would mention that no fewer than 90 steam-vessels were employed in the trade of tugging and assisting ships from the British Channel into and out of the port of London. Those 90 vessels involved a capital of £200,000. With reference to steam colliers, one thing which had greatly tended to promote the use of that particular class of vessels of late years, was the greatly-increased facilities for unloading cargoes of coal which were obtained by the use of hydraulic apparatus, by means of which a vessel of 800 tons could be discharged in ten or eleven hours, though this formerly occupied nearly as many days. With reference to the material of which ships were built, it was to be borne in mind that as the supply of British oak was failing, there was no difficulty in procuring teak in immense quantities frrom the East Indies, which had been found to be a very excellent material for ship-building purposes. With reference to the "lath-and-plaster" boats to which Mr. Simmonds had alluded, he begged to state that where teak had been used, they would compete for durability with the best description of oak-built vessels. In proof of that assertion, he might mention the fact that the *Ruby*, built in 1837, was still in existence, and having been lately opened, was found to be in as complete a state of soundness as on the day when she was first launched. That vessel, however, was built partly of mahogany and partly of pine.

Mr. Ditchburn begged to make a slight correction in the statement made by Mr. Grantham with regard to the history of the origin of the Peninsula and Oriental Company. The *Thames* and the *Shannon* were sister ships, and were built upon a plan designed by Mr. Oliver Lang, of Woolwich. He (Mr. Ditchburn) having been brought up in her Majesty's service as a ship builder, it fell to his lot to carry out the building of those two vessels, which were

very successful. He had heard with great pleasure the honorable mention which had been made of Captain O'Brien and Captain Bourne. They were both gentlemen of the highest honour, and he held them in respectful and grateful remembrance. With reference to the cry of "bad iron," he could mention a remarkable fact which occurred in connection with a gentleman whose name was well known to them all—Lieut. Waghorn. He proposed to the Admiralty to do some marvellous work in the Mediterranean, provided the government allowed him to have one of their best vessels in competition with the Peninsular and Oriental Company, whose vessels were then about to engage in the mail service. Lieut. Waghorn having consulted him (Mr. Ditchburn) as to the ship he should select, he recommended the *Trident*, an iron vessel. He was aware that the government at that time had no vessel of equal speed to those of the Peninsular and Oriental Company. However, Lieut. Waghorn entered upon his undertaking with the *Trident*, and after a trial of two years, he returned, discomfited and baffled, and his great complaint against the vessel he had employed as to speed, in competition with the Peninsular and Oriental Company's ship *Ariel*, was of the bad quality of the iron used in building the *Trident*. He alleged that the ore contained so much earth that grass had grown from the bottom of the vessel to the length of six inches. He (Mr. Ditchburn) urged upon the lieutenant that he could surely never place such a statement as that before the Admiralty, but he persisted in the idea, and made his report accordingly. The result of such a report was—as might be expected—an end of his commission. Subsequently to this he (Mr. Ditchburn) took an opportunity of examining the vessel, at Woolwich, when he ascertained that the bottom of the vessel had not been cleaned during the whole time she was out, nor had there been any tar or paint bestowed upon the hull. He then stated to Lieutenant Waghorn that the condition of the ship did not arise from the badness of the iron, but from the total neglect of cleaning the bottom of the vessel, and the grass had grown to the length of about four inches near the load water-line. Mr. Ditchburn then proceeded to give an explanation of the various models upon the table, exhibited by that gentleman, commencing with the model of the identical vessel which ascended the Rhine as far as Coblentz, and concluding with that of the vessel called *The Wonder*, which in the measured mile on the Thames exhibited a speed of eighteen miles an hour. The same ship, he stated, was now engaged in the passage from Southampton to the Channel Islands, and was doing excellent work for so delicate a vessel.

Mr. T. G. Taylor called attention to a preparation of oxyde of zinc which had been patented as a preventive of the accumulation of vegetable and other matters upon the bottoms of vessels engaged in long voyages, whereby the speed was materially affected. With regard to one of the large steam navigation companies to which allusion had been made in the paper—the Royal Mail Company—he found that that company had expended in the construction of vessels no less a sum than two millions and a quarter; and he believed the repairs and additions from time to time exceeded another million. Out of the 33 vessels belonging to the company, 20 had been built in the port of London. Associated as he had been with that and other steam navigation companies, since the year 1843, it appeared to him that steam shipping would have progressed more rapidly if the Government had dealt with the subsidised companies in a less capricious and more certain way. He alluded to the mode in which contracts were entered into, and the want of commercial spirit on the part of the Government. When differences arose between them and the companies, the Government almost invariably showed a disposition to take advantage. Large sums of money had been lost by the late General Screw Steamship Company in the conveyance of the Australian mails. In twelve months they lost £100,000 beyond the subsidy in the trade with Calcutta. In the contract with the Royal Mail Company, there was a clause stating that if, under circumstances—such, for instance, as war breaking out—the price of coals exceeded a certain amount, they were to receive compensation. That contingency arose during the period of the last Russian war, and a claim was made by the company on that account. It was, however, contended on the part of the government that the war had not occasioned the enhanced price of coals, and they refused to accord any compensation whatever to the company. He thought if the government dealt more liberally with the subsidised companies, the progress of steam navigation would be materially advanced.

Mr. T. M. Gladstone thought that there were one or two points in the paper which required to be corrected. Mr. Simmonds had stated his opinion that, with proper care and attention, it would be found that a boiler would last 12 years, the engines 30 years, and the hull 20 years. He subsequently stated that the *Rainbow* was built in 1837, and yet the wear and tear of that vessel was hardly perceptible, because she was properly constructed. That was rather a contradiction of the preceding paragraph, and he believed that the durability of iron ships was a question which had yet to be settled. As to boilers lasting 12 years, it was a well-known fact that boilers with ordinary care had not lasted more than two or three years, whilst cases were not wanting in which they had lasted for the full time stated by Mr. Simmonds. He was, however, sure that gentlemen acquainted with engineering would admit that 30 years was a very long period for machinery to last without being reconstructed, almost from beginning to end, in those parts most subjected to wear. The next point he would allude to was as to the alleged deterioration in the manufacture of iron. They knew that the iron manufacture of this country had progressed like all other branches of industry, and although inferior iron was to be obtained now as well as at earlier periods, yet he believed the progress made in the character and quality of iron was better determined in the present day than it ever was before. The introduction of inferior iron into a ship rather reflected upon those who inspected the vessels, and he considered that more specific instructions should be given to such inspectors with regard to the quality of the iron used. He thought his friend Mr. Grantham, from his experience in shipbuilding, would agree that the main cause of weakness in ships did not arise so much from the quality of the iron as from the mode in which it was put together. Those points of weakness were now well ascertained, and he had only to refer to the *Persia* in order to show the great advancement which had been made in iron ships.

Mr. William Hawes said it was always important at these meetings, when it appeared to any member that a principle was stated and commented upon directly in opposition to those great economic principles which they all admitted, and the application of which was known to be essential to success in trade, that some remarks should be made upon it. The gentleman who spoke last but one (Mr. Taylor) complained that the subsidies to companies were not only insufficient, but were not paid in a liberal spirit. He (Mr. Hawes) thought it a great evil that any subsidy at all should be granted. It tended to retard improvement, and check progress on the part of the great companies, who always followed rather than led the way in improvements. All the improvements in navigation were due to private individuals, and it was not till such improvements had been made apparent that they were adopted by the companies. The great firm known as Cunard's were amongst the first to adopt improvements, and the result was, that they had the finest vessels in the world. Although subsidy was taken by them, it appeared to act as a stimulus rather than as a check to progress; but then they were a firm of private individuals, and not a company. Upon the subject of the Government refusing to increase the amount of the subsidy to the Royal Mail Company, owing to the enhanced price of coals during the war, it was to be remarked, that if the price of coals was

doubled, the increased rates of freight more than doubled the receipts of the Companies, and there was scarcely a large Steam Navigation company which did not owe its salvation to the enormous profits made during those wars. A very large bonus was then paid by the Peninsular and Oriental Company, gained by the war rates. The Royal Mail Company paid off its debts from the profits made during the war: and if the Government had increased the subsidy because of the increased price of coals during that period, without reference to the rise in freights, they would have acted unfairly to the public, and would have added to the injustice which was inflicted by the payment of any subsidy at all. He thought Government interference in steam navigation, or in anything else, was alike injurious to trade and to public spirit; and he should be glad when the time came when they would build steam vessels which could earn sufficient to pay a dividend to their owners without relying upon Government subsidies.

Mr. Carnegie said there was a class of steamers which appeared to have been entirely overlooked: those employed by private enterprise in the Mediterranean trade. He regarded subsidies as protection in its worst form. Private enterprise had abundantly proved that great profits could be earned without any assistance from government. The steamers employed in the Swedish trade were realising large profits, and the Baltic was covered with those of private individuals. Nine-tenths of the Mediterranean trade was carried on by steam vessels which received no assistance from government, and the same parties were ready, if the existing subsidies were withdrawn from the large companies and the trade thrown open, to put vessels upon that line and carry on the postal service under the Admiralty regulations, if they only received the profits of private sailing ships for letters. He joined with Mr. Hawes in disapproving of all government subsidies to companies.

Mr. Leonard said the subject brought forward by Mr. Simmonds was one of vast importance, and in the great extent of the field embraced it was not surprising that the mention of two or three companies should have been omitted. The Aberdeen Company's ships had been overlooked, one of which, the *City of Aberdeen*, was the only vessel which was able to steam away during the disastrous storm which occurred off Balaclava, in which so many vessels were wrecked. He believed they were on the eve of great changes in steam navigation. The employment of super-heated steam, by which increased power was obtained with less consumption of fuel, would, he believed, accomplish great things.

The Chairman said he regretted that the short notice given to him relative to the subject under discussion had prevented his searching for accurate details upon the precise dates at which steam was first introduced into the Royal Navy. But he had had the advantage of roughly scanning the authorities which were accessible, so as to state decidedly the names of the first vessels that were employed in the British navy, as well as the dates of their construction. Upon the mercantile department, relating to steam navigation as particularly applying to the port of London, he had had but little experience, his duties occupying him generally in foreign climates; still he had not failed to watch with no small interest the rapid development of this power afloat between the years 1842 and the present time, particularly in the adoption of the screw, against the most stubborn opposition, until at last it was found impelling even our ships of the line, and eventually the Great Eastern, with a rapidity exceeding what was at one time deemed the wonderful despatch of our light packet boats. The first incidental correction which he had to notice in the elaborate paper under discussion was that even a smaller vessel than the *Disowned* was tried in the Thames waters. Two of less than four tons were constructed for the *Investigator* and *Enterprize*, one of which lay at Port Leopold, and was less in actual tonnage than two tons. He would now refer to two vessels, of which he had a pretty familiar knowledge, constructed partly at the expense of two of his personal friends, the late Admiral Sir David Milne and James Macbrain, Baillie of Edinburgh. They had been built so early as 1820, and were subjected to heavy ocean work between Falmouth, Oporto and Lisbon, during the war between Dons Pedro and Miguel, and he considered them to have proved themselves first-rate vessels for ocean navigation. The *City of Edinburgh* was launched in March, 1821, and commenced duty in June of the same year. The *James Watt* was launched in August, 1821, and made her first passage in the year 1822. In the year 1821 the *Royal Sovereign* was constructed for the postal service between Holyhead and Dublin. She was built by Messrs. Evans, of Rotherhithe. She was then turned over to the Royal Navy, changing her name to that of *Monkey*, and was the first steamer which bore the pendant in the Royal Navy, and accompanied the Royal squadron to Ireland—making, he had been informed, a very bad sea-boat. She then descended to tug duty. The next vessel built by Government was the *Comet*, as a steam tender, on the lines and under the superintendence of the late Oliver Lang. Subsequently, in 1835, he (the Chairman) was offered the command of this vessel, which was fitted with a mercurial apparatus for heating hot plates, the water impinging on their surfaces, and generating instantaneously steam at a very high pressure. This, however, he declined, considering her as untrustworthy for the service demanded in the Irish Seas. She was then sent, under Lieut. Otway, to Lisbon, and towed back, a total failure. Next there was the *Lightning*, constructed in 1823, and the *Meteor*, in 1824, both also on the lines and under the supervision of Mr. Oliver Lang. These he considered to be our first effective steam vessels. They accompanied the fleet sent to Algiers in 1824, and from that period to the present had maintained a high character. The *Lightning* had been generally used as the Admiralty yacht, and the *Meteor* as a most serviceable dispatch-boat and steam-tug, and in both, as vessels of war, he (the Chairman) had held command. They were fitted with Morgan's feathering paddles, and were most successful. He mentioned these vessels particularly as being the first, in 1824, to brave the sea in long voyages, and as entering into war operations. In the year 1829, he drew the attention of Sir Robert Seppings to a model of a fast boat in the Canton river, which, carrying her extreme beam at one-fifth from the stern instead of the bow, beat all boats of European structure. Sir Robert was so fully aware of the advantage thus gained, that he directed his (the Chairman's) attention to the lines of his vessels already constructed on that principle, one of which, the *Thetis*, was selected as the trial ship, against which were run the vessels constructed by Admiral Hayes and Captain Symonds. In conclusion, he would venture to suggest that, in addition to the valuable paper now laid before the Society, it would be highly interesting, before many of our older members lost their clearness of recollection, that a complete tabular statement of the precise steamers now alluded to, their horse-power, consumption of coal, extreme and average velocities with and without canvass, should be placed on record. The materials now collected ought only to excite others to contribute their mite, and thus, at some future period, close the door to anything like controversy upon matters which should be deemed a portion of our national history. He begged to propose that the thanks of the meeting be given to the author of the paper.

The vote of thanks having been passed,

Mr. Simmonds, in returning thanks for the vote, said that in dealing with so large a subject, it was scarcely possible that he could do justice to all the points touched upon, and give a correct idea of the several great interests identified with steam-shipping in this port. Instead of an hour's discourse, it would take a volume to illustrate the subject. And, moreover, in reading his paper, to economise time, he had omitted many statistical and other details, which would be found when it was printed in the

Journal. This referred especially to the observations of Mr. Taylor and Mr. Carnegie. He had not overlooked the importance of the two great companies, the Peninsular and Oriental and the Royal Mail, which he had summarised, as it was impossible to go into particulars relative to their rise, progress, fleets, and extensive service. Indeed, as his paper was confined to the steam navigation of the port of London, he might have seemed to be travelling a little out of the record, if he had dwelt largely on the steam-shipping trade of Southampton, which would alone form an admirable field for discussion. Neither had he overlooked the operations of individual owners of boats, and such important companies, as the Greek and Oriental Steam Navigation Company, which Mr. Carnegie represented—a most useful, extensive, and admirably-conducted company, carrying on transactions with the leading Mediterranean ports, the Black Sea, and the Danube. But it must be self-evident that, to trace the rise and progress of all these sea-going vessels and companies, would take up a large amount of time. And, moreover, many of these changed their lines of service a good deal with the variable demands of commerce. With respect to the period of the duration of engines and boilers he had not spoken from his own practical knowledge on this point, but the opinion he had given was furnished him by one of the most practical and experienced official surveyors of iron boats, who had had more observation of this kind than perhaps anyone else. The supplementary observations and corrections of the Chairman were very useful, but he had endeavoured to confine his remarks to mercantile operations rather than naval, as it was chiefly a trade question he had taken up, and he had not followed steamers into foreign ports. In a paper of this kind, dealing with so many varied facts, extending over so long a period, and derived from so many different sources, there would, no doubt, be found errors and discrepancies; therefore he trusted gentlemen present, or those who might read this paper, would do him the favour to correct any such by a note, addressed either to him personally, or to the Secretary, for publication.

The Secretary announced that on Wednesday evening next, the 1st February, a paper "On the Arts and Manufactures of Japan," by Dr. Macgowan, would be read.

THE LONDON UNIVERSITY.

The Senate of this University have recently instituted, in accordance with representations made to it by many men of science in this country, the degrees of Bachelor and Doctor of Science. The regulations provide that the acquirements of the candidates for these degrees shall, in the first place, be tested by the Matriculation Examination, which candidates for the other degrees conferred by the University are required to pass before entering upon their special courses of study; that the degree of Bachelor of Science shall take rank with that of Batchelor of Arts, being conferred (like it) after two consecutive Examinations, at an interval of a year from each other and from the Matriculation Examination, and attesting the general knowledge acquired by the graduate of the fundamental principles and most important facts of the chief divisions of science; and that the degree of Doctor of Science shall be conferred on such candidates as have not merely given evidence of general scientific attainments, but have shown themselves to possess a very high proficiency, both theoretical and practical, in some one branch of scientific knowledge. In following the course of study required as a preparation for these degrees, candidates are left to their own free choice, both as to locality and as to instructors; and by the New Charter recently granted to the University, candidates for its degrees in Arts now enjoy the same liberty.

Home Correspondence.

SCIENCE IN COURTS OF LAW.

Sir,—I was unfortunately prevented, by a temporary illness, from being present at the reading of Dr. Angus Smith's paper, on Wednesday evening last. But my object in now writing is not so much to re-open the discussion on his proposals, as to protest against the calumnies wherewith the characters of scientific witnesses were then so freely assailed. I may say, however, that I dissent from the general views expressed in his paper, and strongly object to his suggested alterations. I may also say that I differ from Dr. Smith in my estimate of the bench and the bar; that I have never met with discourteous treatment from either; that I have always been allowed to say whatever I wished to say; and that I have not experienced that sneaking or wriggling through a wearisome examination to which he so feelingly alludes. A court of law is not, in my opinion, the arena in which scientific distinctions are to be achieved, neither is it the object of a legal inquiry to elevate the position of scientific men, but rather, as I conceive, to mete out justice between contending parties, by ascertaining the truth of the disputed matter. Now, the experience of past centuries, and the judgment of modern thinkers, alike support the notion that truth can only be arrived at by the conflict of testimony.

It is wrong to say, as was said the other evening, that men of the highest scientific attainments do not appear in the witness-box. Although many eminent men, from their special inaptitude, or their position, or their wealth, or their indifference to wealth, decline to give evidence before courts and committees, yet such is not the case with others. Taking my illustrations from my own profession, I may adduce Mr. Graham, Dr. Hofmann, and Dr. Frankland as examples of men who have frequently appeared in the witness-box, and who have notwithstanding made original rearches in science second to none in their extent, importance, and philosophic character. Or I might refer to others who, from various causes, are less distinguished as investigators, but not a whit less distinguished as men of learning and integrity. Thus, Mr. Brande and Dr. Miller, two well-known scientific witnesses, have each filled the offices of vice-president of the Royal Society, and president of the Chemical Society, sufficient proof, if any were needed, of the estimation in which they are held by the general scientific world, and by the cultivators of their own special science. Yet these, I suppose, are the men who were branded the other evening as mere trading witnesses engaged in a nefarious traffic; these are the men who receive thousands of pounds to support an opinion by their name and their cunning, which others of less name know to be false; and it was to encourage such men as these in coming forward to enlighten our law courts with their knowledge, that the position of a scientific witness experienced such wholesale detraction.

It is also wrong to say that scientific men will support any cause or any opinion for which they can get paid. In illustration, I may refer to my own experience of nuisance cases during the past year. Dr. Taylor and I were employed by a maker of artificial manures, who was indicted for a nuisance, and we made a favourable report of his premises and processes. But at the trial, matters quite new to us, which materially altered the complexion of the case, were established by the witnesses for the prosecution. We accordingly informed our counsel that we could neither defend nor palliate such practices, and advised a compromise, which was ultimately effected. We were next employed by a gas company: we gave evidence as to the freedom of their works from nuisance, and the committee decided in our favour. The next case was one of bone boiling. I gave evidence for the prosecution that a nuisance did exist, and the arbitrator so decided. The defendant

applied to Dr. Taylor to give evidence for him, but after examining into the case the Doctor refused, although he might doubtless have received almost any fee he chose to name. But mark this, Mr. Chadwick, the case of the bone boiler was one in favour of which much might be said, and although Dr. Taylor, as a mere scientific witness, refused to assist him, yet he secured the support of three distinguished members of your own immaculate sanitarian confraternity. Henceforth reserve your strictures for those of your own body, and do not publicly exclaim against the characters of men of whose conduct and motives you are entirely ignorant. Our next case was an action for damages. We undertook to investigate, report, and possibly give evidence upon the matter. But our report was considered so unfavourable that our client's solicitor declined to have us subpœnaed as witnesses, whereby we lost fees to a considerable amount. Our next case had reference to some alum works. We gave evidence for the defendant, and the magistrate, who had himself examined the premises, agreed with our opinion. So that, out of five cases that came to my personal knowledge, in which Dr. Taylor was applied to by alleged nuisance makers, he declined to give evidence in three, and in the other two obtained decisions in his favour. But these two of the five alone became known to the public, and he and I were consequently stigmatised as the unscrupulous advocates of every abomination under the sun. Not only Dr. Taylor, but scientific men in general, are constantly in the habit of refusing to give evidence in support of opinions they do not entertain; though their conduct in these cases is, for the most part, known only to themselves and their intimates.

It is wrong, I conceive, to reproach scientific witnesses, on account of their being often opposed to one another, not only on questions of opinion but also on questions of fact. Frequently scientific men have arrived at opposite opinions, quite irrespective of the cause in which they are engaged, and are indeed engaged in the cause on account of their previously-expressed opinions. Thus different geologists entertained very different notions of what constituted coal, long before the celebrated trial of the Torbane Hill mineral case. At other times scientific men arrive at different opinions upon a particular case, from the circumstance of that case having been presented to them in totally different aspects. One man, looking at the subject from one point of view, and being best acquainted with one set of facts, will form one opinion; and an equally honest man, looking at the subject from an opposite point of view, and being best acquainted with another set of facts, will form an opposite opinion. But scientific witnesses are not unfrequently opposed to one another on a question of fact, and very proper it is that they should be. I remember one case in point. Three or four scientific men of eminence, retained by the patentee in an action for infringement, declared that a particular chemical reaction could not take place. They were supported by works of authority, and the reaction most certainly did not take place when the ordinary modes of experimenting were adopted. But it was most important for the defendant to show that this reaction was practicable, and his witnesses, after various attempts, succeeded in devising a method by which it was effected with facility. Accordingly they contradicted the witnesses for the plaintiff, and declared positively that the reaction could take place. And this illustration shows the importance of having a subject investigated by men desirous of establishing different conclusions. Had this case been referred to an independent commission, they would probably have decided it by the mere knowledge of the day, and this new reaction, with its important consequences, would have been altogether overlooked. Opposition, either as to fact or opinion, does not necessarily imply falsehood, and may indeed be creditable to all parties; for there are very few cases in which a great deal of scientific truth may not be urged on both sides. When a scientific man undertakes to give evidence, it is no part of his duty to decide upon the justice of the side on which he is retained. That is for the judge and jury, not for the witness, who must obviously be unacquainted with the very grounds on which alone a judgment can be formed. The scientific witness merely undertakes to give, in his examination in chief, a statement of the scientific truths and deductions which bear upon one side of the question; and in his cross-examination to admit or refute, according to his knowledge, the positions of his adversary which bear upon the opposite side of the question. So long as a witness answers, cautiously but straightforwardly, the favourable questions put to him in examination, and the unfavourable questions put to him in cross-examination, he will equally acquire the esteem of the bench, the bar, and the public, no matter whether he be on the winning or the losing side, no matter whether his view of the case be adopted or rejected. For the court has not to decide which set of scientific men are telling truths, and which set are telling lies. Its province is to balance the truths brought to bear upon one side of the question, by one set of witnesses, against the truths brought to bear on the other side of the question, by another set of witnesses. And here it is that the function of a judge is so ably and independently exercised. He is skilled in evolving the points of a complex case, no matter how technical; he is accustomed to abandon remorselessly his first impressions upon the establishment of fresh facts; he is trained to decide from reason and not from prejudice; he is, in fact, educated to the duties of an assessor or arbitrator to an extent that no scientific man possibly could be.

But it is said that some witnesses will swear to a certain opinion in one committee-room, and to an opposite opinion in another. Such may probably be the case sometimes, for unfortunately there are unscrupulous men in every profession, not even excepting the sanitarian. I may say, however, that I have failed to get substantial proofs of such occurrences. I have generally found the charge proceed from men ignorant of the subject, who have confounded together cases which had a general broad resemblance, but of which the scientific features were altogether distinct. As for the allegation that some men are wicked enough to describe the trade carried on by one party as a nuisance, and the same trade carried on by another party as no nuisance, it is too preposterous to require a moment's consideration. Every one knows that the offensiveness or inoffensiveness of a trade depends less frequently upon its exact nature, than upon the manner in which it is conducted. Some years back I was employed independently by the Government to examine very many reputedly offensive trades, and I reported that some gasworks, sugar-houses, tan-yards, &c., were nuisances, and that other gasworks, sugar-houses, tan-yards, &c., were not.

In conclusion, I would recommend those self-constituted critics of other men's integrity, Dr. Angus Smith, and Messrs. Holland, Homersham, and Chadwick, to exercise in future a little more of that charity which thinketh no evil.

I am, &c.,

WILLIAM ODLING, M.B., F.R.S.

Guy's Hospital, January 25, 1860.

BOTTLING IN CARBONIC ACID GAS.

Sir,—In the last *Journal of the Society of Arts*, it appears that you made an announcement that Sir James Murray, of Dublin, had invented a plan for bottling liquids in carbonic acid, so as to prevent the contact of the liquid with atmospheric air. I beg to inform you that I adopted precisely the same plan two years ago, with complete success. Being the managing brewer at Messrs. Bass and Co., I had often observed that beer was very much deteriorated by bottling in atmospheric air, and, feeling certain that it was in consequence of oxidation, I had an oblong box made, quite tight, and in one corner placed the materials for generating carbonic acid—viz., carbonate of lime and hydrochloric acid—till the box was com-

pletely full of gas. I then placed the clean bottles upright in the box, and allowed them to fill with the carbonic acid, and at once filled them with the beer and corked them down. Some more were filled at the same time, in the ordinary way, and set aside for a time. It soon became apparent that the plan had been completely successful. I then explained my plan to Mr. Bass and his partners; and I have at various times explained and recommended it to our agents and bottlers in London, Liverpool, and Dublin, besides talking of it to many other persons. I cannot see, therefore, how Sir James Murray can be the original inventor. I never sought to keep it a secret, and I never received any hint of such a thing having been done before.

I am, &c.,
JOHN MATTHEWS.

Burton-on-Trent, Jan. 24th, 1860.

MEETINGS FOR THE ENSUING WEEK.

MON. .....Actuaries, 7.
London Inst., 7. Mr. J. Pittman, "On the Results of the Use of Music in Divine Worship, and their Influence on the Art in General."
Medical, 8½. Dr. Richardson, "On the Study of Disease by Synthesis—Inflammation."
United Service Inst., 8½. Mr. G. Turner, "On Tents invented by himself."

TUES. .....Royal Inst., 3. Prof. Owen, "On Fossil Mammals."
Civil Engineers, 8. Mr. E. B. Webb, "No. 1015. Upon the Means of Communication in the Empire of Brazil, chiefly in reference to the Works of Mangaratiba Serra Road, and to those of the Mana, the first Brazilian Railway."

WED. .....London Inst., 7. Mr. E. W. Brayley, "On the Physical History, Structure, and Materials of the Earth."
Society of Arts, 8. Dr. Macgowan, "On the Arts and Manufactures of Japan."
Geological, 8. 1. Mr. L. Barrett, "On some Cretaceous Rocks in Jamaica." 2. Mr. R. Godwin-Austen, "On some Fossils from the Chalk near Guildford." 3. Mr. S. V. Wood, jun., "On the Extent of Land during and after the Cretaceous Period."
Pharmaceutical, 8.
Royal Soc. Literature, 8½.

THURS. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8. 1. Mr. Lubbock, "On the Tracheary System of Insects," in continuation. 2. Mr. Spruce, "On the mode of Branching of some Amazon Trees." 3. Rev. C. Parish, "Botanical Notes made in a Tour to the 'Three Pagodas,' Moolmeyn."
Chemical, 8. 1. Dr. Guthrie, "On some Derivations from the Olefines." 2. Dr. Gladstone, "On an Iron Sand." 3. Dr. Frankland, "On the Composition of Air from Mont Blanc."
Artists and Amateurs, 8.

FRI. .....United Service Inst. Dr. Livesay, "Personal Narrative of the Expedition against the Pirates in Borneo in 1849."
Archæological Inst., 4.
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Mr. F. Field, "On the Mineral Treasures of the Andes."

SAT. .....Asiatic, 2.
Royal Inst., 3. Dr. Lankester, "On the Relations of the Animal Kingdom to the Industry of Man."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January 20th*, 1860.]

Dated 28th October, 1859.

2466. H. Greaves, 5, Victoria-street, Westminster—Imp. in constructing the permanent way of railways, and in preparing parts thereof to prevent oxidation.

Dated 14th December, 1859.

2842. A. Leslie, Hebburn Quay, Gateshead—Imp. in the construction of iron ships or vessels, and for strengthening the same.

Dated 15th December, 1859.

2856. H. Martin, Stockton-on-Tees, Durham—Imp. in pumps and beer engines.

Dated 17th December, 1859.

2868. B. E. Pym, King William-street—An improved cinder shovel or cinder sifter.
2872. R. W. Savage, 15, St. James-square, Westminster—Imp. in fire escapes, also applicable to ladders, portable scaffolding, and such like purposes.

Dated 19th December, 1859.

2882. E. B. Wilson and R. S. North, Rotherham, Yorkshire—Imp. in the manufacture of cranked axles, and also of tyres for railway and other wheels, and in the machinery or apparatus employed therein.

Dated 20th December, 1859.

2908. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in churns. (A com.)

Dated 23rd December, 1859.

2922. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in voltaic batteries. (A com.)
2924. J. Hyde and J. H. Hooper, Christ's Church, Surrey—Imp. in propellers of steam vessels on canals.
2932. J. Giles, Cannon-street—Imp. in locomotive traction engines.
2934. J. J. de Arrieta, Piccadilly, and J. P. Lamar, Bush-lane, City—Imp. in bleaching, cleansing, and decolorizing, and in apparatus employed therein. (A com.)

Dated 24th December, 1859.

2940. H. B. Barlow, Manchester—Imp. in screw cutting machines. (A com.)

Dated 28th December, 1859.

2956. L. S. Magnus, 3, Adelaide-place, London-bridge, and W. Sinnock, Brompton, Kent—Imp. in preparing yarn, twine, cords, and strands, and other fibrous materials, to render the same more suitable for submarine telegraph cables and other uses.
2958. A. McDougall, Manchester—Imp. in the preparation of disinfecting and antiseptic substances.
2960. F. Dressler, Nassau-street—Imp. in dining and other tables, which improvements are applicable to other articles of furniture.
2962. C. S. Rostaing, Dresden, Saxony—Imp. in combining and mixing gutta percha with mineral and vegetable substances, capable of altering its quality in such a manner as to produce hard resistent unalterable and imputrescible compounds diversly coloured.
2964. J. Englemann, Mulhouse, France—Imp. in steam engines.
2966. G. T. Peppe, Peak-hill, Sydenham—Imp. in apparatus for keeping time.

Dated 28th December, 1859.

2968. E. Kirby, Lower Moor, Oldham, Lancashire—Certain imp. in or applicable to machines for spinning, doubling, winding, reeling, and weaving, and in cop tubes used in such machines.
2970. A. V. Newton, 66, Chancery-lane—Imp. in the mode of, and apparatus for, submitting yarns or threads to the action of gaseous and liquid bodies. (A com.)
2972. T. Fearnley, Bradford, Yorkshire—Imp. in steam-hammers.
2974. T. Thomas, Rawtenstall, Lancashire—Imp. in machinery or apparatus for spinning fibrous materials.
2976. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in sewing machines. (A com.)
2978. W. E. Newton, 66, Chancery-lane—Imp. in machine belting or banding, and in the machinery and process of making the same.
2980. Sir P. Fairbairn and R. Newton, Leeds—Improved machinery for combing silk, flax, and other fibres.

Dated 30th December, 1859.

2982. W. Smith, Kilmarnock, Ayr—Imp. in stack-pillars, or supports for stacks and ricks of agricultural produce.
2984. W. Smith, Kilmarnock, Ayr—Imp. in vent or chimney linings, and in smoke-preventive and ventilating apparatus connected therewith.
2986. R. Jones, Trinity-terrace, Trinity-square, Southwark, and D. Stathard, Peacock-street, Newington, Surrey—Improved mechanical arrangements for raising, lowering, and disengaging ships, boats, and other ponderous bodies.
2988. W. E. Gedge, 4, Wellington-street South, Strand—An improved tooth brush. (A com.)
2990. J. Whitworth, Manchester—Imp. in projectiles, and machinery for their manufacture.
2992. H. Cochrane, Middlesbro'-on-Tees—Imp. in the construction of core bars.

Dated 31st December, 1859.

2994. J. Braggins, Banbury—Imp. in gates for fields and carriage roads.
2996. R. Gibson, Lincoln—Imp. in the permanent way of railways, and in the manufacture of parts of the same.
2998. W. Jackson, 4, Spring-terrace, York-road, Lambeth—Imp. in sewing or stitching machines.
3000. J. Eason, Oxford-street—Imp. in tanning and in the manufacture of leather, and in machinery adapted thereto.

Dated 2nd January, 1860.

2. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved safety lock. (A com.)

Dated 3rd January, 1860.

8. T. Hardy, Windmill-street, Wednesbury, Staffordshire—An improved tool for cleaning the inside of the tubes or flues of tubular steam boilers.

10. J. Horridge, Birkenhead—An improved iron wheelway for streets and roads.
12. E. Chetwyn, Worcester—Imp. in the manufacture of gloves.
14. D. Bateman and S. Bateman, Low Moor, near Bradford, Yorkshire—Imp. in machinery for the manufacture of cards for carding wool and other fibrous substances.
16. A. V. Newton, 66, Chancery-lane—Imp. in the cut off motion and slide valves of steam-engines. (A com.)

Dated 4th January, 1860.

18. M. Blacet, St. Etienne, France—Imp. in miners' safety lamps.
20. J. L. E. Klein and J. P. Roger, Montmartre, France—A rotatory vice applicable for the manufacture of shoes and all objects of art or industry generally made by hand.

Dated 5th January, 1860.

30. A. V. Newton, 66, Chancery-lane—An improved mode of and apparatus for fitting the abutting ends of the rails of railways together. (A com.)
32. G. Sample, Montague-place, Whitechapel—Imp. in boots, shoes, clogs, and such like coverings for the feet.
36. R. A. Robinson, 25, Cannon-street—Imp. in sugar mills.

Dated 6th January, 1860.

38. V. de Tivoli, 67, Lower Thames-street, and Col. J. Hudson, 13, Victoria-street—A swimming and floating apparatus.
39. J. Knowles, Lower Broughton, near Manchester—Certain imp. in looms for weaving.
40. H. C. Hill, Stalybridge, Chester—Certain imp. in or applicable to machines for carding cotton, flax, wool, and other fibrous materials.
41. R. C. Videgrain, Laffitte-street, No. 10, France—Imp. in the manufacture of artificial marbles.
42. T. Moy, 1, Clifford's-inn—Imp. in steam engine governors.
43. J. Fowler, Waterford—Imp. in locks for doors and other purposes. (A com.)
44. L. F. Perrier, Marseilles, France—Imp. in machinery for making wax matches and in wood matches.
45. R. Vivian, Tucking Mill, Cornwall—Imp. in constructing balls for cricket and other games, which invention is also applicable to spherical valves.
47. W. Hooper, Mitcham, Surrey—Imp. in re-working compounds of india-rubber and sulphur, and in insulating telegraphic wires or conductors.

Dated 7th January, 1860.

48. T. Bellamy, Birmingham—An imp. or imps. in the manufacture of wire lattice-work.
49. J. B. D'A. Boulton, Usk, Monmouthshire—Imp. in slide valves.
50. J. Hawkins and C. Hawkins, Walsall—An improved apparatus for the use of railway guards and passengers, for the purpose of communicating with the engine drivers of railway trains when necessary.
51. B. Bayliss, Aston-park, near Birmingham—Imp. in breech-loading fire-arms, applicable for military and sporting purposes.
52. J. Garnett, Windermere, Westmoreland—Imp. in writing desks and in apparatus connected therewith.
53. R. Moreland, jun., 5, Old-street—Imp. in condensing apparatus, to be used with high pressure steam engines.
54. H. Chance, Birmingham, and T. Howell, Smethwick, Staffordshire—Imp. in the manufacture of glass.
55. J. W. Wilson, 9, Buckingham-street, Strand—Imp. in apparatus for cleaning guns.

Dated 9th January, 1860.

56. J. F. Hillel, 18, Welbeck-street, Cavendish-square—An improved machine for squatting, separating, and tearing rushes, and all other textile fibrous plants,
57. G. Beningfield, Clark street, Stepney—Imp. in reservoir or fountain pens.
59. R. Mathers, 287, Oxford street—Imp. in the manufacture of wheels and axles.

Dated 10th January, 1860.

61. W. H. Thornthwaite, Newgate-street—Imp. in the treatment and reduction of ores, and in the manufacture of iron and steel, and in the construction and mode of working the furnaces employed in such said manufacture.
63. S. Isaac, Saint James'-street—Imp. in overcoats, particularly adapted to military purposes.
65. J. F. Dickson, 6, Russell-street, Litchurch, near Derby—Imp. in the construction of sewing machines, together with the apparatus connected therewith.
66. W. A. Henry, Sheffield—Imp. in machinery or apparatus for the manufacture of screws.
67. W. T. B. Allday, Rednall, Worcestershire—Certain improved apparatus for separating filings, or other small bits or particles of iron or steel, from other metallic filings, scrapings, chippings, or other small particles or dust.

Dated 11th January, 1860.

69. C. Johnson, 6, Northumberland-street, Strand—Making a shoe without the use of leather.
71. A. Strauss, Spitalfields, Middlesex—An imp. in pipes for smoking.
73. A. Brownlie, Glasgow—Imp. in the treatment of sewerage matters and in the apparatus employed therein.
75. W. E. Newton, 66, Chancery-lane—Improved apparatus for transmitting signals. (A com.)
79. C. T. Boutet, 176, Tottenham-court-road—A new mover applicable to all branches of industry, and designed to replace steam, The Aéro-hydraulic mover.

Patents Sealed.

[*From Gazette, January 20th*, 1860.]

January 20th.

1719. J. G. Isham and S. D. Albertson.
1722. J. B. Whitehall and S. Wheatcroft.
1734. W. H Buckland.
1737. J. Hinks and G. Wells.
1746. W. Hudson and C. Catlow.
1754. W. Clark.
1755. J. Jackson.
1798. J. Horton.
1801. F. Walton.
1806. M. A. F. Mennons.
1849. W. Muir.
1875. H. T. Lambert.
1991. C. Chatterton.
2065. H. O. Robinson.
2268. J. Turpie.
2314. A. V. Newton.
2338. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.
2364. S. Newberry and H. Moore.
2382. W. E. Newton.
2383. W. E. Newton.
2460. H. Phillips and J. Bannehr.
2669. J. Sim.
2713. G. J. Firmin.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, January 20th*, 1860.]

January 16th.

148. R. Reeves and J. Reeves.
157. E. Clark.
158. J. Bird.
159. E. Clark.
167. T. Johnson.
198. W. Roberts.

January 17th.

169. W. H. Barlow and H. Woodhouse.
214. P. H. Sharkey.

January 18th.

153. T. Sagar.
155. W. H. Mitchel.
160. F. Walton.

[*From Gazette, January 24th*, 1860.]

January 20th.

182. S. Neville.
200. J. G. Marshall.
209. J. F. Powell.
91. W. E. Newton.

January 21st.

193. J. Rubery.
207. G. Eskholme & H. Wilkes.
221. H. Bessemer.
222. W. Stubbs and J. Burrows.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, January 20th*, 1860.]

January 17th.

121. H. Browning.
128. R. Neale.
145. G. E. Gazagnaire.

[*From Gazette, January 24th*, 1860.]

January 24th.

273. J. Cockerill and T. Barnett.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,225	Jan. 6th.	A Super-heating Apparatus for Steam Boilers	John Hall	London street, E.C.
4,226	,, 10th.	Improved Chimney or Draught Doors for Domestic Fire Grates	The Shotts Iron Company	Shotts Iron Works, near Motherwell, N.B.
4,227	,, 14th.	Improved Folding Carriage Head	Laurie and Marner	313, Oxford-street, W.
4,228	,, 17th.	A Graduated Goffered Cap Front	Chas. Grey Hill	Commerce-square, High Pavement, Nottingham.
4,229	,, 18th.	Improved Wire Rope, for Lightning Conductors	Henry Wilde	St. Ann's Church-yard, Manchester.
4,230	,, 19th.	Sack Elevator	Amies and Barford	Peterborough.
4,231	,, 23rd.	The Coronet Needle Case	S. Allcock and Co.	Redditch.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 3, 1860.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

EXAMINATIONS OF 1860.—LOCAL BOARDS.

The following is a General List* of the Local Boards appointed to co-operate with the Society of Arts, in the Previous and Final Examinations of 1860.

*** Those marked with three asterisks have not taken part in the Examinations of former years.

Local Board for Aberdeen.

Mr. John Miller, Manufacturing Chemist, *Chairman.*
The Lord Provost of Aberdeen.
The Eldest Baillie.
Mr. J. S. Brazier, Lecturer on Agricultural Chemistry, Marischal College, Aberdeen.
,, William Brebner.
Rev. Dr. J. C. Brown, Lecturer, King's College, Aberdeen.
Mr. John Bulloch, Brassfounder, Aberdeen.
Dr. Clark, Marischal College.
,, Cruickshank, Marischal College.
Mr. Henry A. Dewar, Surgeon-Dentist.
Dr. Fraser.
,, John Gray, Millwright.
Baillie William Henderson.
Dr. Kilgour.
Rev. Dr. Longmuir, Lecturer, King's College.
Baillie M'Hardy.
Mr. David Maver, Teacher, Free Bon-Accord School.
Prof. J. C. Maxwell, Marischal College.
Mr. Thomas Melville, Jun., Ironmonger.
,, John D. Milne, Advocate.
,, William Raimage, Architect.
,, Wm. Rattray, Teacher, Free South Church School.
,, J. W. Schlesinger, Teacher, Gymnasium, Old Aberdeen.
,, Henry A. Smith, Actuary, Northern Assurance Co., Aberdeen.
,, James Westland, Banker, Aberdeen.
,, James Sinclair, Mechanics' Institution, Aberdeen, *Secretary.*

*** Local Board for Andover.

The Mayor, *Chairman.*
Hon. and Rev. S. Best, Abbotts Ann.
Rev. C. H. Kidding, Vicarage, Andover.
Mr. Henry Thompson, Andover.
Rev. P. Ward, Andover.
Rev. H. M. White, Andover, *Secretary.*

Local Board for Ashbourn Working Men's Institute.

Rev. J. R. Errington, Vicar of Ashbourn, *Chairman.*
Mr. W. Francis.
Dr. John Lee.
Mr. C. J. Welch, Solicitor.
Capt. Holland, R.N., Ashbourn Hall, *Secretary.*

Local Board for Ashford.

Mr. James Janson Cudworth, Locomotive Superintendent, Ashford New Town, *Chairman.*
Rev. John Price Alcock, M.A., Vicar of Ashford.
Mr. John Keener, Accountant, Ashford Railway Works, and 3, Mead-terrace, Willesborough, near Ashford.
Rev. Samuel C. Lepard, B.A., Church-villas, Ashford.
Mr. Richard C. Mansell, Carriage Superintendent, Ashford New Town.
,, Richard Rabson. Church Gates, Ashford.
Rev. J. C. Taylor, M.A., 5, Church-villas, Ashford.
Mr. Thos. Henry Vie, Schoolmaster, Barrow-hill, Ashford.
,, Thomas Nesbit, Accountant, 33, Queen-street, Ashford, *Secretary.*

Local Board for Bacup.

Mr. Thomas Aitkin, Holmes, Bacup, *Chairman.*
,, Henry Maden, Spring Mount, Bacup.
,, J. H. Worrall, M.D., Bacup, *Secretary.*

Local Board for Banbury.

Mr. A. B. Rye, Banbury, *Chairman.*
,, Charles Neighbour, Banbury.
,, Richard Henry Rolls, Banbury.
Rev. William Wilson, Banbury.
Mr. John H. Beale, Banbury, *Secretary.*

*** Local Board for Barnet.

Mr. Charles Herbert Cottrell, Hadley-lodge, Barnet, N., *Chairman.*
Rev. John D. Bell, Brunswick-house, Barnet, N.
Rev. Thos. Reader White, M.A., Rector of Finchley, N.
Mr. John Thimbleby, President of the Institute, Barnet, N., *Secretary.*

Local Board for Belfast.

Mr. Joseph John Murphy, 13, College-square East, Belfast, *Chairman.*
,, Thomas McClinton, 81, Donegal-street, Belfast.
Rev. J. Nelson, Sugarfield, Shankhill-road, Belfast.
Mr. Robert Patterson, 6, College-square North, Belfast.
,, Hamilton Pink, 2, Windsor-place, Belfast.
Rev. J. S. Porter, 16, College-square East, Belfast.
Mr. Charles Rainey, 118, Joy-street, Belfast.
Rev. William Anderson, 23, Lonsdale-street, Belfast, *Secretary*

* A supplement to this List will be published.

Local Board for Berkhamsted.

Rev. J. Hutchinson, M.A., Rector of Berkhamsted, *Chairman.*
,, J. W. Cobb, M.A., Curate of North Church.
,, F. B. Harvey, S.C.L., Grammar School.
,, J. Hodge, Independent Minister.
,, J. R. Crawford, M.A., Master of Grammar School, *Secretary.*

Local Board for Birmingham & Midland Institute.

Mr. Arthur Ryland, Calthope-street, Edgbaston, *Chairman.*
Rev. E. H. Gifford, M.A., King Edward's School, Birmingham.
Mr. John B. Hebbert, Hagley-road, Edgbaston.
,, John Jaffray, Arthur-road, Edgbaston.
,, J. N. Langley, Hon. Sec. of Working Men's College at Wolverhampton, Wolverhampton.
,, T. P. Salt, Bull-street, Birmingham.
,, Robt. Wright, Hunter's-lane, Birmingham.
,, Wm. Mathews, Jun., M.A., Edgbaston House, Birmingham, *Secretary.*

Local Board for Messrs. Chance's Library, Glass Works, near Birmingham.

Mr. R. L. Chance, Jun., Highfield House, Edgbaston, *Chairman.*
,, Henry Chance, M.A., Ellerslie, Edgbaston.
,, A. Masselin, C.E., Glass Works.
,, F. Talbot, Glass Works, *Secretary.*

*** Local Board for Bishops' Stortford.

Rev. Thos. T. L. Bayliff, M.A., Vicar of Albury, Herts, *Chairman.*
Mr. Joseph Bell, M.A., Head Master, Collegiate School, Bishops' Stortford.
Rev. William J. Copeland, B.D., Rector of Farnham, Essex.
Mr. E. M. Dillon, M.A., Collegiate School, Bishops' Stortford.
Rev. Godfrey Goodman, Head Master, High School, ditto.
Rev. John Menet, M.A., Chaplain, Diocesan Training School, Hockerill.
Rev. William Mirrielees, M.A., High School, Bishops' Stortford.
Mr. G. Augustus Starling, M.D., L.R.C.P., Lond. Windhill, Bishops' Stortford.
Mr. F. Woodham Nash, B.A., Sion house, Birchanger, Bishops' Stortford, *Secretary.*

Local Board for Blackburn.

Mr. Miles Baron, Draper, Northgate, Blackburn, *Chairman.*
,, Ellis Duckworth, Builder, Blackburn, *Vice-Chairman.*
,, John Bell, Goods Traffic Manager, Blackburn.
,, James Booth, Druggist, Blackburn.
,, James Garstang, Grocer, Blackburn.
,, John Garstang, Schoolmaster, Blackburn.
,, Robert Hopwood Hutchinson, Cotton Spinner, Blackburn.
,, Thomas Livesey, Mechanical Engineer, Blackburn.
,, J. H. Margerison, Book-keeper, Blackburn.
,, John Robinson, Cotton Manufacturer, Blackburn.
Dr. J. Withrington, Blackburn.
Mr. Robert C. Radcliffe, Solicitor, Blackburn, *Secretary.*

Local Board for Blandford.

Mr. Spence Abbott, Draper, &c., West-street, Blandford, *Chairman.*
,, Edward Fisher, Draper, Market-place, Blandford.
,, Wellington E. Groves, Pharmaceutical Chemist, Market-place, Blandford.
,, James B. Green, Architect and Surveyor, Salisbury-street, Blandford, *Secretary.*

Local Board for Bradford.

Rev. W. R. Smith, M.A., Incumbent of Christ Church, Hanover-square, Bradford, *Chairman.*
Rev. J. R. Campbell, M.A., Great Horton-road, Bradford, Independent Minister.
Mr. Thos. Clark, Trafalgar-street, Bradford, Bank Clerk.
Rev. H. B. Creak, M.A., Professor of Philosophy and Mathematics, Airedale College.
Mr. D. J. Crebbin, Chapel-street, Bradford, Schoolmaster.
Rev. Daniel Fraser, LL.D., President of Airedale College.
Mr. J. V. Godwin, President of the Institute, Bradford, Merchant.
Rev. S. G. Green, B.A., Classical Tutor, Rawden College.
Mr. James Hanson, 51, Hanover-square, Bradford, Proprietor of the *Bradford Review.*
,, J. M. Jaques, Trafalgar-street, Bradford, Warehouseman.
Rev. Jno. Jones, Leeds-road, Bradford, Wesleyan Minister.
Mr. James Law, Claremont, Bradford, Merchant.
,, J. T. Newboult, Borough-rate Collector, Bradford.
Rev. J. H. Ryland, Cliff Villas, Manningham, Bradford, Unitarian Minister.
Mr. S. Smith, Bedford-street, Wakefield-road, Bradford, Woolsorter.
,, A. Walker, Little Horton-lane, Bradford, Woolsorter.
,, M. H. Walls, 66, Victoria-street, North-parade, Bradford, *Secretary.*

Local Board for Sussex (Brighton).

Mr. W. Alger, Mayor of Brighton, *Chairman.*
,, George Airey, Steyning.
Rev. John Allen, 4, Vernon-terrace, Brighton.
Mr. W. W. Attree, Queen's-park, Brighton.
Dr. Beard, Grand-parade, Brighton.
Mr. R. W. Blencowe, Chailey.
Rev. Dr. Cary, Kemp-town, Brighton.
Mr. G. Cobb, 1, Hampton-place, Brighton.
,, A Creak, 118, Lansdowne-place, Brighton.
Rev. J. Griffith, College, Brighton.
Mr. John Grix, Littlehampton.
,, H. E. Harris, 17, Cannon-place, Brighton.
,, W. H. Harper, Shoreham.
Rev. E. C. Hawkins, Vernon-terrace, Brighton.
Mr. James Howell, 7, Guilford-road, Brighton.
Dr. Jardine, Portland-place, Brighton.
Mr. F. Merrifield, Park-crescent, Brighton.
Rev. J. Newton, Eastern-road, Brighton.
Mr. G. de Paris, Atlingworth-street, Marine-parade, Brighton.
Mr. M. Penley, Gothic-cottages, Western-road, Brighton.
,, John Peto, Malvern-house, Buckingham-place, Brighton.
Rev. W. Porter, Hastings.
,, P. S. Rickards, 57, Lansdowne-place, Brighton.
,, W. D. Savage, 65, Edward-street, Brighton.
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,, Samuel Rushton, Warehouseman, Macclesfield.
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,, James Budd, Thomas-street, Waterford, *Secretary.*

*** Local Board for West Bromwich.

Mr. G. A. Hudson, High-street, *Chairman.*
,, Joseph Cooksey.
,, James Hall, Wesleyan School.
,, Rogers, Schoolmaster, Carter's Green.
,, F. Talbot, Messrs. Chance's Glass Works, near Birmingham.
Rev. J. Whewell, West Bromwich, *Secretary.*

Local Board for the Bucks and Berks Lecturers' Association, Windsor.

The Hon. and Very Rev. the Dean of Windsor, M.A., Windsor Cloisters, *Chairman.*
The Rev. R. P. Bent (Lecture Secretary), M.A., Burnham, Maidenhead.
The Rev. H. Ellison, M.A., Windsor.
The Rev. W. C. R. Flint, Sunningdale, Staines.
Mr. J. S. Gilliat, B.A., Fern-hill, Windsor.
The Rev. C. D. Goldie, M.A. (Night School Secretary), Colnbrooke, Slough.
Rev. E. Hale, Eton College.
Rev. H. C. Hawtrey, Windsor.
Mr. W. Johnson, Eton College.
,, A. L. Melville, Thames-street, Windsor.
Rev. C. K. Paul, M.A., Eton College.
Mr. C. T. Phillips (Treasurer to the Association), Sheet-street, Windsor.
The Rev. Lord Wriothesley Russell, M.A., Windsor Cloisters.
Mr. T. H. Stevens, Eton College.
The Rev. Thomas Rooke, M.A., Windsor, *Secretary.*

Local Board for Wirksworth.

Dr. W. Webb, *Chairman.*
Rev. F. H. Brett.
Mr. W. Cantrell.
,, Charles Walker.
,, William Tomlinson, Wirksworth, *Secretary.*

*** Local Board for Wolverhampton.

Rev. T. H. Campbell, M.A., Tettenhall-road, *Chairman.*
Mr. H. H. Fowler, Summerfield-house.
Rev. Stephenson Hunter, Waterloo-road.
,, J. Lloyd, M.A., ,,
Mr. A. W. Wills, Merridale-road.
Mr. J. N. Langley, M.A., Mowbray-house, *Secretary.*

Local Board for York.

Rev. Canon Robinson, M.A., Principal of the Diocesan Training College, Lord Mayor's-walk, *Chairman.*
Mr. James Birchall, Training College, York.
Mr. Samuel William North, M.R.C.S., Castlegate, York.
,, Henry Vaughan Palmer, Trinity-lane, York.
,, Wm. Henry Parr, M.A., Blake-street, York.
,, William Tomlinson, F.R.A.S., the Groves, York.
,, Charles Cumberland, Institute of Popular Science, &c., *Secretary.*

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date :—

Charles Brooke, M.A., F.R.S.,	£2	2
C. Wentworth Dilke, Vice-Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Henry Johnson (3rd Donation)	10	10
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

THE SOCIETY'S EXAMINATIONS.

A meeting of the members of the Metropolitan Church Schoolmasters' Association, the Associated Body of Church Schoolmasters and Schoolmistresses, the United Association of Schoolmasters, and other Masters and Mistresses, was held at the Society's House, on Saturday, the 28th January, at three o'clock, when the Society's system of Examinations was explained to them by Mr. Harry Chester, Vice-President of the Society. Nearly 150 Masters and Mistresses were present. Sir Thomas Phillips, F.G.S., Chairman of the Council, presided.

The Chairman said it was no doubt known to many of those who were present, that in reference to the examinations for certificates and prizes, the merit of introducing the scheme of the Society of Arts belonged chiefly to Mr. Chester, and that upon him the greatest amount of labour in connexion with them had devolved. He was, therefore, the most suitable person to give an account of what the work was, what it was desired that it should become, and what the results of the efforts of the Society in that direction had been.

Mr. Chester said—You are, of course, all aware that the Society of Arts has been for some time engaged in establishing and carrying out a system of Examination of adults instructed in classes, and at Institutions, in union with it. The Council of the Society of Arts feel quite certain that you, who are engaged in the great work of elementary education, cannot but be interested in this labour which they have undertaken, inasmuch as it has for its object to supplement and to make perfect the work in which you are yourselves engaged. I need not, to you who are so familiar with the elements of this subject, enter into any long explanation to account for the fact that the children of the working classes are withdrawn from elementary schools at much too early an age. You are all well aware of the fact, and of the great evils which arise from it. You know well that, under favourable circumstances, children are not retained in elementary schools after the age of twelve years, and that, under unfavourable circumstances, they seldom stay beyond ten. And you know that whatever improvements may have been made in the system of elementary education, and however greatly the general appreciation of knowledge may be raised in this country, it will always remain an impossibility that the children of poor persons should be continued at elementary schools long enough to have their education completed. It is a mere mockery of education to speak of its being perfected at the age of ten or twelve years; and it appears to me, and to the Council of the Society of Arts, as I have no doubt it does to every person who is interested in and has carefully considered this subject, that it is of the very greatest importance that we should endeavour to provide increased means and motives for the continuance of the education of our young people after the age at which they leave school. There are many schemes afloat for this purpose. At the present time there seems to be an idea that the system of "half-time" which has been so useful in the manufacturing districts may be advantageously introduced throughout the whole country. Whether this be so or not, it seems to be a matter of perfect certainty that we shall always require a provision of means and motives for the continuance of education after the age at which young persons leave their schools. In 1852 the Society of Arts formed its Union of Institutions. It invited the various associations which, under the titles of Mechanics' Institutions, Literary Societies, People's Colleges, Athenæums, Lyceums, and other bodies of like character, were engaged in promoting the instruction of adults, to enter into union with this Society, not that this

Society might interfere with their internal arrangements, nor that it might govern them or supersede their own authority, but that by an alliance of the Society and of these bodies they might be mutually enabled the better to carry out their objects, and that the Institutions themselves should be encouraged and strengthened to develop by natural growth their own life and power. In the autumn of 1853 it was proposed to the Institutions that had been received into union that a system should be established for the examination of the students in the classes of those Institutions; and in 1856 the first examination was held in this house. In 1857, examinations were held here and at Huddersfield. In 1858, they were held, I think, in 39 different places, and last year they were held in no less than 54 places. My object in meeting you to-day is to give you an opportunity, which I apprehend you will be glad to have, of ascertaining what the system really is, and to point out in what manner you can co-operate with the Society of Arts in this great work. You are probably aware that this Society was established in 1754, and is chartered for the Encouragement of Arts, Manufactures, and Commerce; and it is in the interest of arts, manufactures, and commerce, of artists, of artizans, of persons engaged in the higher and lower walks of manufacturing industry and commerce, that this Society is engaged in promoting the progress of education. Now the plan which we adopt is this. We know quite well in theory, as well as by the results of experience, that it would be useless to invite the members of the working classes to leave their homes and the scenes of their daily labour for the purpose of undergoing an examination. We therefore came to the conclusion, that it was necessary to carry the examination to the very doors of the persons who were desirous to benefit by it. But in most places there was no local authority competent to undertake this work, and the Society of Arts found it necessary to create a Central Board of Examiners in London whose examinations and certificates should command the respect of the whole country; and also, that it might not be too much centralized, to form Local Boards in different parts of the country to co-operate with the central board in London. We have formed a board in London, with twenty-five paid examiners, gentlemen whose names will bear comparison with those of any other staff of examiners in the kingdom. This Board never leaves London. It prepares a programme of the different subjects in which the examinations are to take place; and the Institutions in connexion with the Society of Arts in the different localities are called upon to appoint Local Boards. These Local Boards ought to represent the different educational Institutions and educational interests of the localities in which they exist. They frequently contain representatives of the mechanics institutions, literary institutions, working men's colleges and of the different kinds of schools, national, British, and any other existing there. It is very important that they should include representatives from all the educational institutions in the locality. At least one month before the time at which our examinations are to be held, the Local Board is called upon to hold what is denominated a "previous examination" of all the candidates who wish to be examined. Our object in having that previous examination is two-fold. In the firrt place we wish that the local authorities should ascertain that the persons who desire to be examined by the Society of Arts on advanced subjects are not ignorant of elementary subjects, such as reading, writing, and arithmetic. The Local Board has also to ascertain that they have a reasonable amount of knowledge of the special subjects in which they desire to be examined. The object of that is manifest; it is to act as a kind of strainer of the candidates, so that the Society of Arts may not be overwhelmed by an immense number who are not ready to be examined, and that unready candidates may not be disappointed with the result of their final examination. They have the advantage, therefore, of going before their neighbours and friends—persons interested in their success—and it often happens that failure in the first examinations leads to increased efforts to attain future success. [Mr. Chester then explained in detail the duties of the Local Boards in carrying out the Previous and Final Examinations, as set forth in the programme (see *Journal*, vol. VII., page 627 et seq:) and continued as follows:—] The prizes and certificates awarded are forwarded to the various Local Boards, and generally presented to the candidates at a public meeting of the friends of education in the neighbourhood. So far as the award of certificates is concerned, the Examinations are not, strictly speaking, competitive; any person reaching a certain standard gets a certificate of the first class, irrespective of the merits of his competitors. But we think competition is necessary to induce people to put out the whole of their strength, and consequently we give prizes—two prizes in each of the 25 subjects, the first being £5 and the second £3. We do not, however, allow persons who have had great advantages of education to compete for these prizes. Graduates or undergratuates of the Universities, professional persons, certificated schoolmasters or mistresses, and pupil teachers, are excluded from this competition. When we first began, we excluded these persons altogether. We thought that, our Examinations being for the working classes, who had not had any great educational advantages, but were to a great extent self-instructed, it would not be fair to bring them into competition with the persons I before mentioned. We therefore excluded them, but our exclusion of them was not to be carried beyond what was necessary, and it soon occurred to us, when we found that a great many persons connected with these privileged classes were desirous to obtain our certificates, that we should do no harm to any one who had had less advantages, if we allowed them to try for certificates, while we excluded them from competition foi the prizes. In addition to these inducements of certificates and prizes, we have been enabled by the kindness, and, I think I may also say, by the good sense, of some members of the Government, to place a certain number of nominations to compete for appointments in the public service, at the disposal of our prize men. And this has not been confined to the present Government, but has been adopted by successive Governments of late years. The first official person to whom we were indebted for these privileges, was the late Mr. John Wood, the Chairman of the Board of Inland Revenue. This example was followed by Lord Granville, who has always been a friend to education. I am happy to say that, while in the Privy Council office, I had opportunities of judging of the character and conduct of gentlemen who obtained clerkships in this way, and I certainly was never more satisfied with any persons than with them. Lord Derby also gave us several nominations, and Lord Palmerston has done the same. I have great hopes that, as public opinion ripens on this subject, and the evils of patronage of all kinds are more and more known, the great advantages to the cause of education and to the public service of introducing this mode of recruiting it, will become more generally adopted, and patronage will be looked upon with that disfavour to which I think it is entitled. When we began these operations, it was the complaint of the Mechanics' Institutions and other public bodies of that kind, that, though they were most anxious to have classes for systematic instruction, they found it most difficult to maintain them; there were then no sufficient inducements held out to people after the hard work of the day to endeavour to improve their minds by study in the evening. I am happy to say that since this system has been in operation we have received information from all quarters that new life and vigour have been given to efforts for the instruction of adults; that classes have been formed where they did not exist before; and that there is every reason to hope that by affording this opportunity of having their attainments properly tested and certified, with the subsidiary advantages of prizes, and some prospect of employment in the public service, the cause of adult instruction has received a real impetus. It has not been confined to the Go-

vernment to recognise these certificates of merit, they have been admitted as passports to appointments in many public companies, and large establishments of various kinds, as well as among private employers. It seems to be obvious that a man's usefulness, in any calling, must be in proportion to his intelligence and fidelity, and that there is no subject the study of which may not act beneficially upon his daily work, however mechanical that work may be. It may be that the influence, the connexion between his study and his work, is a remote one, but the general improvement of his mind, the patient determination with which the subject is pursued, and the freedom which he thus acquires from habits of dissipation, must be beneficial to a greater or less extent. I am sure you must all feel that your work is often almost entirely frustrated by the very early age at which the children are withdrawn from your schools. I am sure that you who have not been mere speculators, but have been mixed up intimately with the great work, cannot look at the enormous efforts made during the last 20 years for the improvement of the education of the people without feeling bitterly how much money has been wasted, and how much of the reasonable expectation of parents and children has been blighted and destroyed, because what is called education has terminated at an age when the children were still babes. I hope you will see that you, as schoolmasters and mistresses, can render a most important service to the country if you will look fairly into the question of the education of adults. I believe myself, that this is now the most important part of the great question of popular education. Every difficulty under which elementary education labours would be diminished if we could provide for this want. Take the condition of the parents of your children. What is it you all feel? A want of appreciation on their part of what you are doing. What is the cause of that? Simply that they are unable properly to appreciate the value of education, because they themselves are uneducated. I have no doubt many of you are in the habit of setting your children lessons to learn at home, and if, in the selection of those lessons, you give those which can be interesting and useful to the parents, you find it a great advantage. But what I want you to see is, that when the children leave your school at the age of ten or twelve, you should not part with them altogether, but still keep alive the interest you have in them, and which, at that moment, they have in you. The machinery which the Society of Arts is creating in all parts of the country, will enable you to go to the parents and say, "Do not let your children give up the blessings of instruction. It is necessary for the interests of your daily life to take them away from school, but let them not lose what they have acquired, but do something of an evening to carry on the work which has been begun." Here is a machinery by which such knowledge may be turned to practical account. There is one important point to which I have not yet referred. I have told you that the Local Boards have to sift the candidates who desire examination, and let me say, in passing, that you, the schoolmasters, may give most valuable aid to this work if you will serve, as in many places you do, upon these Local Boards. We suggest to the Local Boards that, besides doing the work for the Society of Arts which I have aleady described, they might usefully institute examinations of children, say between thirteen and sixteen years of age, so as to keep up their interest in learning until they reach the age at which the Society of Arts Examinations are available. You might then say to parents, "You talk of removing your child from school; but, if he remains a little longer, he will get a certificate, and perhaps a prize." This would do much to retain the child in the school; or, if he has left it, he may be induced, with the same end in view, to attend an evening school, and so, by degrees, he will be led on to the age of 16, at which time, having undergone his examination in the "little goes" of the Local Board, he will be prepared to enter upon the "great go,"—the Examination of the Society of Arts. One of the great evils which the system of elementary education suffers from at this time is what is called the religious difficulty, which prevents the friends of education from combining. I am not going to enter into that subject now. I only allude to it with one particular object, that is to say, that by the present system of the Committee of Council on Education, although there are collective examinations for pupil teacherships among the pupils of different national schools, among the pupils of British schools, those of Roman Catholic schools, and so forth, each apart from other denominations, there is no possibility of the different schools being compared. We have no means of knowing which of the educational systems adopted by the different religious bodies produces the best educational fruits. If we succeed in persuading Local Boards to conduct annual examinations of all children between thirteen and sixteen years of age, the result will be, that while there will be no interference in the internal management of the schools, we shall see which system produces the most advantageous results, and I have not the least doubt that any one of the religious bodies engaged in education would be glad to borrow from any other anything which, on comparison, proved to be the best. To revert to our Final Examinations, our list of subjects is a long one. There are 25 different subjects, and my own impression is that instead of having this number reduced, it might be extended, because I believe that those who wish to improve the education of the country, and to place it upon a sound and beneficial basis, must offer the most unrestricted curriculum of studies possible. I was the other day at a public meeting connected with these Examinations of the Society of Arts. There was a large number of working-men present, and after a great deal had been said, a very learned and clever gentleman made a speech, in which there was much that was interesting, but in the course of it he expressed his apprehension that the people of this country were in danger of being over-educated, and he told us a story which he thought was very lamentable indeed. It appeared that there had been a recent inspection of schools in his neighbourhood, and the schoolmaster was foolish enough to be disappointed because the Inspector refused to examine the children in Conchology! I felt disposed to sympathise with both parties. I sympathised with the Inspector who was in a position of difficulty, because I have not the least doubt he knew nothing at all about Conchology, otherwise I think he would not have disappointed the schoolmaster and the children. And I certainly sympathised with the schoolmaster, for though Conchology is a long and learned word, which might frighten some people, the meaning is a very simple one, and it is very advantageous for little children to understand the natural history of the shells and of the creatures contained in them, which it has pleased God to present to our eyes and understanding in all directions throughout the world. I believe there is no subject, next to the highest subject, Religion, which it is more beneficial for the children to understand than natural history. It gives them a habit of observation and a quickness and correctness of eye and hand and mind which are invaluable. In reference to our list of subjects, some of our friends are apprehensive that it is not so useful as it might be in the real education of the mind, because the subjects are of so practical and mercantile a character, while others refer to them as not sufficiently practical and mechanical for poor persons. I do not say that these objections neutralise each other, but I believe they are both capable of being got rid of. To take the last first, I think that the candidates, being adults, are the best judges of what they like to learn and what they find useful to them, either in their calling or in their hours of leisure. And when we find, as we do find, that people engaged in what seem very mechanical operations, as that of a butcher, have obtained high certificates and prizes in Latin, I think we may conclude they were very good judges of what suited them best. I think we take a low view of the advantages to be derived from education,

if we do not take into consideration its effects on the occupation of leisure. I ask myself what would be the character of our leisure if we were as uninstructed as a large number of people are. If we could not easily read, if art were a blank to us, if science were darkness to us, and if every subject of political and social science, which is now interesting to us, were unknown, what would be the character of our leisure hours? Therefore, when I find people occupying their leisure in reading Latin, or anything else which is improving to the mind, I have an unmixed satisfaction. On the other hand, some persons object to some of the subjects, such as arithmetic and book-keeping, as not being of a character to raise the tone of the mind. This is an objection easily met. There are many persons constantly failing in business simply for want of a good knowledge of book-keeping and arithmetic. A knowledge of book-keeping and arithmetic is a necessity for every person intended for business; and if you had a son who was to be a clerk or a book-keeper, would not those subjects be among the first that you would wish him to study? Moreover, upon looking over the list of persons who obtained certificates in 1858 and 1859, I find that rather more than one-third of those who obtained certificates in arithmetic and book-keeping in 1858, presented themselves again, and obtained certificates for history, Latin, French, chemistry, and various other subjects in 1859. It appears to me that by the encouragement we give to these persons we put them upon a course of improvement in which they are likely to proceed to a late period of life. Besides the prizes to candidates we give prizes to the Institutions whose candidates obtain the first prize in each subject, provided the candidates have studied the subject for which they get the prize, in the Institution. In addition to that we give prizes to the local boards, to induce them to sift their candidates well. Schoolmasters and schoolmistresses might have the opportunity of coming to be examined—if members of the Institutions, without any fee—and if not members, at a fee of half-a-crown. You must be better judges than I can be, whether it would be an advantage to you to undergo an examination and obtain a certificate. One advantage, at least, would certainly result from your undergoing the Examinations, as they would give to the public a test whereby to judge of the value of the certificates which you obtain from the Privy Council. At all events, you can do a great deal to make this system known in your neighbourhood, and to move the friends of education and the managers of schools to establish Local Boards, and also to induce your old pupils and intelligent persons with whom you are acquainted, to prepare themselves for such an examination. You cannot but be aware that the whole system of education in this country is likely in the next two or three years to be reconsidered, and perhaps to a certain extent to be readjusted, while the condition of school-masters must in some respects be modified; so that whereas now you have certain advantages and restrictions, it is within the range of possibility you may lose some of the advantages without losing the restrictions; or, on the other hand, you may lose the restrictions and retain the advantages. But I am quite sure you must see that, in connexion with the education of adults, which is becoming so very important a matter in this country, there is much which may seriously affect the career of the schoolmaster. You at present are restricted in your operations, not being allowed to afford instruction to adults of an evening, but I can easily conceive of a different state of circumstances, under which it would be very agreeable and advantageous to the elementary schoolmaster to discharge his duty in the instruction of adults in the evening, as well as of children in the morning of the day; and I cannot but think that that promotion to which all of us must look, may be found in some degree by schoolmasters in connexion with adult education.

In reply to an inquiry,

Mr. Chester said that these examinations were open to females on the same terms as to males. In several places females have been examined and have obtained certificates. This had been specially the case at Bristol, where a Local Board had been established under the presidency of Canon Girdlestone, and many governnesses had found it desirable to get certificates of the Society of Arts in Music, French, &c. The competition was open to women upon the same terms as to men. The Society for Promoting the Employment of Women was engaged in forming classes with the special object of teaching women to prepare for these examinations. He (Mr. Chester) believed that the whole question of the employment of women was one of education, and that if they were well educated there would be no difficulty in their obtaining suitable employment.

Mr. Hay inquired how a Local Board should be formed where at present there was no Institution in connexion with the Society of Arts?

Mr. Chester said it should be composed of the principal friends of education in the district, and the steps to be taken for its formation would be the same as in the establishment of a new school. It was better that the Local Board should not depend upon a single Institution; it should, as far as possible, represent all the educational establishments in the district.

Mr. Hay asked whether the Committee of Council would step in with any restrictions, and how a schoolmaster, holding a certificate from this Society, would stand with them?

Mr. Chester replied that he could not undertake to answer for the Committee of Council, but he thought they had nothing to do with it. If a schoolmaster thought that he ran any risk, he must ascertain it for himself. There was no connexion between this Society and the Committee of Council, but it must not be supposed that therefore there was any antagonism.

Mr. Runtz thought he was under some misapprehension as to Mr. Chester's remarks. He understood that the examination for the junior branch, from 13 to 16 years of age, was for children in day schools in places where there were local boards.

Mr. Chester replied that the Society of Arts did not examine children between 13 and 16, but they pointed out to the local boards that they might usefully prepare candidates for the Society's examinations by examining such children themselves, and giving them certificates and prizes.

The Chairman said it must be clearly understood that the examination of children under 16 could not be undertaken by the Society of Arts, but Mr. Chester had introduced it as a necessary part of the subject, and he was quite sure the meeting would estimate, as highly as Mr. Chester did, the value of any method by which the connexion of these young persons with the schools should be preserved after the age of 12 or 13, when they usually left them. If by such a method as had been suggested, the interest of those young persons in their own improvement could be maintained, a most important aid would be given to the cause of adult instruction. With regard to schoolmasters, it was not by any means sought to impose upon them duties inconsistent with their work. Their sympathies, their suggestions, their aid in promoting local organisation, was what the Society of Arts desired to possess. In this country it was by the spontaneous growth of local action, and not by any central mechanism or central authority, that this work was to be done if done at all; and if those present would assist by urging the friends of education in their several districts to form Local Boards, they would very much contribute to the success of the work.

Mr. Chester would only add to what the Chairman had well said, that the work of Local Boards was not continuous nor onerous. Their duties were to be discharged by the examination of the children once a year (if they thought fit), by the previous examination of the candidates once, and by supervising the working of the papers in the final examinations once. He had seen with great pleasure in

many localities that schoolmasters were members of these Boards.

The Chairman gave an account of his own experience with regard to prize schemes for children, which had been found very beneficial.

Mr. Runtz asked whether, while the children were pupils in their schools, they could establish a Local Board, and let them get certificates after examination before they went out into situations; and, also, whether there would be any objection to a number of schoolmasters in a district forming a Local Board for the purpose, and whether such a Board would be recognised as in connection with the Society of Arts.

Mr. Chester said certificates of such examinations must be issued on the authority of the Local Boards only.

Mr. Hawes said he understood the point of the inquiry to be whether a Local Board could be formed to examine children from 13 to 16 years of age. This might be done by such a board on its own authority, it being clearly understood that the examinations of the Society of Arts did not begin till the age of 16.

Mr. Tremenhere said it occurred to him, while listening to the excellent address they had heard, that a small addition might be made to an old proverb, and he would say that though a rolling stone gathers no moss, a rolling idea does. When, in 1850, he first set rolling the idea of forming groups of elementary schools for the purpose of examination, and of bringing out the results before the public—which had been alluded to by the Chairman, as "prize schemes"—he did not contemplate that that idea would, like a large snow-ball, roll on and on until it assumed its present dimensions, mainly, as it had done, through the instrumentality of his valued friend, Mr. Chester. In listening to the observations that had been made in reference to bringing the elementary schoolmasters in connexion with the Society of Arts, by means of Local Boards, he did not see that there was any material distinction between what might be done in that respect in London and elsewhere and what was done through the instrumentality of the prize schemes. It might be said that in everyone of those cases Local Boards were formed. They consisted of a number of leading gentlemen in the neighbourhood who were interested in education, all of whom subscribed to form the fund for prizes, and they were cordially seconded by the schoolmasters in the district. Those districts were sometimes very large. The last example which he remembered was one formed a year and a half ago in the diocese of Oxford. The first examination embraced candidates from 116 schools, and no less than 665 candidates were examined. If such an association could be formed to embrace the diocese of Oxford, he did not see why many could not be formed to cover the area of London, or any other large town or district. There were no less than twenty-three prize schemes at present existing. The experience of the past showed that the principle was sound, and capable of very general application. He would be very glad, if through the efforts of the schoolmasters of London, something of the kind could be formed in this locality. He thought if they would, in their respective localities, communicate with those gentlemen who had taken the most active part in the cause of education, it would not be more difficult here than elsewhere to form large groups of schools. They might contrive means to examine candidates, certainly some under 13, but many of the age to which his friend (Mr. Chester) had referred. After the children had been accustomed to prepare for such examinations, and had distinguished themselves in them, it was fair to infer that there would be a nucleus of young men and young women who would be stimulated to continue their instruction after they had left school, and would be just the class likely to enter into the competition proposed by the Society of Arts.

Mr. Hawes said it must be clearly understood that the Society of Arts had an ample field for their exertions in the examination of candidates above the age of 16. But they asked the Local Boards to keep up the connexion between the children of the ages of 13 to 16 and their instructors, so that by the time they arrived at the latter age they might be fit to come before this Society for certificates and prizes. Let it be remembered that though the examinations of this Society were not exactly competitive, there was competition enough to stimulate the most active exertions of those who were about to be examined. One feature of importance, and which had not been referred to sufficiently, was that it embraced the examination of young women upon those subjects which were most likely to be useful to them, whether married or single, and in whatever station of life they might be placed. He believed that the improvement of the general health of our juvenile population would be greatly promoted if young women would study those subjects which would give practical information bearing on sanitary questions. The great social difficulty at the present moment appeared to be how to employ young women consistently with those other duties which God had placed within their sphere, and he thought that this would be an important step towards solving that difficulty.

Mr. Crampton said the principle of these examinations appeared to be a most valuable one as applied to the schoolmasters' work, and he should like that they should share the countenance of this Society in forming such associations as those to which Mr. Runtz had referred.

Mr. Chester said the Society of Arts would not discourage the efforts of schoolmasters to form local boards, but it would not be desirable to confine them exclusively to schoolmasters, or, indeed, to any one class.

Mr. Bithell said the prize schemes were confined to schools receiving aid from the Government. If he understood aright, the Local Boards now proposed were to include schools of every denomination, whether receiving Government aid or not. He thought, therefore, there would be a liability to confusion in having the same Boards.

The Chairman said that in some prize schemes it was not necessary that the children should be educated in Government schools, and in some, provision was made for those children who had left school and desired to pursue their own improvement.

Mr. Graham referred to the importance of girls being educated in subjects more immediately connected with domestic economy, and in reference to the formation of Local Boards, expressed a hope that no selfish feelings would influence the schoolmasters as a class, but that in their several districts they would endeavour to get the most influential persons to take part in the movement.

Mr. Daintry said there were now two schemes before the meeting—the Prize Schemes and the one proposed by the Society of Arts. He was afraid they might clash if the matter were not fully understood. He did not see that there was any mode of direct action with this Society, except in reference to youths above 16 years of age.

Mr. Chester said, as the major included the minor, it was evident that, if the Local Boards could conduct Examinations for the Society of Arts, they might also have Prize Schemes, or do anything else which, in their judgment, was expedient. He would read the memorandum at page 12 of the Programme, which referred to this subject:

"It has been resolved that it would greatly promote the interests of public education, and the success of the Society's Examinations, if the Local Boards were to act as administrators of what are now well known as Prize Schemes for children between 13 and 16 years of age, so as to induce them to continue their instruction between the time at which they usually leave their elementary schools and the time at which they become admissible to the Society's Examinations."

Mr. Shields said, that while recognising the right of the Society of Arts to limit their Examinations, and justifying the determination in their own minds, as they regarded the magnitude of the work which the Society had undertaken, it should not be a reproach to the schoolmasters

present if they evinced a considerable anxiety in reference to the children before arriving at the age when they were eligible as candidates for examination by the Society. He believed that, whatever those present could do to help forward the plan proposed by the Society they would do, and he hoped that if in the difficulty in which they found themselves in reference to their elder boys, they should turn to the prize schemes for assistance, they would be regarded as working, if not in conjunction, at least with the approbation of this Society.

Mr. Hawes, in explanation, said that the Society of Arts began this scheme for the purpose of encouraging adult education. In doing so they had to fix a point at which they would come downwards, and they fixed upon the age of 16. On the other hand, the schoolmasters present were looking at what was to be done upwards, and this was just the difference. It was desirable that there should be no misconception as to the feeling of the Society in reference to the work of the schoolmasters. The Council knew that they should have no chance at all in their efforts if it were not for them. It was to the schoolmasters they looked for support; it was upon the foundation they laid that the superstructure to be built by the Society must be reared.

Mr. Tremenheere said this subject could no doubt be better discussed by elementary schoolmasters, if the Committee of Council placed no restriction upon them as to teaching in evening schools, because the schools promoted by the Society of Arts were eminently evening schools. It was not for him to give an opinion upon the proceedings of the Committee of Council on Education, but they appeared to him to have a very important bearing upon the subject before the meeting. There was some misconception with regard to the limitations of the prize schemes. When first founded, they were in connexion with church schools, but after a short time it was found possible to merge the whole body of schools into one, and very gratifying results had ensued. Many of them were now conducted quite independently of the Government on the point of examinations. In truth, the great proportion of the twenty-three which existed found their own examiners, and he apprehended that would be the course taken with the majority of those which might hereafter be framed.

The Chairman, in bringing the discussion to a close, said that he could not but express his own gratification, and that of the Council of the Society, that the meeting had been attended by so large and influential a body of the schoolmasters of the metropolis. He believed that there was no body of men who, whether permitted to teach in evening schools or not, could so materially contribute to the progress and extension of the Society of Arts' Examinations as they could, although it might be that their connexion with the persons who came up to be examined had been severed for many years. There were no persons whose sympathies young persons more valued, and for whose opinion they had a higher respect. He felt assured that in so far as the schoolmasters could aid the Society of Arts in stamping, with a given and definite value, the efforts which those young persons took to gain accurate knowledge, by devoting to study the time which others gave to the amusements of life, they would most willingly and cheerfully accord it.

On the motion of Mr. Runtz, seconded by Mr. Hay, a vote of thanks was given to Mr. Chester, and a similar compliment to the Chairman terminated the proceedings.

NINTH ORDINARY MEETING.

Wednesday, February 1, 1860.

The Ninth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 1st instant. Sir Thomas Phillips, F.G.S., Chairman of the Council, presided.

The following candidates were balloted for and duly elected members of the Society:—

Benedict, Jules.	Le Breton, Francis.
Bernays, Dr. Albert J.	McFarlane, Walter.
Buist, Dr. George.	Newcombe, W. L.
Burrell, Thomas Houghton.	Page, John.
Dawson, Thomas.	Plimsoll, Samuel.
Hall, Ralph.	Radcliffe, Thomas.
Hewitson, William.	Ross, J.
Johnston, George.	Rowbottom, Rev. Frederick.

The Paper read was—

ON THE ARTS AND MANUFACTURES OF JAPAN.

By D. J. Macgowan, M.D.

My first introduction to you was through the late Sir G. Staunton, who communicated for the *Journal* of your Society a paper of mine "On the Artificial Pearls of China," which he had received from Sir John Bowring, in compliance with whose suggestion the paper was drawn up. Now that I have the honour of presenting myself in person before the Society of Arts, it may seem that China, where I resided so many years, should be my theme rather than Japan, which I have merely visited. But the Land of the Rising Sun, being a *terra incognita*, presents many features of striking interest, and is a country withal which is now attracting the attention of every class of thinking men. Viewed from any stand-point it is a remarkable country. The geologist finds it a focus of volcanic action, where there are more volcanoes in active operation than in any other part of the earth's surface of the same area, and nowhere in the same area will be found such a variety of metalliferous wealth. Extending as it does through 23½ degrees of latitude, and traversed by lofty mountains, extending in some cases above the snow-line, it affords to the botanist a wide field of discovery, and some of its forest trees, judging from the timber one meets with, must be new. The zoologist also, will find in the lower scale of animal existence not a little that is novel and interesting. So also the ethnologist, the politician, the statist, and the Christian philanthropist, each find matter of peculiar interest in the study of this singular empire. In the lectures that I have been delivering in Scotland I have endeavoured to afford a view of Japan inclusive of all these subjects, as well also as some information of interest to the merchant and artizan.

This the industrial branch of my discourse is an appropriate subject for discussion before this scientific body. The specimens which I shall show you speak for themselves, proclaiming in unmistakable language the high civilization of the Japanese race. They would seem to say to the manufacturer, and to the merchant, these people have no wants; they seem to afford arguments in favour of tariffs and a restricted policy, as, in consequence of the long seclusion of the Japanese, their ingenuity and industry have been stimulated so as to make them almost wholly independent of the rest of the world. This last point trenches upon politics, and I must dismiss it without discussion. As regards the prospect of a market for some products of Western industry, I presume that I am safe in saying, that their advance in civilization and the Arts is a better augury than if we had found them in a semi-savage state, our best customers probably being those people who are themselves farthest advanced in the industrial arts.

I cannot better introduce the subject than by showing this Japanese work, an encyclopædia, entitled "The Wonderful Productions of the Seas and Hills," evidencing, by the subjects treated and the merit of the typography, their advance in arts and knowledge, filled with spirited cuts of almost every industrial pursuit, commencing with mining, and concluding with whaling, an operation in which we find seamen and shore-men jointly engaged, the former wielding harpoons, the latter employing huge nets.

Let us, in imitation of our methodical encyclopœdist, commence with metallurgy.

Gold is abundant in Japan, bearing the relation to silver as 1 to 5, instead of as 1 to 15, as elsewhere. Indeed, the last mail brings intelligence to the effect that silver had been exchanged for gold, weight for weight. This in itself does not demonstrate the existence of extensive auriferous deposits; the abundance of the metal may possibly be the consequence of gradual accumulation, being pent up, as it were, by the system of seclusion so long persevered in by that sagacious people.

These volumes, six in number, afford another illustration of the advanced state of the arts in Japan. It is a work on Numismatics. The elegance of the coloured pictures of the various coins—gold, silver, and copper—of different periods and various principalities, is remarkable.

Gold-dust is found in the south of Jesso, in the province of Sado.

The silver coin, or *Ichibu*, is of a very peculiar figure. This metal is found in Dewa, Sado, and Tasimo. It does not appear to be abundant at present, but it promises to become so, from the dollars that are pouring into Nagaski and Kanagawa from China, Japan coming in for a large share of the drain of silver to the East that now attracts general attention.

Japan, as is well known, is remarkable for its richness in copper.

The first thing which attracts the traveller on landing is the great abundance of this metal and the plentiful manner in which it is used. The gutters and shutters for the houses are of copper; the pillars and verandahs are protected with the same metal. The monumental gateways in the cities are often of copper, and the idols in the temples are formed of the same material; and even before landing the traveller would notice that the vessels are sheathed in all parts with copper—in many instances more for ornament than for use. If restrictions were not placed upon the exportation of that metal from Japan the markets of the world would be glutted with it for a time. The Japanese are very expert in blending copper with other metals, as shown by the various specimens of bronzes before you.

In iron the Japanese are most deficient. Much of their iron is obtained, as in some parts of China, by washing the sands of the rivers. In the summer season multitudes of men, women, and children, may be seen washing the sand, and they take all this pains to get a few specks of black oxyde of iron, which is subsequently melted and forged for the purposes of their manufactures. As might be expected from this state of things with regard to iron, their cutlery is of a very inferior description, with the exception of swords, which are in many instances very costly, both from their superior workmanship and the large amount of gold used in their ornamentation.

[Dr. Macgowan here exhibited specimens of native cutlery, including a pair of scissors, a carpenter's saw, and a file. From these specimens he imagined that Sheffield would find a market in Japan for her products. He also showed a small description of reaping-hook, which was stated to be almost the only implement used throughout the country for cutting down the crops of rice and wheat in harvest time. Dr. Macgowan also exhibited two costly swords, of Japanese manufacture, such as are worn in the girdles of the higher classes.] Attached to the scabbard of one of these swords is a small knife, used for what is known as the Hari-kari, or "happy despatch," that is, self-evisceration.

It is stated that these swords will sever a nail without being notched. They are made out of good bar-steel, and tempered by being covered with a paste consisting of powdered porcelain, charcoal, and potash, dried in the sun, brought to a white heat, and then plunged into tepid water. The shagreen on the handle, the massive gold ornamentation, and above all the singular mode of combining gold and iron in decorating the hilt, are all worthy of notice.

There are also mines of antimony, tin, lead, and mercury, and perhaps no country in the world of the same area presents so many volcanoes in operation. Sulphur, of course, is very abundant. But, what is more important for civilisation and Christianity as well as for the commerce of the Pacific, coal is found in considerable abundance.

This precious mineral, so necessary for the commerce and civilization of the Pacific, is found in nearly all the islands which girt Eastern Asia, from Borneo to Sagalien. The first-named locality has fallen into the hands of the British, the last named, probably the richest, has become Russian property. The Chinese in Formosa and the Japanese at home, will, it is to be hoped, furnish supplies of coal, should either of the others fail for a season. I have visited several of the mines in Japan, and am inclined to attribute the inferiority of the mineral to unscientific mining. The Japanese themselves have not been insensible of this, and at once ordered, through the Dutch, suitable machinery, but either the machinery was defective, or the requisite skill was wanting for rendering it available. I saw some of it rusting at Desima, and found the miners labouring at every disadvantage, under circumstances, I may add, calculated to throw doubts on the glowing accounts that have been rendered of the comfortable condition of the labouring class in that country.

On the coast of Fizen, I believe, there is as much suffering amongst the labouring classes of Japan as in any part of the world. I have seen them, on a bitter cold day, the children naked and the women nearly so, crawling on all-fours up a hill side, dragging small coal-cars attached to their loins, and I longed for the time when machinery would be brought to their aid.

Japan extends through 23½ degrees of latitude, having mountains of great altitude, rising, in some cases, above the snow-line, with a very fertile volcanic soil, with deep ravines, dense forests, and declivities which are inaccessible to the operations of even spade husbandry. These form the rich botanical regions of the country. Our shipmasters and carpenters are very much struck with some kinds of timber found there, specimens of which I have before me. One of these is particularly hard and heavy, and is almost as strong as iron.

[Dr. Macgowan here produced a carpenter's plane which was made of this wood, and explained the manner in which it was used by the Japanese workman.]

In this respect, as in almost all other mechanical operations, practices contrary to those of the Western world prevail throughout nearly every portion of China and Japan. For example, the carpenter planes from without inwards, instead of from within outwards, and the tailor sews from himself instead of towards himself.

The wood of which this plane is made would be very valuable to us if it could be procured in sufficiently large quantities, but I believe the tree has not yet been seen by any competent observer. The Japanese pine is also well worthy of notice.

One of the most remarkable products is the vegetable wax, several cargoes of which have already arrived in this country from Japan.* It is said that the first adventurer in that article sold his cargo at 100 per cent. profit. The Japanese, having discovered this wax to be a valuable article of commerce, seemed, when I was in the country, to be making arrangements for cultivating more largely the trees producing the berries from which this wax is expressed; and, with improved machinery, this article could, no doubt, be produced more abundantly and more cheaply. The berries, after being boiled, are subjected to heat and pressure; the product requires protracted bleaching before it arrives at the white state in which it is sent to our markets.

I will now draw attention to the substance known as "Japan," a kind of varnish, extensively enployed for giving an almost vitreous appearance to wood and metals. I believe I have here the first unadulterated specimen which

* See *Journal*, Vol. vii., pp. 424 and 611.

has reached this country. It requires a great deal of manipulation before it can be applied to the various articles for which it is intended.

I should have had more specimens if I had not had so much difficulty in getting them through the Custom-house here, against which, as a traveller, I feel certain prejudices; for I believe Custom-houses and tariffs to be more inimical to the progress of civilisation, Christianity, and kind feeling throughout the world, than forts and arsenals, armies and navies.

I will now draw attention to a tree of peculiar interest, known as the paper mulberry, from which paper is very extensively manufactured in Japan. The manifold uses to which paper is applied in that country are very remarkable. From it substantial umbrellas and parasols, as well as great coats, of a most useful and durable description, and wholly impervious to wet, are made. From the same material is manufactured twine which is capable of sustaining great weight. On the other hand, some of the paper is so fine as to be capable of producing fabrics as soft as cambric, employed for pocket handkerchiefs. I have here some specimens of what is called woven paper. Papier-mâché manufacture is also carried to great perfection.

I will now show you some specimens of the "eggshell china," of a most delicate character, together with coarser descriptions of porcelain, the products of Japan. The transparency, lightness, and beauty of the former are most remarkable. The Japanese have also a peculiar method of combining glass and porcelain with the finest wicker work, so as to form small cups and other articles.

I have here a lyre, about four feet long, which is capable of being taken to pieces and packed in a very small compass. Similar portable articles, such as folding candlesticks and lanterns, are in common use in that country.

As a specimen of the surgical appliances, you will note the ingenuity of the shampooing instrument, with rollers, which produce an agreeable effect when in use.

I will now speak of the textile productions of the country, and I have here some remarkable specimens of cotton and silken fabrics. Cotton is largely cultivated, and the common people are clothed in it to a great extent. The manufacturers of Manchester will very probably find a market for their produce in Japan. The Japanese sandals are the most cumbrous articles possible, being held in their place by a pin clasped between the toes. Their recent adoption of foreign naval and military tactics has necessitated the introduction of the ordinary leather shoe, a cargo of which arrived while I was at Nagasaki. Judging by the character of their stockings, the English woollen manufacturers will also find a market in this article.

The Chinese, the Japanese, and the Aztecs, in former ages were known to possess the art of weaving feathers, but it now only exists in history.

I have here a gorgeous head-dress, formed of feathers laid on tinsel, which may be regarded as a vestige of the ancient plumagery. Some of the English artisans might, perhaps, derive some valuable hints from such a specimen as this.*

The Japanese have carried the typographic art to considerable excellence, as is evidenced by the books before you, particularly the coloured pictures and maps.

There is not a town of any importance which is not provided with its map defining with great accuracy all the streets and principal buildings. This is especially the case with Jeddo, the port of which (Kanagawa) has been thrown open to commerce by the recent treaty. A map of the empire, which I have here, has all the principalities variously coloured, and the lines of latitude and longitude accurately marked.

A very large traffic is carried on with China, in various descriptions of seaweeds or marine algæ; some specimens of which, when mixed with milk, make a most beautiful blanc-mange. Having noticed that a premium had been offered by a member of the Society for a treatise upon marine algæ, I have no doubt this specimen will be very interesting. When I received it from the hands of the manufacturer it was perfectly white, but has now become discoloured.*

Numerous other articles of interest were exhibited and explained by Dr. Macgowan, particularly a clock, showing the method in which the Japanese compute their hours, which vary in length according to the season of the year, being calculated from sunrise to sunset.

The prospects of Japan, in a mercantile point of view, are different from what was anticipated. The foreign commerce of Japan having dwindled down on the part of the Dutch to a single vessel per annum, and on the part of the Chinese to less than half a dozen junks, no great expectations were formed respecting the trade of that country, and now no small surprise exists at its rapid rise. This is not so apparent to observers here as in the East, for the principal trade is with China and the Straits. If they have not as yet made many purchases of English and American goods, there can be no doubt of their soon acquiring a taste for many articles not now in use. Being rich in many things, they will discover new wants.

One sombre cloud looms ominously in yon Eastern horizon,—it is charged with an element fatal to the best interests of Japan, and, consequently, to be deprecated as inimical to the general interests of those who seek her commodities, or who find in her a customer. We all admire the wisdom of the shopkeeper, who, when his son was called out on service as a militia-man, in quelling a riot, entreated him to "spare the customers." Now, as the well-being of any state with which we have intercourse is in no small degree blended with our own, we must deplore and suffer from the degradation of any large community. It is clear, at least to my mind, that if "China-bane," I mean opium, should be sent to Japan, we shall be disregarding the injunction to "spare the customers," for we shall, in fact be poisoning them, and by so doing we shall ourselves suffer, directly or indirectly, sooner or later.—To employ a trite phrase, "it will not pay." It is capable, I think, of demonstration, that it does not pay in China, but that comes not under our consideration this evening, nor is the present a fit occasion for adverting to the moral and political bearings of this question—It is only incumbent on me at the present time to call attention to the prospective influence of the introduction of opium upon our intercourse with the Japanese, and to express the hope that Christian governments, so called, and an enlightened public opinion, will co-operate with the Japanese in averting the opium traffic from that country, for they are an amiable and unoffending race. Whatever may be adduced in extenuation of the traffic, or in palliation of the use of this drug, there is this damning fact staring us in the face (a fact elicited by my professional investigations), that this aphrodisiac speedily destroys the procreative power, acting as a check upon population, less from abbreviating life than by emasculating those addicted to its use. The Japanese being sensual, no ordinary vigilance is called for on their part and on ours, to prevent them from becoming the victims of that fascinating drug.

In conclusion, I will mention that I am about commencing in this country the delivery of courses of lectures on Japan generally, which I have already given in various parts of Scotland, with some success, if I may be allowed to say so.

At the conclusion of the paper,

The Chairman said he would now propose that the meeting should authorise him to present their thanks to Dr. Macgowan for his very interesting address, and for the valuable information he had afforded as to the condition of a very remarkable people, of whom heretofore they had had a very imperfect knowledge. Its interest to them as a commercial nation was considerable; its interest to them as a Christian nation was still greater; and, whilst they saw in

* See paper by Dr. Macgowan, *Journal*, vol. iii., page 93.

* See *Journal*, vol. v. p. 657.

the intercourse of mankind that commerce was largely the agent of civilisation, and would probably be more so, it was impossible that we could give too great thanks to those of our own country, or of our own kindred on the other side of the Atlantic, who had come forward to assist us in understanding what was the condition of the people with whom we had to deal. It was clear from the address they had heard, and from the various specimens introduced, that in industrial skill the Japanese were a nation very far advanced. No one could look at the products shown that evening without feeling that we had something to learn even from Japan. Perhaps the most beautiful article exhibited, was the delicate specimen of ceramic production. That porcelain was, he thought, the most delicate he had ever handled. With regard to the social position of the Japanese people, Dr. Macgowan had somewhat obscured the brilliant colouring in which the natives of Japan had been held out in the very interesting letters which appeared in the public papers some time ago. It was quite evident that Dr. Macgowan did not regard those pictures as faithful representations of the condition of the people of Japan. He (the Chairman) thought it was highly probable, judging from the specimens exhibited, that the Japanese were acquainted with the art of colouring maps long before it existed in this country. With regard to the surgical appliances shown, it was remarkable that the inhabitants of the most civilised parts of Asia were acquainted with a large portion of the surgical science of their own time, and it might be from their discoveries that the Japanese derived such surgical knowledge as they possessed. He now begged to propose that the best thanks of the meeting be given to Dr. Macgowan for the very pleasant evening he had afforded them, and he would express a hope that that gentleman would be permitted to instruct, inform, and amuse a large portion of the people of this country in the subsequent lectures which he understood it was his intention to deliver.

The vote of thanks to Dr. Macgowan was then unanimously passed.

The Secretary announced that on Wednesday evening next, the 8th inst, a paper on "On the Extended Production of Sheep's Wool and Hair of the Angora Goat," by Mr. Leonard Wray, would be read.

INSTITUTION OF NAVAL ARCHITECTS.

The second meeting of the officers and promoters of the Institution of Naval Architects was held at the house of the Society of Arts on Monday evening (by permission of the Council), and was attended by Dr. Woolley, Mr. J. Scott Russell, F.R.S., and Mr. Penn, Vice-Presidents; Messrs. Chatfield, Fincham, Grantham, Maudslay, Robinson, Samuda, Thornton, and Turner, Members of Council; Messrs. Barnaby, Barnes, and Crossland, Members; and Mr. E. J. Reed, the Secretary. The reports of the business committees were adopted, together with bye-laws and regulations for the government of the Institution. The rules provide for the payment of an annual subscription of two guineas by each member and associate, or, in place of an annual subscription, a single payment of not less than thirty guineas. They also require that every candidate for "membership," shall submit to the Council a set of drawings and calculations of a ship. No such requirements will, however, be enforced in the case of Associates. It was decided on Monday evening that the reading of papers should commence about the 1st of March. The thanks of the meeting—which was very cordially conducted—were voted to the Society of Arts for the accommodation afforded to the New Institution.

EXHIBITION IN CANADA.

The *Canadian News* says:—"The idea of a Grand Provincial Exhibition has been very happily suggested on the inauguration of the Victoria Bridge next summer, and the anticipated visit of one of the royal princes. This occasion will attract thousands of visitors from abroad, and nothing would convey to them a better idea of the resources and industry of Canada than a provincial exhibition on a large scale. The show made by Canada at the universal exhibitions of London and Paris was of great importance to the province in calling attention to her natural wealth and progress in industry, and it is well observed 'that upon our own soil we should be able to make a greater and more perfect display; while the occasion would be such as would induce the largest amount of exertion by the whole country, with the prospect also of the enterprise being in a great degree self-sustaining.'"

BITUMENISED PAPER TUBING.

An experiment was recently made under the Great Clock Tower, Westminster, for trying the strength, by hydraulic pressure, of a new description of tubing, composed of bitumenised paper, invented by M. Jaloureau, of Paris. M. Jaloureau is a contractor for paving Paris, and other towns in France, with bituminous concrete. It happened, in the course of his experiments, that some paper which had been coated with bitumen was laid aside in a coiled form, and after some time it became very stiff and solid. Pursuing the idea which thus accidently occurred to him, M. Jaloureau put several layers of bitumenised paper round a cylinder, and submitting them to internal pressure, he found that a tube a quarter of an inch in thickness was capable of resisting a pressure of 250 lbs. to the square inch. The municipal authorities of Paris tried these tubes for the conveyance of gas, and in the recent experiments made here a piece of tube was produced, which, though stated to have been under ground in Paris as a gas pipe for twelve months, had the appearance of being a new pipe. The tubes subjected to the pressure of the hydraulic pump, bore a strain of 250 lbs. to the square inch without bursting, which is more than they would be ever called on to bear in ordinary use. One of the tubes, half-an-inch thick, and with a bore of two inches, was also tested by weight, and it only gave way to a pressure of 428 lbs., the bearings being three feet apart. It was stated that the tubes might be submitted to a temperature of 160 degrees of Fahrenheit without any deterioration of the material. The cost of the tubing is said to be less than half that of the ordinary iron piping. Messrs. Paul Joske and Alexander Young are the patentees of the invention in this country.

Home Correspondence.

SCIENCE IN OUR COURTS OF LAW.

Sir,—I have asserted the high mental cultivation of scientific men as a body, and have desired for them a corresponding high position in courts of law. Dr. Odling says I have calumniated them. It is certainly somewhat unfortunate that he should have made such an assertion without first understanding my object. I gave some blame to scientific witnesses—but chiefly blamed the law. Surely I would not unreservedly calumniate the class to which I myself in part belong. My desire is in every way to elevate it. If that elevation cannot be attained, the progressive theory of society receives a severe blow. I expected aid—not opposition from men of science.

I am accused of charging certain scientific chemists with some crime of which I know them to be entirely innocent—men whose works I almost daily consult—men whom I greatly respect. This accusation is made, although I ex-

pressly state, in the passage alluded to by Dr. Odling, and partially quoted, that I did not allude to chemical questions at all.

I am told that I am a self-constituted critic. Is not Dr. Odling in the same category? If he is appointed by a body of men to advocate their cause, then I must remind him of what I said in my paper, that there is great danger of a scientific man losing the normal scientific condition of mind by becoming an advocate for a party.

Dr. Odling defends his own conduct in several cases; he speaks as if my words accused him, whereas I never heard that his conduct required defence. His unjust attack on me is the first fault I have known committed by him.

The remarks on evidence do not refer to any of my opinions.

I am not willing to be responsible for the *scholia* of others. My general meaning is clear, and I have no time to answer those who distort my views. I do not care even to support my views if better are produced.

Dr. Odling, an Officer of Health, speaks sneeringly of the "sanitarian confraternity." To me this sounds strange. Thoughtful men recognise a certain dignity even in degraded human nature. How greatly must that dignity be increased in men who have, like Mr. Chadwick, laboured successfully during their entire lives for the good of their country.

Dr. Odling concludes by recommending me, amongst others, to exercise "that charity which thinketh no evil." After such a letter as his, it was much needed. I will exercise charity by ceasing without being exhausted.

I am, &c.,
R. ANGUS SMITH.

Manchester, Jan. 30, 1860.

Sir,—When I spoke at the meeting the other evening upon the question of Science in our Courts of Law, I fear that in my anxiety to occupy as little time as possible, I did not sufficiently explain my views on that most important subject.

My idea is that the Government should organize the means of producing scientific testimony in our courts, in order to afford the community the assurance that in those very important cases where such testimony is needed, it shall have the best that may be gotten; and this assurance, it would appear can only be obtained by taking care to select such persons as testifiers as are well acknowledged to be competent for such office, and who shall be free, as far as may be, from any such temptations or bias as might lead them to do other than speak "the truth, the whole truth, and nothing but the truth," in the fullest and most emphatic sense of the words—in order thus to do away with the difficulty now experienced of laymen having to decide when "doctors disagree."

The *modus operandi* to secure this would seem to be that the Home Secretary (or the Minister of Justice, if we ever have one) should call upon the various scientific corporations and public bodies to prepare lists of fit and proper persons to give scientific testimony in the courts. For instance, in medical cases, one would say the Colleges of Physicians and Surgeons. In non-medical cases, the College of Chemistry, the Institutes of Civil Engineers and British Architects, and others. In Patent matters this business should, perhaps, be entrusted to the Commissioners of Patents, provided they consulted these bodies.

When any Law case might require the production of scientific testimony, then each party in the case should be at liberty to nominate one of the persons in the lists, or more persons than one, in case the question at issue should involve more than one branch of science, and a third or extra name should be added by the Court, such name to be subject to be challenged, like the name of a juror. These persons should meet together, have access to documents, papers, and things necesssary to their investigation; should, as Dr. Angus Smith suggested, make a report or statement of testimony in writing, copies of which should be given to the parties to the case, a sufficient time before the trial; and at the time of trial their report should be read, and the reporters should be subject to cross-examination and re-examination. It should, however, be competent to any of the reporters who might dissent from the views of the others, to state his views in a separate report.

In Patent cases, as there is such a large surplus patent fund, the litigants should pay only a moderate sum, say £10 each, to cover costs of scientific testimony, all other expenses to be borne by the patent fund. And further, these scientific testifiers should be made use of, where necessary, in any question arising anterior to the grant of letters patent.

In conclusion, allow me to remark that I am confident, however eminent may be the person who may uphold the practice now in use, he will not find himself supported in his favourable views by the majority of the judges, of jurymen, or of persons who have been intimately concerned in cases where scientific testimony is important to their proper settlement.

I am, &c.,
F. W. CAMPIN.

156, Strand, 31st January, 1860.

MR. SIMMONDS'S PAPER ON STEAM NAVIGATION.

Sir,—Permit me to rectify an error in the report of the discussion on Mr. Simmonds valuable paper.

I mentioned inadvertently the *City of Aberdeen*, but immediately corrected myself by stating that the *City of London* was the only ship which successfully steamed off the shore at Balaclava in that disastrous hurricane.

That beautiful specimen of naval architecture, after doing good service in the Mediterranean and Black Seas during the war in the Crimea, is still one of the finest steamers that enters the port of London.

I am, &c.,
JAMES LEONARD.

2, Salisbury-street, Strand, 27th Jan., 1860.

BOTTLING UNDER CARBONIC ACID GAS.

Sir,—In the Society's *Journal* of the 27th January, your correspondent, Mr. Matthews, speaks of the great value of excluding common air from fermented liquors, a plan which he adopted two years since. His testimony deserves respect.

As to the point of time, I will gladly show him an apparatus for shutting off atmospheric air from animal and vegetable substances, so far back as 1832, when, as a member of the Central Board of Health, in Dublin Castle, at the Cholera Office, I by this means defended various kinds of food and drink from the epidemic miasmas then infesting the atmosphere in damp places.

Five years back, I patented plans for thus protecting cod-liver oil and the livers themselves from rancidity, by manipulating them in deep vessels full of fixed air. But my present patent, sealed the 22nd January, relates to new and useful improvements of a known liquid, viz., re-carbonating my fluid magnesia a second time. By removing the common air, with its smells and vapours, both from the bottles and corks used in preserving my preparation, it is kept for any length of time in an agreeable and efficient state of sparkling effervescence.

I am, &c., JAMES MURRAY.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. J. Pittman, "On the Results of the Use of Music in Divine Worship, and their Influence on the Art in General."
Entomological, 8.
Brit. Architects, 8. Mr. E. M. Barry, "On the rebuilding of the Italian Opera House, Covent Garden."
Medical, 8½. Clinical Discussion.
United Service, 8½. Captain Wheatley, R.N., "A New System of Building and Arming Ships of War, and the Advantages of this Improvement."

Tues. .....Royal Inst., 3. Prof. Owen, "On Fossil Reptiles."
Civil Engineers, 8. Mr. J. R. Walker, "Description of the Works of the Netherton Tunnel Branch of the Birmingham Canal."
Pathological, 8.
Photographic, 8. Anniversary.
Wed. .....Literary Fund, 3.
London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. Leonard Wray, "On the Extended Production of Sheep's Wool, and Hair of the Angora Goat."
Graphic, 8.
Microscopical, 8. Anniversary.
Archæological Assoc., 8½.
Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Soc. Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri. .....United Service Inst., 3.
Astronomical, 3. Anniversary.
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Prof. T. H. Huxley, "On Species and Races, and their Origin."
Sat. .....Royal Inst., 3. Dr. Lankester, "On the Relation of the Animal Kingdom to the Industry of Man."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered during the Vacation 1859.

Par. Numb.
168. Episcopal and Capitular Property (Metropolis)—Return.
173. Vessels and Tonnage, &c.—Return.
214. Pontefract Election (Childers' Petition)—Report from Committee.
184. Conveyance of Mails (North America)—Return.
144. Queen's Printers' Patent—Report from Committee.
177. Education (Ireland)—Annual Report of Commissioners.
203. New Foreign Office (Cost of Designs, &c.)—Return.
226. New Foreign Office (Number of Square Feet of Floors in Mr. Scott's Plan)—Return.
31 (1). West India Colonies and Mauritius—Papers, Part 2.
149. Education Grants (Scotland)—Return.
198. East India (Expenditure)—Return.
199. East India (Income and Expenditure)—Account.
208. Army (Sale of Commissions, &c.)—Return.
210. Army (Pay of Officers)—Return.
223. East India (Uncovenanted Servants)—Return.
115 (1). Royal Commissions—Further Return.
214. Pontefract Election (Childers' Petition)—Evidence, &c.
236. Loughs Corrib, Mask, and Curra Drainage—Return.
204. Lunacy—13th Report of Commissioners.
42 (2). Trade and Navigation—Accounts (31st July, 1859).
135. East India (Examinations)—Returns.
171. Colonization and Settlement (India)—Report and Evidence.
187. Beverley Election—Minutes of Evidence.
191. Universities (Scotland)—Copy of Ordinance.
192. Municipal Boroughs (Ireland)—Abstract.
193. Foreign Office Messengers—Return.
200. East India (Revenue)—Return.
201. East India (Loans, &c.)—Return.
202. East India (Oudh)—Copy of Letter.
209. Trinidad (Mortality, &c.)—Return.
225. East India (Annexations, &c.)—Return.
233. Picture Galleries—Return.
143. East India (Deyrah Dhoon)—Return.
152. Land Revenues—Returns.
189. Poor Law Unions (Ireland)—Return.
197. Sugar, &c.—Return.
217. Redundant List (Public Departments)—Abstract of Returns.
224. East India (Railways)—Return.
170. Huddersfield Election—Minutes of Evidence.
145. Navy and Army (Receipts and Expenditure)—Return.
219. Kingston upon Hull Election—Minutes of Evidence.
221. Mercantile Marine Fund, &c.—Return.
228. Emigration—Return.
211. Army (Presbyterian Chaplains)—Correspondence.
194. Ambassadors, &c.—Return.
185. Church Leaseholds—Return.
195. Consuls, &c.—Return.
216. Isle of Man—Correspondence.
158. East India (Travancore)—Copies of Official Papers.
222. East India (Paumben Passage, &c.)—Return.
156. Lunatics—Report and Evidence.
231. Customs (Warehousing-Deficiencies, &c.)—Return.
234. Hythe Musketry School—Copy of Report.
183. Geelong and Melbourne Railway—Return.
180. Packet and Telegraphic Contracts—Report.
159. East India (Civil Service)—Return.
13. Standing Orders of the House of Commons.
139. Navy (Dockyard Economy)—Report.
164. Savings' Banks—Return.
42 (3). Trade and Navigation Accounts (31 August, 1859).
146 Irremovable Poor—Minutes of Evidence.
155. Friendly Societies—Report of the Registrar.
178. Metropolitan Board of Works—Report.
206. Army—Return.
163. Passing Tolls, &c.—Returns.
190. Publication of Ancient Laws, &c. (Ireland)—Copies of Reports.
205. Army (General and other Officers holding Staff Appointments)—Return.
230. Newspapers, &c.—Return.
227. Metropolitan Drainage—Return.
139 (1). Navy (Dockyard Economy)—Minutes of Evidence.
232. Spirits—Return.
54. Woods, Forests, and Land Revenues—37th Report.
165. Savings' Banks—Return.
176. Hops—Return.
42 (4). Trade and Navigation—Accounts (30 September, 1859).
175. Revenue (Ireland)—Accounts.
179. Church Rates—Lords' Report.
167. Diocesan Courts, &c.—Returns.
188. Joint Stock Companies, &c.—Return.
235. River Thames—Returns.
137. Audit Office—Return.
42 (5) Trade and Navigation—Accounts (31 October, 1859).
220. Election Petitions—Return.
166. County Treasurers—Abstract of Accounts.
172. Old Stores—Return.
196. Commissions—Return.
235 (1). River Thames—Further Return.
186. East India (Education)—Papers.
212. Submarine Telegraph Company—Copy of Correspondence.
42 (6). Trade and Navigation—Accounts (30th November, 1859).
218. Emigration (North American Colonies)—Return.
165 (1). Savings' Banks—Return.
128. Bills—Metropolis Local Management Act Amendment.
129. „ Roman Catholic Charitable Trusts Law Amendment.
China and Japan (Earl of Elgin's Special Missions)—Correspondence.
Weedon, &c., Establishments Commission—Report.
British Columbia—Papers (Part 2).
Statistical Tables relating to Foreign Countries—(Part 6).
Local Government Act, 1858—1st Annual Report.
Costs of Prosecutions, &c.—Report of Commissioners.
Statistical Tables—Part 4 (1857)—Colonial and other Possessions.
East India (Ship Canal across the Isthmus of Kraa)—Despatch.
Trade and Navigation (1858)—Annual Statement.
Treaties of Guarantee.
Manufactures and Commerce—Reports of Her Majesty's Secretaries of Embassy and Legation.
Do. do. (Effect of the Vine Disease)—Do. do.
Decimal Coinage—Appendix to Final Report of Commissioners.
Treaties of Guarantee—Additional Paper.
Public General Acts—Cap. 1—66, and Table.

First Session 1859.

208 (A 3).	Poor Rates and Pauperism—Return (A).		
208 (A 4).	Do.	Do.	Do.
208 (E).	Do.	Do.	Do. (E).
208 (A 5).	Do.	Do.	Do. (A).
208 (A 6).	Do.	Do.	Do. (A).
208 (B).	Do.	Do.	Do. (B).
208 (A 7).	Do.	Do.	Do. (A).
208 (C).	Do.	Do.	Do. (C).

243. Railways—Return.
242. Railways (Sums of Money raised)—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January 27th*, 1860.]

Dated 20th September, 1859.

2138. A. Manbré, 10, Rathbone-place, Oxford-street—An improved method of extracting and purifying sugar, called glucose and "syrup de fecule" from potatoes, or fecular, or starch, or dextrine.

Dated 25th October, 1859.

2434. H. Greaves, 5, Victoria-street, Westminster—Imp. in moulding and casting gas water and other pipes, sash weights and other articles, and in cleaning some of the same from the sand.

Dated 3rd December, 1859.

2746. C. L. Smith, Highbury-crescent—Imp. in the preparation of certain colouring matters for dyeing, staining, and printing. (A com.)

Dated 20th December, 1859.

2894. J. Stonyer and J. Whitmee, Ray-street, Clerkenwell—Imp. in fluid meters, such improved meters being applicable to purposes in addition to the ordinary purposes of fluid meters.

Dated 24th December, 1859.

2938. R. J. Hill, Inverness-lodge, Brentford—An improved fire escape.

Dated 2nd January, 1860.

6. A. Prince, 4, Trafalgar-square—Imp. in the construction pianofortes. (A com.)

Dated 4th January, 1860.

24. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in the production of motive power, and in the apparatus connected therewith. (A com.)

Dated 6th January, 1860.

46. E. J. Harland, Belfast—Imp. in constructing and covering the decks of ships and other floating bodies.

Dated 9th January, 1860.

58. P. Czugajewicz, Paris—Certain imp. in stereoscopes.

Dated 10th January, 1860.

62. W. H. Morrison and H. Kinsey, Nottingham—Imp. in means or apparatus employed in the manufacture of bonnet and cap fronts, rouches, and other articles of millinery, parts of which improvements are also applicable in the treatment of lace for other purposes.
64. M. Vergnes, New York—Imp. in galvanic batteries.

Dated 11th January, 1860.

68. A. S. Bolton, Oakamoore, Staffordshire, and F. S. Bolton, Birmingham—An imp. or imps. in the manufacture of hollow cylinders of copper or alloys of copper, which said cylinders may be used for rollers for printing fabrics, and for such other purposes as the same are or may be applicable to.
74. A. Reid, Londonderry—Imp. in shirts.
76. O'D. Grimshaw, Belfast—Improved apparatus for registering the number of impressions given to documents or other articles by hand stamps and stamping or printing presses.
78. A. V. Newton, 66, Chancery-lane—An improved construction of lock. (A com.)

Dated 12th January, 1860.

80. A. West and J. Robinson, Wickham Market, Suffolk—Imp. in furnaces, and in apparatus to be used therein.
82. C. De Bergue, Dowgate hill, London—Imp. in machinery for rivetting, parts of which are applicable to machines for punching metal.
83. E. Ferrier, 22, Boulevard Montmartre, Paris—A new clock.
85. W. Sinnock, Brompton, Kent—An improved apparatus for paying out submarine telegraph cables.
87. S. Frankau, Bishopsgate-street—An imp. in pipes for smoking.
88. G. Robinson, Newcastle-upon-Tyne—Imp. in the manufacture of carbonate of lead and of chlorine.
89. R. Burley, Glasgow—Imp. in handles for hammers, mallets, picks, and similar tools.
90. A. C. Twentyman, Wolverhampton—Imp. in machinery to be used in manufacturing spikes, bolts, rivets, screw-blanks, and other similar articles. (A com.)
91. P. Moore, and P. Moore, jun., Birmingham—Imp. in the manufacture of the dies or draw-plates used in drawing wire and tubes, and for other similar purposes.

Dated 13th January, 1860.

92. E. Harrison and J. Scott, Oldham, Lancashire—Imp. in gas meters.
93. F. N. Gisborne, Sydenham, Kent—Imp. in insulating material for telegraphic purposes.
94. A. B. Mitchell, Birmingham—Imp. or imps. in ornamenting brass knobs for doors, drawers, cupboards, and for other like purposes.
95. J. Hayes, Gloucester—Improved break for common road and railway carriage wheels, applicable also to the wheels of machinery for raising and lowering weights.
96. J. Goddard, Stockport—Imp. in the preparation and dyeing of yarns or threads.
97. J. Musselwhite, Devizes, Wiltshire—Imp. in apparatus for transferring fluids.
98. J. Eunson, Wolverhampton—Imp. in refrigerating apparatus. (A com.)

Dated 14th January, 1860.

99. W. Knowles, Bolton-le-Moors, Lancashire—Certain imp. in machinery for carding cotton and other fibrous materials.
100. M. A. Mennons, 39, Rue de l'Echiquier, Paris—An improved candlewick. (A com.)
101. B. Lang, 67, St. Martin's-lane, Westminster—An improved method or apparatus for obtaining a continuous stream of water or other fluid, particularly adapted for pumps, and for administering injections and other such like purposes.
103. T. Wilson, Birmingham—Imp. in breech-loading fire-arms.
104. J. Davis, 18, Frith-street, Soho—Imp. in music stands, part of which is also applicable to tents for military and other purposes.
105. J. A. Coffey, Providence-row, Finsbury—Imp. applicable to or connected with steam engines, and other motive mechanism, with the view to economise power.
106. T. J. Smith, Plaistow Marshes, Essex—An improved machine for printing in more than one colour at a time.
107. W. Smith, Pownall-road, Dalston—Imp. in transferring designs, and in ornamenting glass and other surfaces, also in the manufacture of slides for magic-lanterns.
109. J. Chatterton, Highbury-terrace, and W. Smith, Pownall-road, Dalston—Imp. in treating gutta percha, india rubber, and compounds of those substances.

Dated 16th January, 1860.

111. A. M. Rende', 8, Great George-street, Westminster—Imp. in the construction and arrangement of ships of war.
112. J. Stenson, Northampton—Imp. in the manufacture of iron.
113. W. S. Cope, Hanley, Staffordshire—Imp. in apparatus for preventing accidents in mines.

Dated 17th January, 1860.

115. W. Hughes, Manchester—Imp. in metal ties or fastenings for packing bales of cotton, wool, and other fibrous substances, which imps. are also applicable to packing bales of manufactured goods. (A com.)
116. S. Fearnley, Rochdale—Imp. in looms for weaving looped or pile fabrics, some parts of which imp. are applicable to other kinds of looms.
117. D. Vogl, Sambrook-court, Basinghall-street—Imp. in knapsacks, haversacks, and such like portable receptacles.
118. R. A. Brooman, 166, Fleet-street—Imp. in extracting substances from cereal grains, and some of their products, and the application of the substances extracted.
119. D. F. L. Ruchet, J. Vonwiller, and F. Seiler, Paris—An improved rotary machine. to be used as a water-wheel, steam engine, or pump, and for transmitting at any distance motive power.
123. T. G. Dawes, Wolverhampton—A new or improved compressed air and exhaustion hammer.
124. J. Goulson, 37, Ponsonby-place, Vauxhall-bridge-road, Westminster—Imp. in gas meters.
125. C. Martin, St. Martin's-place, Camden-street, Camden-town—An improved portable scaffolding, adapted for constructing, ornamenting, and repairing buildings, and for the removal of goods and persons therefrom in cases of fire.

Invention with Complete Specification Filed.

172. C. C. J. Guffroy, 3, Duke-street, Adelphi, Westminster—An improved smoke consuming apparatus, and also an improved method of introducing the coal or fuel into it. 24th January 1860.

Patents Sealed.

[*From Gazette, January 27th*, 1860.]

January 25th.

1669. J. Bailey.
1728. J. Rowland, jun.
1729. G. Davies.
1733. J. King.
1736. P. D. Mickles.
1739. D. B. Hale.
1744. J. Scoffern.
1752. J. Aspinall.
1766. F. Haeck.
1826. L. B. Ollivier.
1855. R. Heaton, jun., and G. Heaton.
1937. J. Murray.
2105. J. Bottomley and A. H. Martin.
2126. J. Hawkins and C. Hawkins.
2524. G. T. Bousfield.
2621. J. Bancroft.
2740. J. Anderson and J. Bradshaw.

January 27th.

1768. A. B. Seithen.
1770. H. J. Newcome.
1773. P. M. Parsons.
1833. T. Blinkhorn and R. Blinkhorn.
1835. T. Dunn.
1851. W. K. Westly.
1883. J. Chanter and D. Annan.
2151. W. E. Newton.
2601. G. Taylor.
2635. G. W. Lenox.
2743. N. Clayton and J. Shuttleworth.

[*From Gazette, January 31st*, 1860.]

January 31st.

1775. J. Mollady.
1776. T. W. G. Treeby.
1777. T. G. Messenger.
1779. J. Rowland.
1782. E. de Bassano.
1786. B. Donkin.
1787. A. Pin.
1788. J. Hewett.
1789. W. K. Peace.
1791. W. H. Tooth.
1793. J. Petrie, jun.
1863. A. Evaux.
1878. C. Mather.
1884. E. Stone.
1895. R. A. Brooman.
1908. J. Fowler, jun., R. Burton, D. Greig, jun., E. E. Allen, and W. Worby.
1916. R. A. Brooman.
1938. T. Biggs.
2114. J. Luis.
2302. G. Davies.
2550. G. Spill and D. Spill.
2672. M. Tildesley.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, January 27th*, 1860.]

January 23rd.

216. J. Harris.

January 24th.

243. G. Sampson, J. Sampson, and E. Ledger.
278. Isaac Holden.
279. Isaac Holden.
348. N. Nomico and G. Heyes.

January 25th.

284. J. Owen.

[*From Gazette, January 31st*, 1860.]

January 26th.

235. J. S. Crosland.
241. D. Y. Stewart.
267. W. Weild.
301. J. F. Dudebout.

January 27th.

250. R. A. Brooman.
258. G. E. Dering.
280. I. Holden.
281. I. Holden.
343. G. Wright.
477. T. W. Davenport & S. Cole.
613. D. Partridge.

January 28th.

285. J. A. Williams.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, January 27th*, 1860.]

212. W. Tranter.

[*From Gazette, January 31st*, 1860.]

January 27th.

200. J. H. Johnson.
217. J. P. Kingston.
241. J. B. Lavanchy.

January 27th,

210. R. Shaw.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 10, 1860.

TENTH ORDINARY MEETING.

Wednesday, February 8, 1860.

The Tenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 8th instant, Colonel H. Cunliffe Owen, R.E., C.B., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bailey, W. H.	Edwards, Frederick.
Donnelly, Captain, R.E.	Lack, H. Reader.

The Paper read was—

ON THE MEANS OF INCREASING THE PRODUCTION OF SHEEP'S WOOL AND OF ANGORA GOAT'S HAIR.

By Leonard Wray.

On the opening of this Session of the Society, Sir Thomas Phillips, in his inaugural address, sketched rapidly, but faithfully, the gigantic strides which this country is making in almost all its manufactures and trades.

Those raw materials which furnish employment to our great manufacturing industries have been pouring in upon us in greater quantities than ever. The world, throughout its utmost extent, has been ransacked; its productive resources have been stimulated with unceasing assiduity and energy; enormous fleets of busy merchantmen are ever traversing oceans and seas, laden with produce destined for the British market; and yet, notwithstanding this universal and constantly increasing stream of raw materials into our manufacturing districts, still we hear, on every side, the complaint,—"We have not enough; —give us more, and yet more!"

In all cases the demand quite outstrips the present supply, vast though it be, and we even hear it asserted that our industrial progress is, in many instances, seriously impeded thereby, to the great detriment of the nation at large.

This condition of things does not, however, furnish any just cause for complaining; on the contrary, I maintain that it affords the strongest grounds for congratulating ourselves as a nation on the wonderfully expansive character of our manufacturing and commercial industry.

Let us visit Manchester, Glasgow, Paisley, Leeds, Bradford, and other great manufacturing centres, and we witness such an amount of cheerful, exhilarating activity as the world has never before exhibited. Those gloomy prophets, who are ever prognosticating that our productions will inevitably overstock all the markets of the universe, must carefully avoid those great hives of industry if they wish to preserve any self-confidence in their own predictions; for there they will assuredly see the triumphs achieved by intelligence, labour, and capital, in the constantly expanding operations of numerous prosperous manufactories, and in the manifold blessings which their prosperity diffuses throughout the country.

But, if the man of science, the political economist, the intelligent colonist, or, in fine, any man of observation and common sagacity, makes a tour of our manufacturing towns and districts, he will gain for himself such a mass of varied information, such an enlarged conception of things he knew but dimly before, and such ample scope for new ideas, new feelings, and new modes of reflection, as will impart an additional stamp and value to his mind, character, and opinion, until the latest moment of his existence.

The mighty working of the untrammelled "spirit of industry" does indeed afford a study of the deepest import,—one worthy of occupying the minds of the greatest thinkers in the universal globe. We have seen, within but a few years, raw products introduced into this country which were new to our manufacturers, but which have now become so universal in their application and uses as to be looked upon as very necessaries of life. Those raw products, which were then unappreciated, because they were almost unknown, are now sought for with the utmost avidity by our manufacturers, from whose warehouses they are disseminated throughout the world in an endless variety of shapes and forms. Need I mention, amongst others, alpaca, mohair, caoutchouc, gutta percha, palm-oil, &c., which, in their various appliances, now minister to the comfort and enjoyment of all humanity, from the Queen on her English throne to the Fejee dandy in the Cannibal Islands.

Does anyone ever hear of a glut of such raw products in our markets? Certainly not, to my knowledge; but we do hear, and that continually, the most anxious inquiries as to the possibility of obtaining increased supplies of each and all of them; and any man who can throw the smallest light upon this interesting question, is sure to be listened to with respect and attention.

If this, then, be the position of affairs as regards the supply of, and demand for, these but recently new raw products, we cannot be surprised that there should exist a very great necessity for increased supplies of those better known and more extensively employed products, viz., cotton, wool, silk, &c.

The members of the Society are, no doubt, fully aware of the energetic measures now being taken by the Manchester Cotton Supply Association, to insure a larger and more certain production of cotton; and I believe the subjects of silk, fibres, &c., will very shortly be most ably laid before you by competent gentlemen who have undertaken that task.

The particular subject to which I ask your attention this evening is one of the deepest importance to our manufacturing interest, as well as to our home and export trade—it is the means of increasing the production of wool and of Angora goat's hair.

Although the fleece of the sheep is "wool," whilst that of the Angora goat is, to all intents and purposes, "hair," yet that hair is so soft, so fine, so silky, so nearly allied to wool, and so readily worked up with it, that I venture to class them as sister products. For this reason, I have thought that they may not inappropriately be treated of together in this paper, the more especially as these goats can be successfully reared in almost all the great wool-producing countries.

With this apology for discussing these two substances in one paper, I will now proceed, in the first place, to set before you a few facts and figures respecting that great staple wool.

I do not intend to weary you with those masses of figures and interminable statistics which might be crowded into a paper treating on so inexhaustible a topic as that of wool, but I will, in the briefest possible manner, touch upon a few points directly bearing upon the particular branch of the subject that I have selected, and which are absolutely necessary to a clear conception of the value of the suggestions I shall afterwards offer for increasing the supply of this article.

The United Kingdom itself produces a larger amount of wool, than any other country in the world, its estimated yield being about 275 millions of lbs., obtained from 50 millions of sheep; and yet it may truly be said that sheep are kept in this country not so much for their wool, as for the meat their carcasses furnish,—and for the great benefit they confer on agriculture.

They have indeed been aptly designated "the sheet anchor of British agriculture," so indispensable are they t

the scientific farmer of the present day. But in improving the carcass of these valuable animals, great care has also been bestowed upon their wool-producing capabilities, in order to preserve and increase as much as possible the quantity and quality of that important article.

The wools of this country are, therefore, abundant in quantity, and of good, strong, and very useful qualities; although not of such fine description as the Saxony, Spanish, and other merinos.

Other countries of Europe likewise produce very large quantities of wool, which are, however, chiefly used up by themselves, for their own consumption and trade. I will, therefore, only refer to them in so far as they export to this country, and this will be best seen in the following statistical Report of the Board of Trade, of the quantities of wool imported into the United Kingdom from each country in the year 1858:—

Wool—Sheep and Lambs.

	Lbs.
Russia	6,647,420
Denmark and Iceland	2,795,379
Prussia	413,852
Hanover	311,530
Bremen	268,758
Hamburgh	10,014,898
Holland	3,131,218
Belgium	2,600,551
France	279,380
Portugal	1,113,211
Spain	110,510
Turkey Proper	268,108
Egypt	1,227,861
Morocco	146,898
United States	951,938
Paraguay	457,673
Buenos Ayres	4,776,965
Chili	205,399
Peru	1,959,720
British Possessions in South Afri	16,597,504
St. Helena	175,528
British East Indies	17,333,507
Australia	51,104,560
Other Parts	1,158,222
Total	124,050,590
Total Value	£8,652,042

Of this quantity, about eighty-six million pounds (or more than two-thirds of the whole) came from our own colonies.

Bearing this fact in mind, I shall more especially direct attention to our own possessions, although I shall also make a few observations respecting the capabilities of certain other countries in Africa and the Americas.

British Wool-Producing Colonies and Possessions.

In 1857, Australia and Tasmania produced of wool as follows:—Victoria, 17,176,920 lbs.; New South Wales, 17,044,201 lbs.; South Australia, 10,105,699 lbs.; Western Australia, 478,486 lbs.; and Tasmania, 5,251,886 lbs.—or a total of 50,057,192 lbs.

From a variety of causes, Australia has not within the last few years increased its exports of wool so largely as might have been anticipated.

The four colonies of Australia Proper, viz., New South Wales, Victoria, South Australia, and Western Australia, produce altogether about forty-four and-a-half to forty-five million pounds, and for some years this has remained nearly stationary, whilst Tasmania has gone on steadily increasing.

There is no doubt that the discovery of gold in Australia, in the first place, led to immense losses in the flocks of sheep, which were in numerous cases left literally "without a shepherd;" then the healthy flocks that were "boiled down" (for the sake of their tallow) by their affrighted owners during and immediately after this season of panic; thirdly, the really diseased flocks that were similarly treated; and, finally, the immense immigration into those colonies of strong, hearty, mutton-eating Europeans, whose ravenous appetites caused many hundreds of thousands of sheep to be slaughtered. All these causes have tended to keep down the increased export of wool for some years past; but materially strengthened, as Australia now is, by its so greatly augmented population, the continual extension of its vast flocks and herds must necessarily result.

The Australian sheep breeder has some very terrible enemies to contend with, quite apart from all human depredations, viz., that most dreaded disease, the "catarrh" (or influenza), the "scab," long continued drought, and the native dog or dingoe.

So destructive are these combined evils, that some large flock masters have lost thereby as many as 20,000 sheep in one twelvemonth.

Of late years, the advent of either catarrh or scab consigns at once whole flocks to the "boilers," in order to get as much out of them as possible, instead of making a total loss as previously.

This boiling down remedy saves the flock master from, perhaps, utter ruin; but, at the same time, it effectually lessens the supply of wool, and to these scourges the wool grower of Australia is, and always will be, more or less liable.

There are still vast regions of country being continually opened up. These enterprising colonists and their sheep are rapidly penetrating into these newly-found localities, but unhappily they too frequently take with them the infection of these dreadful diseases.

Careful and observant colonial writers have estimated the rate of increase in the Australian flocks as being only 75 per cent. per annum, whereas others, more sanguine, state it to be as high as 90 per cent.

Taking the average increase of the four colonies, I am myself inclined to accept the former calculation, viz., 75 per cent., as being nearer the truth; but even at this rate the flocks of Australia would increase with much greater rapidity than they do, were they not continually thinned by disease, drought, wild dogs, and "black fellows!"

In New Zealand there are none of these great drawbacks; that is, drought, dingoes, and "black fellows" (in the Australian sense) are not known; and disease, although sometimes brought over by the Australian sheep imported, speedily disappears, and can now be said scarcely to exist in those healthful islands. Hence we find that, in less than five years, New Zealand has doubled her exports of wool, notwithstanding the tens of thousands of sheep which have been annually slaughtered to feed her rapidly increasing population.

In 1854, she produced about 1,300,000 lbs.; in 1856, 2,559,618 lbs.; and in 1859, upwards of 3,000,000 lbs.; and as great and intelligent endeavours are being made to stock the millions of acres in the North and Middle Islands, suitable for sheep (and capable of supporting five head to the acre), we may reasonably look for a continual and very large annual increase of wool from New Zealand.

The increase of breeding amongst the sheep of this fine colony is variously estimated as being from 95 up to 110 per cent., which is the highest rate of any of our wool producing possessions.

The Cape colony now furnishes upwards of 18 million pounds of wool per annum, notwithstanding that its sheep farmers have to contend with wild animals, drought, and depredations by Kaffirs and bushmen. Disease, as prevalent in the Australian colonies, is entirely unknown.

The Cape colonists have had, however, three Kaffir wars to desolate their country, destroy their homesteads, and retard their agricultural and pastoral progress. Millions of sheep have been run off by Kaffirs, starved, or otherwise destroyed, entailing ruin and the most incredible distress upon the enterprising colonist and his family. I know an

English gentleman who, after many struggles, had comfortably established himself and family on a fine farm, with a flock of 12,000 sheep, wherewith to support himself and make a provision for his children when he died. The first Kaffir war broke out, and he was forced, with his wife and two infants, to fly for life, leaving his home to be sacked and his sheep and cattle to be killed or driven off. Again he began the world, and when peace was restored, retook possession of his farm, built some rude huts to live in, and once more commenced sheep-breeding. His friends helped him, fortune smiled on him, and at the outbreak of the second Kaffir war, he possessed a flock of 7,000 sheep. With these he managed to find his way to Graham's Town, having sent on before him his wife and children, in charge of his Hottentots.

Arrived at Graham's Town, he found the immediate neighbourhood literally swarming with sheep and cattle, pouring in from all quarters, to save them from the ruthless Kaffirs. Of course, the parched-up country surrounding the town could not afford food for such flocks and herds, consequently, those the Kaffirs did not steal or kill, died from sheer starvation, and my unfortunate friend was again reduced to destitution.

The last Kaffir war began in 1851 and ended in 1853. Now, mark the result. In 1854, the Cape produced 8½ million lbs. of wool, whilst in 1859 she exported upwards of 18 millions of lbs. Boundless tracts in the Cape Colony, in the Sovereignty, and in Natal, still remain unoccupied by sheep farmers, although admirably adapted to their purposes.

The rate of increase is very fairly estimated at 95 per cent. per annum, a progression which only requires peace and more farm servants, to enable her farmers to run a close race even with Australia Proper. Hitherto the Cape Colony has been greatly retarded by desolating warfare, and by an uncertain and irresponsible system of government. Now she has a sagacious and well-beloved ruler, a legislative assembly, and a peaceful tranquillity within her borders, with the pleasing prospect of its long continuance.

Few persons are in the habit of regarding India as a great wool-producing country, and people, even of good general information, will be thoroughly surprised to learn, that in 1858 the three Presidencies of India exported 18,635,396 lbs. of wool, of which upwards of 17 millions were brought into Great Britain.

This quantity, however, affords but a very inadequate idea of the actual production of this staple in so vast and so populous an empire as British India, but from my own personal knowledge of the country, I believe that its wool may be very materially improved in quality, and enormously increased in quantity.

In parts of the Upper Provinces, where I resided, I could purchase any number of young ewes at from 1s. to 2s. each, and from these, when crossed, excellent flocks might be obtained at a very small cost, comparatively.

I do not believe that any European has yet fairly settled himself down to sheep-breeding on an extensive scale in any part of India, but, I imagine, such a pursuit might be very advantageously entered upon, now that the country is being so extensively opened up by railways and river steamers. To those gentlemen engaged, and about engaging, in tea-culture, in Kumasn, Gurhwal, Silhet, Darjeeling, the Neilgherries, and other localities, I would suggest that they combine with their agricultural operations the experiment of sheep-breeding.

Up to the present moment, Bengal and Madras have exported little or no wool, certainly not as much as 100,000lbs. between them in any one year; so we find that it is from the Bombay Presidency alone that upwards of 18½ millions of lbs. were exported in 1858. This is a very telling fact, certainly, and it gives us a very high notion of the wool-producing capabilities of this Presidency, but we should be altogether in error if we thought slightingly of the capabilities of the other two Presidencies, for they really have extraordinary capabilities for wool-growing, and we may rest quite sure of this fact, that the same railways which are relied upon for bringing to the coast the vast cotton crops of the interior, will also bring down the fleeces of millions of sheep.

Many who listen to me will be ready to exclaim, "But what wretched stuff East India wool is, after you have got it." Very well, I will grant all that; but, remember, it is wool notwithstanding, and very useful to manufacturers for a variety of purposes. Moreover, this great defect in quality may with certainty be remedied, and that very speedily. The manner of effecting this very desirable result is simple, inexpensive, and effectual. Take, as an instance, that great sheep country, Mysore, and distribute throughout it well-bred "tups," to be used, free of all charge, by the native shepherds, and let the natives thoroughly understand the object in view, and the benefits which will result to themselves, and I am convinced the whole Mysore territory would speedily produce wool of a greatly improved quality. The same plan should be pursued in every large sheep district, and the result would be, that Indian wool would run up in value to *at least* 1s. per lb. on the spot, and at the same time the sheep would produce much heavier fleeces.

This is no crude or ill-digested idea on my part. I know the country and the people I am speaking of, and I am perfectly sure that it is not only a very feasible plan, but that it is in reality the only one whereby the native races of sheep can be improved, and the value of their wool enhanced.

I respectfully call the particular attention of the Society to this suggestion of mine, and I hope that it will be fairly and usefully discussed.

I remember that as far back as 1842, crosses were made between the Merino male and the common Patna ewe, which produced wool, valued by competent judges, at from 13d. to 15d. per lb., whilst fleeces were obtained from the Kohistan-Merinos, worth 14d. to 16d. per lb. Again, in 1845, common Patna ewes, crossed by the Southdown breed, furnished wool valued at 14d. per lb.

All the products were from the first crosses with the common native ewes, which fact leads to the very natural inference that succeeding crosses would afford wool of a much higher class and value.

The fine-woolled ewes of Mekram and of Jhawar, in Beloochistan, may easily be procured in large numbers, and from these superior animals very valuable crosses might be at once made with the Merino, or other suitable European breeds. The Jeypoor race of sheep is likewise deserving of all attention.

The exports of really good wool from British India should be 200 millions of lbs. per annum, instead of 18 to 20 millions, and if they do not attain that amount within a few years, then, I assert, that the fault will be due to the supineness of this country, rather than to the capabilities of India itself.

Having thus rapidly glanced at our own colonies and possessions, let me now call your attention to the position occupied by the United States, as a wool producing country.

From the official reports we find that there were in the Union, in 1840, 19,311,374 sheep; 21,723,220 in 1850; 23,000,000 in 1853; and about 30,000,000 in 1859: these thirty millions being roughly valued at £12,500,000.

Taking the average of the whole, I think we cannot err very greatly in estimating the wool at two pounds from each sheep, or a total of sixty millions of pounds in 1859.

Of this quantity I am quite certain that a large proportion is entirely wasted at the present day, although I am aware that the farmers are daily becoming more careful in this respect.

In 1858, we see from the report of the Board of Trade, that under one million pounds was imported into Britain from the United States, so that a very large amount of wool must be (and is) worked up into fabrics by their own manufacturers.

In travelling through the States I was much struck by their

suitability for sheep-breeding, and continually expressed my opinion on the subject, but I was met by the universal declaration, "It's no use attempting to keep sheep until we have a dog-law." Of course I very naturally asked why then did they not get a "dog-law?" but I was speedily made to understand, that in a country where every citizen is in himself "a sovereign," no such law could be passed with impunity, and even were it passed, it would be next to impossible to enforce it. One gentleman said he saw no fun in keeping sheep to feed the hungry curs of his poor neighbours. Another, after having sixty-eight fine ewes killed in one night, concluded that sheep-raising would not pay in his location.

But the case which struck me most was that of an acquaintance of mine, in the State of Georgia, at whose farm I saw some remarkably fine pointer pups, on the possession of which I congratulated him. Looking at me, with a singularly rueful countenance, he said, "I have not been able to keep one of these puppies for myself. I have even promised all of the next litter, for you must know that I am surrounded by a set of fellows who, although scarcely able to support themselves and families, always manage to keep a tribe of mangy dogs, which used to eat my sheep as regularly as the night came round. To rid myself of these brutes I kept the remainder of my sheep up for a few nights, and laid poisoned meat about the pastures, and so killed off quite a number of the curs, my negroes searching for, and burying the bodies before daylight. But doing this I just jumped out of the frying-pan straight into the fire, for their respectable owners guessed what had happened, so I was obliged to smooth down matters 'right off,' by promising away all my pointer puppies, and by making presents of pigs, lambs, and even sheep. I tell you, sir, I settled that business right sharp, for I didn't want those Piney-wood's fellows to make a target of me.'

I entirely agreed with my friend, that sheep-breeding was by no means a pleasant or profitable occupation in that particular part of Georgia.

As a set off to this, I was once talking to a gentleman of high position from Texas, which he assured me was the very finest country in the world, and would some day supply all Europe with wool; when I said, "but how about the dogs? Have you a 'dog-law' in your State?"

He replied, with the utmost coolness, "Yes, in Texas we have the most effectual law possible, and it's just this, if any fellow keeps dogs to injure his neighbours, the dogs are shot right off, and himself too, if he does'nt clear out pretty smart. We don't allow them kind of cattle to play up any games with us in Texas."

Of course I saw at once that "Judge Lynch" was the titular deity of Texan sheep farmers, and that under such fostering care their flocks will assuredly increase and very greatly multiply throughout the fair state of Texas.

During a journey from Washington to Georgia, in company with the Hon. Howell Cobb (Secretary of State for the Treasury), amongst other topics of conversation we came to that of wool and the facilities for producing it in the United States, which he said were only held in check by the vast number of vile, half-starved curs kept by poor white people and negroes.

He said that no man would be elected either to Congress or to the State Legislatures who was known to entertain designs against these miserable dogs; but he trusted the time would come when this state of feeling would change, and a stringent dog law be passed. Although a foreigner, I heartily joined him in this hope.

I have been thus particular in bringing these facts to light, because I am so often asked why the United States does not produce more wool than she does. It will scarcely be believed that she even imported 961,828 lbs. from India in 1858, yet such is the fact. It will, however, be remarked that, notwithstanding the intolerable nuisance she labours under, the Union possesses within her territory some 30 millions of sheep, and I have no doubt that she will, some years hence, produce much more wool than will be required for her own consumption.

Mexico, Central America, Brazils, the Argentine Republic, and Peru, are all capable of raising multitudes of fine-woolled sheep, and no doubt will do so in time to come.

The French colony of Algeria deserves, I think, a few words as to its capability of producing wool. There can be no doubt that the climate and herbage of Algeria are remarkably favourable for the growth and perfect development of the sheep; indeed many learned men are strongly of opinion that it was from this part of Northern Africa that the renowned race of merino sheep originally came. Avoiding, however, this disputed point, we yet know as a fact, that it still possesses on its numerous elevated table-lands, breeds of sheep little inferior to the merino when they receive the care and attention of intelligent Europeans.

The French government has not overlooked this significant fact, but has of late years done much to improve the native races, and to stimulate the energies of both European settlers and Arabs, in carrying out so useful an enterprise as sheep-farming.

Although there certainly have been *some* results, yet, upon the whole, these results have been very small, more I fancy from the very nature of the Frenchman (who does not seem cut out for an African sheep-farmer) than from any fault of the country, or from the obstacles opposed to the settlers from the half-wild Arab population. I think I risk nothing in saying, that if it were an English possession, it would be immediately settled up by enterprising fellows, eager to try their luck in wool.

Whether the efforts of their government will succeed in establishing Frenchmen throughout the colony as sheep-breeders, remains yet to be proved; but there can be no doubt that Algeria is admirably adapted for that purpose, and might be made to produce immense quantities of most valuable wool.

We have now taken a brief survey of our own wool-producing possessions, also of America and Algeria, and although we may be fully satisfied that each and all of them are very largely extending their flocks and increasing their fleeces, yet we must come back to the fact I have before remarked on, viz., that our manufacturers still manage to keep ahead of these increasing supplies, and are loudly calling for more rapid production.

We see every woollen rag that can be collected carefully bought up, that it may be picked to pieces, and under the notorious name of *shoddy*, be again worked up into various deceptive kinds of cloth, to the injury of the unlucky wearers, and to the shame of our manufacturers.

Those excellent specimens of genuine woollen cloths lying on the table, were manufactured from fleeces of sheep bred on the estate of an esteemed and high-minded gentleman (of the legal profession) at Huddersfield, who, writing on this "shoddy question," says—"Depend upon it that its use has a demoralising effect on the minds of those who have recourse to it."

When I was a boy it was 1-6th shoddy to 5-6ths wool; now it is 5-6ths shoddy and 1-6th wool; or, as a person said to me the other day, "call it by the unit, and forget the wool."

Mixed with shoddy, mixed with cotton, and, in fact, with everything else that will mix with it, our woollen garments have become, or are rapidly becoming, objects of great suspicion to the community at large. The tricky manufacturer, and his honest, high-minded rival, both cry out, "What is to be done? We cannot get enough wool. Can nothing be devised for increasing our supplies in proportion to our wants?" As in the article of cotton, there exists a great and influential body named the "Cotton Supply Association," so also has there been very wisely suggested, the formation of a "Wool Supply Association" amongst the woollen manufacturers. Such being the actual position of affairs, I will now endeavour to show how the demand may be supplied.

Means of Largely Increasing our Flocks of Sheep and Wool.

I start on the plain ground, that the rate at which our

flocks of sheep increase and multiply in our colonial possessions at present, is quite inadequate to keep pace with our manufacturing demands. Have we a remedy for this? I answer we have—a sure and certain remedy, as I will show.

Whilst in the United States in 1857, I fell in with the following letter, in the Transactions of the American Institute :—

"New York, June 2nd, 1856.

"Dear Sir,—It is now about nineteen months since I came into possession of three Nankin sheep (all ewes). I took them from aboard the clipper ship *Jacob Bell*, just then arrived from Canton, and sent them to my farm, Norwalk Island, Connecticut. These were all the sheep I had of any kind, and no buck with these, though they were all with lamb, and I relied upon raising a buck, as the sequel will show. They brought forth shortly afterwards each with three lambs, the ewes being poor, but they soon fattened and the lambs grew finely. The next time, (for they have lambs twice in the year,) they had three, four, and five lambs at a birth, and raised them. One of these sheep has had twelve lambs in fifteen months; and the increase of the three original sheep, up to eighteen months, has been seventy-four. * * * * * * * * * I should add that they are large and handsome, and the mutton of superior delicacy. Wool coarse.

"Yours, &c.,
"THEODORE SMITH,
"Capt. U. States Light Horse Service, &c.

"To Henry Meigs, Esq.,
"Sec. American Institute, New York."

On reading this remarkable letter I hastened to make inquiries as to its truth, and I found that Capt. Smith had stated nothing but a plain matter of fact, Mr. Pell, the President of the American Institute having purchased these sheep, and witnessed their astonishing fecundity, for they had increased largely in his hands. This gentleman told me that he had sheared as much as nine pounds of wool each from some of these animals; and so great was the public appreciation of them, that he was selling them at 500 dollars each to various friends.

Mr. Pell gave me this small sample of their wool. When I returned to England, I found that the same description of sheep had been received in England in 1855, from China, under the following circumstances.

Mr. Rutherford Alcock, then H.M. Vice-Consul at Shanghai, having noticed this breed of sheep in China, saw at once their extreme importance to England, and wishing to place them in the best possible hands, shipped, in 1854, several of them as a present to H.R.H. Prince Albert, who, in April, 1855, presented them to the Zoological Society of London.

Here they were seen and abundantly ridiculed by numbers of our intelligent and enlightened gentlemen-farmers and noblemen, who could not for the life of them see any merit in these poor "Celestials." Such coarse-woolled monsters (without ears) that were always bringing forth lambs at the rate of four or five at a time, why no really respectable English farmer would have them at any price.

Such men as the lamented Earl Ducie thought otherwise; and, accordingly, some of this foreign importation found comfortable quarters on that nobleman's estate. Lord Ducie died, and his Chinese sheep died also.

In the meantime, the others at the Zoological Gardens were becoming a prodigious nuisance; first one ewe had five bouncing lambs, then another had four equally lively; nine young Chinese in one day! Two days after, a third had four, making thirteen lambs from three ewes.

Such increasing multitudes would soon have filled the Zoological Gardens and Regent's Park also; but as this could not be allowed, the (then, not the present) secretary hit upon an effectual means of stopping such an inconvenient accumulation, viz., by serving up the unhappy little strangers as fresh meat to their lions, tigers and wolves.

Now it can well be imagined, that not even the ever-producing Celestial sheep could stand such treatment as this long; and no one will be surprised to learn, that at this moment it is very doubtful if a single individual of this truly valuable breed of sheep remains alive in England.

I am sure many would ask, "was there not one clear-sighted and intelligent man to raise his voice in favour of the preservation of this invaluable present of Mr. Alcock?" Yes, most certainly there was; and any one who will take the trouble of examining the *Zoological Society's Journal*, will find that a paper was read on the 26th May, 1857, by Mr. A. D. Bartlett, the superintendent of the Society's Gardens, from which I will give one short extract:—

"These sheep differ from all others that I have seen, in not possessing external ears. In size they are equal to ordinary sheep; the wool is perfectly white, rather coarse, and mixed with long hairs; the head and face are smooth, and covered with white hair; they have no horns; the tail is short, rather broad, and turned up at the tip; the profile is very convex.

"My attention was first called to these sheep from the fact of their great reproductive power; I find that they breed twice in the year, and produce four and sometimes five at a birth, the three ewes now in the Society's Gardens having this spring produced thirteen lambs. These lambs are very easily reared by hand and are perfectly hardy."

* * * * * * *

"Having submitted specimens of the wool of this animal to my friend Dr. Price, who kindly forwarded the same to Mr. Darlington, the Secretary to the Chamber of Commerce, at Bradford, for the purpose of having it examined by the most competent judges, the following report from these gentlemen was received. They say, 'that the sample of sheep's wool from China enclosed in Dr. Price's letter, is a class of wool which would be extensively used by the manufacturers of this district for goods of low quality; that it appears to be a wool suitable for combing purposes, and would now command about one shilling per pound."

Mr. Bartlett then strongly advises that this breed of sheep should be employed for crossing with other races, but he pleaded in vain; and the objects of his solicitude are now no more.

If I had not known other cases very nearly akin to this treatment of the Chinese sheep, I should not perhaps have said so much about this most unfortunate business; as it is, let our blunder in this instance warn us against similar blunders in future. We have lost the breed for the present, and must recover it.

I do not regard the Shanghai sheep for the quality of its wool (although that might be improved, and in any case must not be despised), but for its great fecundity, and the rapid means thus afforded of getting up a flock of sheep.

Let any one who understands arithmetic, just calculate what a progeny ten such ewes and one buck might have in five years, then extend the calculation to ten years, and he will begin to have some idea of the value of such a breed on our boundless plains and hills in Africa, Australia, New Zealand, and British India. Employ this prolific sheep in establishing your flock (always remembering that its wool is worth a shilling a pound at Bradford), and when you have some thousands in number, then cross them with Merinos, or any other description of sheep you may deem best suited to the locality you occupy. In this manner the quantity of sheep produced, and of wool furnished by them, would be limited only by the capabilities of the soil to afford them food. For England a most valuable cross might be made between the Chinese and the Folder Holstein breed, which also frequently produce five at a birth, and which is a long-woolled sheep, yielding from 10 to 20 lbs. of wool each.

In these two breeds fecundity meets fecundity, and their other characteristics are by no means antagonistic, whilst the Holstein would give to the Chinese increased size, hardihood, and weight of fleece.

This cross again crossed with the Merino, or Southdown, would produce a breed of exceeding excellence in every point.

In proceeding to the other branch of my subject, I again say, that if we have indeed lost the Shanghai breed in England, we must send either to the United States or to China for it once more, for on the aid of this despised and rejected race, the full and rapid extension of our woollen manufactures will very greatly depend.

On the Means of Increasing the Supply of Angora Goats' Hair.

This beautiful and valuable animal comes to us from a small district in Asia Minor already celebrated amongst us for its magnificent cats and rabbits, which are furnished with fine coats of thick woolly hair. The Angora goat may be purchased in its native hills for about 15s. to 30s. each, by any traveller who knows how to deal with the people of the country; and it is very valuable for its fine and beautiful silken hair, which it yields at the rate of 4 lbs. from the ewes, and 7 lbs. from the males.

This product is imported very largely into this country under the somewhat comprehensive name of mohair.

It is employed principally to mix with wool, alpaca, silk, cotton, and worsted, in making ladies' dresses, light overcoats, coat linings, lustres, tabinets and fringes, umbrellas, &c., and also for pinning into yarn, which is exported chiefly to France and Belgium, for the manufacture of Utrecht velvet, the covering of furniture, linings of carriages, &c., and to some extent for a cheap imitation of black silk lace, braid, and other articles. In France it is also used for making fine shawls.

The great utilizer of alpaca wool, Mr. Titus Salt, is likewise the man who has given a greater impetus to the trade in Angora goat's hair than any other person in the United Kingdom. He has, moreover, imported the animals themselves (in 1852), and they are thriving well on his property at Bradford. But here again our farsighted American cousins are considerably ahead of us, for, in 1849, Dr. James B. Davis, of Columbia, carried with him from their native habitat seven females and two males of this breed of goat to the United States. Immediately he arrived at his home he obtained a number of she goats of the common breed (worth about three shillings each) and crossed them with his Angora variety, obtaining, even in the first cross, a coat of fine hair, whereas the third cross could not be distinguished from the pure breed.

Now, it is to this most valuable and interesting experiment that I would call particular attention, for I have seen its results and can bear witness to its complete success. During a week's visit to the gentleman in Georgia, U.S. who bought up Dr. Davis's flock, I had ample opportunities of inspecting them most minutely, and I assert that nothing could exceed the vigour and healthfulness of these animals, both the pure and cross breed.

Professor Bachman, the celebrated German naturalist, inspected this flock just after my visit to them, and in a report published by him on the subject he says:—"Familiar as I have been, through a long life, with the changes produced by crosses amongst varieties of domestic animals and poultry, there is one trait in these goats which is more strongly developed than in any other variety that I have ever known. I allude to the wonderful facility with which the young of the cross between the male of the Asiatic goat and the female of the common goat assumes all the characteristics of the former. It is extremely difficult to change a breed that has become permanent in any of our domestic varieties, whether it be that of horses, cattle, sheep, or hogs, into another variety by the aid of the male of the latter, for there is a tendency to run back into their original varieties; hence the objection to mixed breeds. But in the progeny of these Asiatic and common goats, nine-tenths of them exhibit the strongest tendency to adopt the characteristics of the male, and to elevate themselves into a higher and nobler grade."

Professor Bachman then goes on to say, respecting the woolly hair of these Angora goats:—"The quantity sheared in April was, from the bucks (aged), from 5 to 7 lbs., and from the ewes, from 4 to 5 lbs. * * * * * In regard to the fineness of the fleece, we find a microscopic examination of Asiatic goat's hair from the stock now owned by Mr. Peters and other gentlemen, given in the Patent Office Report for 1855. The examinations were made by Geo. G. Schaffer, M.D. He says, 'The degree of fineness is about that of the finest Saxony wool.' He gave also an outline from a piece of shawl stuff imported from Calcutta, and said to be the finest ever brought to the United States.

"I have lying before me specimens from the fleeces of young Asiatic goats bred in the United States, which we have compared with the finest wool of the merino sheep, and we find the former not only equal in fineness, but of far greater length.

"In the old female it is a little coarser, and in the old males still more so; hence it is proposed to divide the fleeces of these goats, at shearing time, into classes thus:—

Kids under a year old	No. 1.
Yearling ewes and yearling weddars ...	No. 2.
Yearling bucks and old ewes	No. 3.
Aged bucks.....	No. 4."

Amongst the specimens on the table will be seen the fine young hair of the yearlings, and some from a splendid old buck, all bred in the United States. These samples I had given me on the spot by Mr. Peters, together with that pair of socks which some old woman in his neighbourhood had made from the hair of his goats. It will be observed how beautifully soft and comfortable they feel, and as to their durability Professor Bachman says,—"A member of my family has had in use for several years a pair of stockings from the hair of this goat, and they seem to be almost indestructible."

I have had some of that longer specimen sent down to Leeds for valuation by the manufacturers, and it came back with this answer, "Any quantity of such an article would be readily purchased here at 3s. per pound:" but I believe that its present value would be from 3s. 6d. to 3s. 9d. per pound.

At this rate each animal would annually yield a fleece worth from 14s. to 25s., besides being very hardy, and resolute in its own defence against dogs, &c. This return is certainly very far superior to that of even the finest merinos in our colonies, whilst these goats are not liable to the same diseases.

These are very weighty considerations, and have already began to exercise an influence on the minds of our colonial breeders.

When the Angora goats are crossed with the common native kind, the progeny becomes more hardy and more prolific, seldom having less than two at a birth.

From these brief statements (so thoroughly authenticated as they are) it can readily be understood by any one, that a colonist starting with a thousand common native she goats and a few male Angoras, could in the course of a few years get up a large and most valuable flock, which would yield him a very handsome income; whereas breeding from the pure goat alone, many, many long years must elapse ere he could hope to attain the same result.

I have now gone over all the ground which I proposed to myself, in writing this paper, and believe that I have clearly pointed out simple and practical means whereby our flocks of sheep and Angora goats may be very largely increased, and our supplies of wool and mohair be rendered as abundant as our manufacturers can desire. I want to see all classes of the community clothed in good, honest, and comfortable woollen fabrics, instead of in those deluding compounds emanating from the factories of McFlimsy, Shoddy, and Co. I want to see our manufacturers supplied with an abundance of good raw wool, that they may be able to supply their customers with genuine woollen cloth; and that those manufacturers who are preying upon

the public, may have as little inducement as possible to continue in such a course.

This Society, comprising so many of the good and great of our country, must cordially join me in these wishes; and will always use its best endeavours to promote such useful objects as I have had the honour of bringing before it this evening.

DISCUSSION.

Mr. S. Sidney said that having for a long time taken an interest in the subjects of agriculture and colonisation, he would venture to add a little to the extremely valuable information that had been laid before them that evening. He was sure that he expressed the feeling of those present, and of all those who, owing to the admirable arrangements of the Society, would have an opportunity of reading the paper in the *Journal*, that a communication containing so much valuable and original information had seldom been presented to the Society; for what they wanted on a subject of this kind, was that some one like Mr. Wray, having had the advantage of personal observation, should take the trouble to present it before the Society in a condensed form. There were some very interesting points connected with the rise of wool production in this country. It was doubtless known to most of them that wool was originally the great staple of the country, and it was considered so valuable that a stringent law was passed to prohibit its exportation, the small manufacturers of that period imagining they would be ruined if foreigners got hold of our wool. He had himself conversed with persons who were old enough to remember that extensive smuggling arrangements were organised in Kent and Sussex, for the exportation (under the penalty of transportation) of wool to the continent. At that time the article consisted of the long, coarse wool, which was all they were able to produce. Although the duty upon foreign wool was so very high, there were, nevertheless, persons who collected the finer qualities from abroad. Some 60 or 70 years ago the South Devon breed was introduced, by Mr. John Ellman, of Glynde. Mr. Robert Bakewell, of Dishley, had produced the medium quality of wool, and Mr. Ellman introduced the breed of sheep producing the short fine wool. When the South Downs and Leicesters were brought into notice, the one producing short wool and the other long wool, the King of Spain, being under some obligations to our Government, presented to King George the Third a flock of Merino sheep, and the idea then occurred to some of the leading agriculturists of that day—including the Earl of Leicester, Lord Western, and Lord Somerville—that they could place the Merino fleece upon the Southdown body. That would have been an admirable thing, could it have been accomplished; for in this closely-inhabited country mutton must be the first consideration in the breeding of sheep; it was only in such colonies as Australia and the Cape that they could afford to breed for the sake of the wool alone. The late Lord Western devoted his life to this subject, but he failed in placing the long-wool of the Merino upon the meat-yielding body of the Southdown, and the Earl of Leicester, although himself impressed with the feasibility of the idea, failed in inducing his tenants to enter upon the experiment. They could not combine the characteristics of the two breeds in one animal, for they sacrificed the meat if they obtained the wool, and they spoiled the wool if they got the meat. The next great change was brought about when the struggle between the manufacturers and the wool-growers reached its height. The home producers were clamorous against the reduction of the duty upon foreign wool, whilst the manufacturers declaimed againgst the reduction of the duty upon the export of English wool. That enabled Mr. Huskisson to get both parties into a corner. He said both were asking for opposite things; he would, therefore, permit the exportation of English wool, and lower the duty upon foreign wool. That enabled the change to take place which ultimately led to the total abolition of all duties on wool. It was that total abolition of duty which led to the increased importation of wool from all parts of the world, and notwithstanding it was predicted at the time that such a measure would prove ruinous to the home grower, it had been shown by the statistics brought before them that evening, that the demand had outstripped the supply; and it was a curious fact that during the last six or seven years the coarser descriptions of wool had been in very great demand for the purpose of admixture with the short-wools; and whereas formerly the short-wools bore the largest price, the long-wools now brought the highest price, and were likely to continue to do so. He could not say that he was sanguine that any changes would take place in the sheep farms of this country, or that any further cross from other countries was likely to be introduced; for this reason—the Dutch sheep were known as a very prolific breed, and they were imported into the London market in large numbers, solely as a good meat-yielding breed. The breed of sheep had indeed been carried to such perfection in this country that the farmers dare not venture upon any other cross. Each district had found out the breed of sheep best suited to it. In the extreme north they had the Highland breed; lower down on the hills they had the Cheviot; on the fine downs they had the Southdown; and on the fat rich pastures of Leicestershire they had the Leicester breed; and there was so large a demand both for wool and mutton that they dare not enter upon a change. On the other hand, however, changes had been made in other directions with the best results, and the quality of the Dutch sheep was such that the price per head in the market had been improved from 20s. to 25s. by sending into Holland tups of the Leicester and Cotswold breeds. With regard to the Shanghai sheep mentioned by Mr. Wray, although they were indebted to that gentleman for having brought the subject forward, he (Mr. Sidney) thought it was only in colonies where the mutton was of little value, that that breed of sheep would find a place. He might mention that the Dorset sheep was the most prolific breed which we had in this country. The London market was supplied with house lamb from that breed; and if it were a point of importance and would be found to pay, they could be got to breed twice a year. With regard to what had fallen from Mr. Wray upon the subject of shoddy, although its use might in some cases be disapproved of in our manufactures, yet it was not altogether to be condemned. Some twenty or thirty years ago the working classes of this country for the most part wore second-hand clothes, but by this admixture of materials they were now enabled to wear new clothes. He thought a man had more respect for himself if he bought a new coat for a small sum, than if he wore the clothes of another man, although they might be of better material. By means of such useful information as had been given that evening, and which would be extensively diffused by the Society, a stimulus would, he hoped, be given to the production of wool all over the world, and he trusted the use of shoddy would ultimately be entirely superseded.

Mr. P. L. Simmonds said the subject which had been brought before the Society by his friend Mr. Wray was of very great importance, since it was evident that the production of wool did not keep pace with the wants of our manufacturers. Unfortunately we heard the same complaint of deficient supplies of the raw material for all the great textile manufactures forming our national industries. Flax, cotton, silk, and wool were not to be obtained in anything like the desired quantities. The woollen trade was the second of our great industries, the value of the home and foreign wool used in this country being about £20,000,000, and the exports of woollen manufactures, £12,750,000, and it was estimated that we used up three-fourths of the manufactures in the country. The importance of keeping up the progressive increase of this great staple industry would be generally admitted, and especially

if it could be done by obtaining increased supplies of wool from our own possessions. Having had occasion recently to investigate very closely the subject of wool and our other textile manufactures, he would go over briefly the ground taken by Mr. Wray, correcting him in a few details. Firstly, as to the production of wool, this was a very debateable ground, and although there were no reliable data to frame a decided opinion upon, yet the wool produced at home made but comparatively slow progress, breeding as we did rather for flesh than wool. He thought, however, Mr. Wray had somewhat overrated the number of sheep and quantity of wool in the kingdom. When he (Mr. Wray) applied to him a day or two ago for his opinion on the matter, he had told him that he thought the number of sheep could hardly be rated higher than 50,000,000, and the quantity of wool at not more than 250,000,000 lb., and even this he thought was a high estimate. In confirmation of his opinion he might be allowed to cite a few authorities from writers who had looked into the question. Sixteen years ago, when engaged upon *Johnson's Farmers' Encyclopedia*, he had endeavoured to arrive at some correct data, and had since followed up the subject:—

	Sheep.	Wool.
In 1801, Mr. Luccock ...	26,147,763 ...	94,376,640
,, 1828, Mr. Jas. Hubbard.	... ...	111,160,560
,, 1834, Mr. McCulloch...	32,000,000 ...	...
,, 1835, Mr. J. McQueen...	48,000,000 ...	246,700,000
,, 1845, Prof. Low ...	35,000,000 ...	157,500,000
,, 1851, Mr. T. Southey...	55,000,000 ...	275,000,000
,, 1852, Mr. B. Poole ...	32,000,000 ...	128,000,000
,, 1857, Mr. Ashworth, before Soc. of Arts	... ...	143,042,782
,, 1858, Mr. E. Baines ...	... ...	200,000,000

Now, all these variable estimates from men of ability and judgment, and with favourable opportunities for inquiry, showed how difficult it was to arrive with any precision at the truth. We had, however, statistical returns within a year or two from Scotland and Ireland, and these gave the sheep at 9,000,000. To our discredit as a nation, we had no agricultural statistics for England and Wales, while almost every other civilized country and colony had them; but he thought we could scarcely assume more than 40,000,000 sheep as kept in England and Wales, and this would make a total of 49,000,000, yielding about 245,000,000 pounds of wool at the utmost. Passing on to the colonial supply, it was gratifying to know that there was ample room for increased production, under favourable circumstances, in our Southern colonies, at the Cape, and in Australia. The extended pastoral districts recently discovered in South Australia and along the banks of the central rivers, with the increased facilities for transport of the wool by the steamers placed on these rivers, and the railroads now being formed to the shipping ports, would be highly advantageous. Then there was much to be anticipated, even from Western Australia, as labour became available. In the Moreton Bay district, beyond the Darling Downs, the new colony of Queensland, as it was now termed, the opportunities for pastoral progress were immense; but labour required to be diffused, not centralised in towns, calling, as in Victeria, for the slaughter of a million or more sheep per annum without a corresponding extension; hence, so far from any increase in the flocks of that colony, there had been a decrease in the last two or three years of nearly 2,000,000 sheep. Glancing over the returns of our imports of wool from Australia, he found that there was comparatively little increase at all in the last few years, with but one or two exceptions. New South Wales, instead of advancing, had, in 1858, fallen back to below the supply she furnished us in 1854, and the same remark applied to Victoria. South Australia had advanced from 4,400,000lbs. in 1854 to 7,500,000lbs. in 1858. But probably much of this was New South Wales and Port Phillip wool, brought down to Adelaide by the Murray river for shipment. Tasmania, instead of going on steadily increasing, as Mr. Wray stated, had largely retrograded in her wool supply to this country, from 5,500,000 lbs., in 1855, to 4,280,000, in 1858. One reason, however, for this was the demand made for sheep for the Melbourne market, and the quantity shipped as stock to New Zealand. From the New Zealand settlements a large increase of wool might be looked for, arising from the extensive emigration of late years to that colony, resulting from the "assisted passages" and free grants of land. The boundless plains and the favourable climate held out great promise, and the shipments already showed that enormous strides had been made, for while but 300,000 lbs. of wool were exported to this country in 1854, in 1858, 2,700,000 lbs. were sent. The extension of wool production in the Cape Colony was a most remarkable feature, and it was fast approaching in quantity the Australian colonies, the production at present being fully equal to that of Victoria or New South, Wales, our largest wool producing colonies. It was, however on the eastern provinces and the adjacent regions that we were mainly dependent, and while peace prevailed on the borders the flocks and herds would increase and settlements extend northwards. The whole of the pastoral productions had arisen there within a quarter of a century, for in 1835 there were not more than 70,000 lbs. of wool produced, while now in that province it amounted to 16,000,000 lbs., and even Natal was shipping its 200,000 or 300,000 lbs. Passing next to British India, he feared that from India Proper we had not much to look for in the shape of wool, for all that came from the Bombay Presidency was derived from the Punjaub, Scinde, and Central Asia, and from these he was glad to see large and increasing supplies coming to hand, even though the wool was not of a very good class. Without going into the question of the policy of breeding from the Shanghai sheep—which he thought a debateable point—he might allude to the quantity of Chinese wool now imported from Hong Kong, amounting to seventeen or eighteen million pounds, besides a few hundred pounds from China ports direct. Thus much for our colonies. From the United States, to which Mr. Wray had alluded, we could never anticipate getting supplies of any consequence, for they produced much too little for their own consumption, and they were buyers in our markets. Having dealt with the wools proper, he now came to the mohair and alpacas, which had led to such important trades and manufactures during the last quarter of a century. It was to be regretted that the supplies of these were also failing, or at least not reaching us so largely as formerly, and no doubt the Continent was bidding against us for these wools. Of mohair, which had been coming in largely of late years, there was a decreased supply in 1859 of about 5,000 bales—the imports having been but 12,711 bales against 17,301 bales in 1858. Hitherto we had been dependent upon single districts for mohair and alpaca, but now that Anglo-Saxon enterprise and energy had been thrown into the production, and we had been able to introduce the Angora goat into the Cape Colony, South Australia, and the United States, some beneficial results might ensue. A large flock of alpacas had also, at great expense and risk, been imported from Peru into Sydney. The following table showed the importation of Turkey goats' hair or wool into the United Kingdom:—

	lbs.		*lbs.*
1842	1,011,780	1851	193,046
1843	575,513	1852	222,239
1844	1,290,771	1853	2,916,509
1845	1,241,613	1854	1,189,147
1846	1,287,320	1855	2,928,411
1847	1,300,400	1856	2,912,838
1848	88,853	1857	3,255,010
1849	253,037	1858	3,312,012
1850	267,650	1859	

In the past ten years, the price of mohair had increased with the extended demand and consumption. In 1849, it

stood at 1s. 8d. per lb.; in 1850 and 1851, it realised 2s.; in 1852 and 1853, it stood at 2s. 4d.; in 1855 and 1856, owing to large supplies, it declined to 2s. and 2s. 2d.; in 1857 and 1858, it recovered to 2s. 2d. and 2s. 4d.; in 1859, owing to a rather limited and unsteady demand, with but light stocks, prices opened and kept at about 2s. 3d. to 2s. 6d. until June, and then ran up to 3s., at which they kept steady. Although we imported, in 1859, 66,180 ballots of alpaca wool, yet the small stock of 2,000 to 3,000 ballots was held for high rates, so considerable was the demand. Mr. Wray had spoken strongly and forcibly upon the shoddy manufacture, and though there was some justice in his observations, yet it must be remembered that the utilisation of waste stockings, woollen rags, &c., had led to a large manufacture, as he (Mr. Simmonds) had occasion to instance in his paper "On the Utilisation of Waste Substances," read before the Society. If people would have cheap goods, they must expect to have inferior materials. But the utility of mixed fabrics in extending manufactures was evident in the cotton, silk, and linen manufactures. He would conclude by observing that the discussion of the subject could not fail to be beneficial in awakening attention, at home and abroad, to the necessity of extending the production and improving the quality of the wool in our colonial possessions.

Mr. Metcalfe remarked, that with regard to Indian wool, the quality was such that it was not desirable to give too much attention to it. If they wanted fine wool, they must seek for it in other quarters than in India.

Dr. Way said much valuable information had been given that evening upon a very important subject, but Mr. Wray had omitted to mention one point in connection with the Cape Colony, which he thought was of interest. Mr. Wray had alluded to the introduction of the Angora goat into America, but he did not know whether that gentleman was acquainted with the fact that that animal had within the last five years been introduced into the Cape with considerable success. He was glad to see present near him a gentleman who had a flock of thirty or forty of those goats, and perhaps he would favour the meeting with the results of his experience on this subject.

Mr. Mosenthal said he had been unexpectedly called upon to address the meeting, and must request the forbearance of the members for the remarks which he had to make. It was twenty-four years since his attention had been first drawn to the capabilities of the Cape Colony for the production of fine wool. In the year 1834 the total exports of wool from the colony were only 500 bales, derived from small flocks of Merino which had been introduced by certain of the English settlers of 1820, and also by certain gentlemen in the Western Province. At that period, millions of sheep of the old Cape or Barbary breed existed in the colony—animals distinguished by their coarse wool, approaching to hair, their wild character, assimilating to some extent to that of the antelopes, and by their massive tails of fat. Sir Andreas Stockenstroem, formerly Lieutenant-Governor of the Eastern Province, endeavoured to induce the Dutch farmers to cross their breed with the merino, and for this purpose offered them rams free of cost, but to no purpose. They refused to employ them, the Boers alleging that the merino was "too ugly," whilst their wives objected most strongly to relinquish the fat tails, which they were in the habit of employing for culinary purposes. Slowly however, but surely, light began to dawn upon them, and the success of some in wool growing induced their neighbours to follow in their course. Large importations of well bred merino sheep were made from Europe to the colony. In 1851, on the occasion of a visit to Europe, he (Mr. Mosenthal) travelled over the continent, with a view to select sheep possessing a large carcass combined with long fine wool, and succeeded in procuring them in France. Some of these rams sold as high as £150 each. Since that period he (Mr. Mosenthal) and his brother had imported about 600 sheep into the colony, mostly rams. By their distribution throughout the colony, vast flocks of the old Cape breed had been converted into wool-bearing sheep, but there still remained one and a half millions of this breed capable of similar conversion. The extent of country suitable for sheep-farming and still unoccupied, was enormous, The vast plains beyond the Orange River were very sparsely peopled, and, if we could only be sure of a more consistent course of policy, would speedily be occupied by enterprising sheep farmers. That tract of country, extending over some millions of acres, was annexed to the colony by Sir Harry Smith, and, four years after, was renounced by Sir George Cathcart. In spite of the uncertainty of tenure caused by such vacillating policy, that country at present exported 10,000 bales of wool, which, under a settled form of government, was capable of an enormous increase. If the colonists were set free from such interference, and allowed to regulate their own affairs under the superintendence of such an able Governor as they now possessed, he did not hesitate to say, that in less than ten years, the production of wool from South Africa, at present large, would be doubled or more than doubled. One word on the subject of Angora wool. In the year 1856, his brother, Mr. Adolphe Mosenthal, proceeded to Asia Minor, and brought thence a flock of 20 ewes and 60 rams, at a cost of about £1,300. Of these, 30 reached the Cape, and had since been distributed in the colony, and a cross had been raised between them and the common goat of the country. Some of the wool from the cross had been received in the English market. The increase which might be expected from that source was very considerable, as the flocks of goats throughout the country were very large; and in the course of a few years this product would, without doubt, occupy a good position among the exports of South Africa.

Mr. Leonard Wray begged to say a few words upon the discussion which had taken place. He would express his great pleasure at seeing Mr. Mosenthal present, of whose exertions in the Cape Colony with regard to sheep and the Angora goat he had previously heard; but he (Mr. Wray) had been obliged to restrict himself in his paper to the briefest possible comments upon all those points, in order to allow time for the discussion of the subject. In the first place, he had directed his remarks principally to the quantity and quality of the wool in our colonies. He had not taken into consideration the carcase of the animal, because that was a thing which colonists did not take much heed of. They wanted the wool. It had been truly remarked by Mr. Sidney, that if they tried to get wool and carcase in the same animal they generally failed in both; but if they paid attention to wool only, they might succeed admirably. In Australia this had been carried to such an extent that until recently they boiled down millions of sheep for the sake of the tallow, saving merely the legs, which were sold for about sixpence each; therefore, in all the remarks he had made, it should, in common justice, be borne in mind that, in advocating the use of the Chinese sheep for getting up large flocks rapidly, he had kept in view the ultimate production of wool only. In the first place they should make use of those sheep to get up a large flock; they could then cross them with any variety of breed they pleased, and by that means obtain a description of wool such as the Chinese sheep itself would not produce. In the Cape Colony it would be folly to cross the Chinese sheep with the native breed, but if they used that sheep at all, they must do so until they got up a flock, and then cross them with superior breeds. His friend Mr. Simmonds had spoken with regard to the wool of this country. He (Mr. Wray) confessed he had not kept in view the production of wool in this country so much as in the colonies. Here they had such a mass of capital, and so many intelligent men to improve the breeds of sheep, and make them suitable to the locality, that he thought it would be impertinent for him to attempt to show them what to do. But he did know something about the colonies, and what he had said particularly applied to them. He knew there were sheep like the old Lincoln, the Teesdale, and the Romney

Marsh breeds, which were like the Polder Holstein breed, with this difference, that the Polder Holstein would produce five lambs at a birth, and the Romney Marsh sheep, which was the nearest in size and quality of wool, would only produce one. He was aware that the most prolific breed of sheep in this country was the Dorset. In establishing a breed in England with the Chinese sheep, he proposed to cross them with those large-carcased, heavy-fleeced sheep, the Polder Holstein, using that cross merely as a step to attain another cross which should be suitable for this country. But again he came to the fact that he looked more to producing them in this country with a view of sending them to our colonies; for they knew that when the great colonial breeders came to Europe, as Mr. Mosenthal had done, they did not come to our great sheep farmers, but they went to Saxony and all over the continent for their improved breeds of sheep, and it was well known how high a price they paid for them. That ought not to be. If they could get these two prolific breeds producing in the first instance large sheep, and then produce finer wool by means of other crosses on them, it would be very desirable. He had kept that in view in what he had recommended. With regard to the subject of shoddy, what he had said in his paper might give some offence; but he thought there was a character to be maintained in our manufactures which was unfortunately too frequently lost sight of. He wished the Government of this country would make it imperative in all mixtures, that the article should bear its right designation. The Government had already done this in more than one case, for instance, coffee and chicory. Why was that done? Because a palpable cheat upon the poor had been perpetrated. Why should it not be done in other things? Why not in the case of woollen cloth, as was done with a mixture of cotton and linen, call it "union," and if shoddy were used, let it be designated as a "union" of shoddy and wool? He had no doubt there were gentlemen present who knew what an enormous quantity of rotten stuff was brought from Germany in the shape of blue petticoats and red nightcaps. Where did it go to? Into the hands of the manufacturers, and it was by them worked up into a worthless material. With regard to the number of sheep in this country, and the quality of wool produced, he quite agreed with Mr. Simmonds that it was a disputed point. No one would imagine the trouble he had been at to get the information which he had put before them on this subject. He was overwhelmed with letters of a contradictory character, until he might say the whole thing was a perfect chaos. He had taken the best means of arriving at what he considered a reasonable conclusion, and he thought he was not very far wrong in the estimate he had given. They knew that since the estimate of Mr. Southey in 1851 there had been an enormous increase in the number of sheep in England, Wales, Scotland and Ireland. He believed they might fairly conclude that in the year 1860 there were 55,000,000 of sheep, which would produce 275,000,000 lbs. of wool. He believed that was on the whole a fair calculation. The next point he would allude to was with regard to the quantity of wool received from America. He had touched very lightly indeed upon Texas. This was an enormous territory, and was to all intents and purposes a sheep grazing country. The number of sheep that might be bred there was something wonderful. They had a fair breed of sheep in Mexico, and those sheep, which might be bought in any number for a dollar per head, were taken into Texas and crossed with a fine breed brought from Kentucky, and wool had been thus produced which would bear favourable comparison with the finest Merino. He knew a German gentleman who was so confident that he could beat the wool of the United States, that he made a bet of 2,000 dollars that he would bring over a ram which should exceed in the fineness of the wool anything produced in America. He got the best ram he could from Saxony, and found that he had made a great mistake, as there were Merino sheep in the country which were far superior. He knew that the Texan farmers had very fine sheep to breed from, without going to Saxony for the stock. Then there was California, another great country in all respects adapted for the growth of wool. The export of wool from the United States to this country did not exceed about 900,000 lbs. per annum; but vast quantities were wasted, though the farmers, he was happy to say, were becoming aware of their folly. Large quantities of wool were consumed in producing clothing for three and a half millions of negroes in the United States. The wool for that purpose was sent to a factory close at hand, and was converted into cloth for the negroes' clothing. It would be unpardonable in him to omit to mention the kindness of Dr. Forbes Watson in having furnished, from the Museum at the India House, the beautiful specimens of Indian manufactures with which the walls of the room and the table were decorated. The production of wool in India was little understood in this country. If he had time to explain the various specimens upon the table, they would see that there were sheep in that country—whether from Beloochistan or the Punjaub was unimportant—of a stock of which they had reason to be proud. There was a Merino breed in that country, and he defied any one to produce finer wool. The crosses had always been of a most advantageous character, and the wool was judged to be worth, at first cost, 16d. per lb. Whether the wool imported from India came from the Punjaub or any other part, there was the fact before them that 18,000,000 lbs. of wool were exported from India to this country in the year 1858.

The Chairman rose to propose that the thanks of the meeting be given to Mr. Leonard Wray for his very interesting and instructive paper. Having been called upon at a very short notice to take the chair, he was sorry that he could add very little to the information already given. There was one remark which had fallen from Mr. Wray with reference to Algiers to which he (the chairman) would make a slight addition, founded upon his personal observation in that country. He believed the French Government had used every effort to make Algiers a profitable colony to themselves, and he imagined that what applied to general colonisation was applicable to sheep breeding in particular. There was no unoccupied land in Algiers. It was all the property of the Arabs. They had peculiar and safe tenures, and it was impossible to dispossess them except by force. It was likewise impossible to purchase their land, and they held to their property with great tenacity. The French government had hitherto found it impossible to locate French colonists in the way they wished to do, or to introduce sheep-farming or any other improved form of agriculture into that country.

The vote of thanks having been passed to Mr. Wray,

The Secretary announced that on Wednesday evening next, the 15th inst, a paper by himself, "On Figure-Weaving by Electricity," would be read. A Model of the Electrical arrangement will be exhibited. The Chair will be taken at 8 o'clock.

THE ALPACAS IN AUSTRALIA.

The following is from the *Sydney Herald*, of Nov. 12:—The shearing of the alpacas was commenced on Saturday last. Two—a white one and a black one—were selected indiscriminately from the flock, and were stripped of their fleeces by the South American herdsmen employed under the superintendence of Mr. Ledger in tending these animals. The black alpaca yielded 17¾lbs. of wool, and the white one 12lbs. Both these products were much larger than had been anticipated. The alpacas being pure bred, the wool is extremely fine, while the extraordinary weight of the fleeces indicates the length of the staple.

It should be stated that the alpacas having been shorn just before being shipped, the wool is about 14 months' growth. The shearing is proceeding rather slowly, as most of the females being in lamb, it is rather feared that taking off the fleeces now might bring on premature dropping. In consequence of this, the immediate yield will not be so much as it otherwise would be. The animals are thriving well. A few deaths occurred through the want of proper fodder and the severe cold combined, during Mr. Ledger's absence, but these have been more than counterbalanced by the births, so that the present number of the flock exceeds that of the animals which landed in Sydney. The lambs born in the colony are particularly healthy and strong.

FLAX AND ITS PRODUCTS IN IRELAND.

By Wm. Charley, J.P., Seymour-hill, Near Belfast.

Letter XV.

As the flax is the foundation of the spinning process described in my last letter,* so the yarn is the great feature in forming the fabrics we have next to consider. Closely allied, indeed, to yarn is thread, and some reference to its manufacture will very properly come first.

Through the kindness of Messrs. Barbour and Sons, of Lisburn, one of the largest firms in this branch of trade, I have recently had an opportunity of closely inspecting the process.

The fibre for heavy, strong thread yarn, used by shoemakers, is spun with a very long reach fully 22 inches, and without going through water. The only damp imparted to it is from a roller it passes over, which is kept moist with cold water. This thread-yarn does not receive any other twisting by machinery; the shoemakers do this for themselves by hand, and, like the jolly tars, can no doubt spin a long yarn occasionally. From the ordinary hot-water spinning frame, the yarn for tailors' thread proceeds to the twisting frame. Here it is passed through water and over little rollers two or three plies, as may be required, and is finally twisted in the same way as the yarn itself originally was spun, on the "throstle" principle.

Besides the strong thread-yarn for shoemakers, a very substantial article is made for fishing nets, called "Gilling thread." Large quantities of this are, I understand, shipped for the Newfoundland fisheries. Almost all threads get, at least, one boil in soda-lye to purify them. The shoemakers' and the Gilling net thread is put up in nice little balls, of two ounces each, or one ounce, as may be ordered by the purchaser. This ball-making is done very rapidly by an ingenious machine, attended by girls. The tailors' thread is generally made up in skeins of 60 inches long, with eight threads to each. Ordinary sewing thread is treated in the same way, or rolled on tiny wooden spools. A new patent machine is just invented for the latter purpose, and will greatly facilitate the execution of this rolling.

There are special spools made to receive thread for the new sewing machines, and thus save any further expense in the preparation. Owing to the recent dearness of flax, a good deal of Italian hemp has been used in making coarse yarns for thread. The flax tow is also regularly adopted for this purpose, and Friesland flax is imported from Holland. This flax possesses a strong fibre, which has, however, the property of absorbing and retaining moisture so rapidly as to be very easily spoiled if kept long in store. This peculiar tendency, it is said, is caused by the flax being steeped in the brackish water of the seaside marshy soil, which impregnates the fibre so thoroughly with the saline character belonging to itself as to render the removal of this unavoidable defect rather difficult. I believe there is no other flax known to have this peculiar saline dampness.

The dew-ripe or dew-rolled flax of Archangel and Northern Europe not being watered in pools at all, but simply exposed to the atmosphere on the grass, is still more difficult to manage than the Friesland.

The flax commonly called Archangel is not actually grown near that northern town. It is produced many miles off in the interior to the south-west, and is merely shipped at that port. The carriage by land must be a heavy item in the cost before exporting, and to that has to be added the freight and risks of sea in bringing to a British port.

The flax and hemp fibres have so much tenacity combined with pliability, that wherever great strength is required they have no successful competitors. In fine bleached sewing threads, however, cotton has very much interfered with flax of late, as the manufacture of cotton thread has been immensely improved, and the white colour so easily obtained in that fibre is with much difficulty approached in linen thread. I feel sure, however, something might yet be done to perfect the bleaching of the flaxen thread, and assist thus in restoring it to its former leading position in this branch of commerce.

The threads to be coloured pass on to the dyeing house, after first undergoing the ordinary boiling process. In this boiling they lose about 10 per cent. in bulk and weight, 2½ per cent. of which is generally regained in the dyeing. Tailors' threads are generally made a black or dark blue shade, if not used whitey brown, the natural colour as they come from the first boil. The principal articles used in the dyeing vats are logwood, sumac, and copperas; in the bleaching, soda-lye, chlorine, and sulphuric acid. After these processes, the thread requires to be softened. This is managed in some establishments by squeezing the yarn into rope-like coils with a hand pin; in others this is done by machinery, called "iron men," which suit equally well and economise manual labour.

Those threads that are to receive the patent, or glossy finish, are dipped in a glaze made of wax, farina, &c., and put on a peculiar machine called a polishing machine. This, by the action of a series of brushes, gives the nice polish or glaze required.

From the hank the thread for balling is wound on large bobbins ready for completion at the balling machine already referred to; the thread for skeins is taken off direct, measured, and made up in pounds; the prices quoted for such being always per package of a dozen of pounds.

The balls of thread, on the other hand, are finally made up in packages of 3lbs. and 1½lbs. each, viz., 24 balls of 2oz. and 24 small balls of 1oz. These little packages are again made up in trusses of 120lbs. each. There is a great deal of detail in all these operations requiring a large amount of minute supervision by competent overlookers. All appears going on satisfactorily, except the bleaching of the white sewing thread, to which I have already called attention, and my having done so may, perhaps, eventually bring to bear on this neglected portion of the trade, a fair share of the skill and science so effectively applied to the other branches.

In Ireland, the principal firms engaged in making thread, are, besides Messrs. Barbour (already mentioned), Messrs. Dunbar and Co. (of Gilford), Messrs. Hayes, and Mr. Dargan; these, probably, turn out daily six tons weight of finished thread, which is sent chiefly to England and the United States, and some also to the European Continent.

The revolution effected, nearly a century ago, in the

* In that letter I made some allusion to the peculiar names "throstle" and "mule," as applied to spinning machinery. I have, since it went forward, had my attention called to the History of Cotton Spinning, and, after searching therein, I find that the "mule" jenny was originally a cross or combination, as I suspected, between the spinning jenny (invented by James Hargreaves, in 1767) and Arkwright's patent system. This clever invention of the mule jenny enabled the cotton spinners to produce much finer and softer yarns than any previous system. The cotton trade is indebted, it appears, to Samuel Crompton for this improvement. He invented and named it about 1786, seventeen years after Arkwright had patented his celebrated spinning frame.

cotton trade, by the introduction of spinning machinery, has been successfully followed in the flaxen manufactures, and we are now again taking a lesson from our great rival sister, by endeavouring to establish the system of power-loom weaving. Seventy-five years ago Dr. Cartwright applied this principle of power to cotton weaving, and since then by a succession of improvements, the cotton power-loom has attained to great perfection.

So long as a man's labour could be had at the hand-loom in Ireland for a shilling a-day it was felt no power-loom could work much, if at all, cheaper; but when wages, some few years back, began to advance, and the population to decrease instead of increase, it was admitted that the power-loom was at length required. At present one of the striking features in the linen trade is, the gradual introduction of power-looms for weaving the coarser qualities of cloth, so as to ensure at all times, irrespective of the rise or fall in wages, or number of weaving hands in the country, a plentiful supply of cloth.

Some years ago it was thought almost impossible to manage flax yarn in a power-loom, and certainly the first attempts were very imperfect; but gradually, by perseverance and skill, the difficulties have been removed in a very great degree, and excellent goods, 10°° to 16°° in fineness, are now turned out, equal, if not superior to the production of the hand-loom. The only point that appears yet in favour of the hand-loom is the selvage or edge in heavy goods; yet even here the improvements of mechanism go on steadily, and are sure to triumph in the end. According to a return, lately made public, there were in Ireland last year, 28 power-loom factories, containing 3,633 looms; but I believe this year there will be a considerable addition to these numbers, as it is found by the spinners more profitable to work up the yarn into saleable cloth than dispose of it to the small hand-loom manufacturers through the country.

The following extract, from a Review of the Linen Trade for 1859, by a Special Committee in charge of the Weekly Circular of the Trade, shows the general feeling that exists as to the ultimate success of power-loom weaving:—"From the enhanced value of manual labour and other causes, the supply of hand-loom goods is becoming less abundant and decidedly less certain, and there are many circumstances which would seem to indicate that while the days of progress in power-looms have unquestionably set in, those of decadence in hand-looms give warning of approach."

I quite agree with this opinion, so far as coarse and medium qualities are concerned, but I think the hand-looms will sustain their superiority in the fine goods, 18°° to 26°°, for years to come, though as the power-loom machinery becomes more perfect in future, I have no doubt it will gradually be creeping upwards, and encroaching on what at present is considered the special domain of hand-loom weaving.

There are two ways of preparing yarn for weaving by power. The first plan is to send it to the factory direct, without any special preparation; the other is to cleanse it by boiling, as is done for the hand-looms. The first plan does well enough for light linens, or those sold for use in the brown state; but the second treatment is necessary in first-class heavy bleaching goods, as the green unprepared yarn reduces very much in the bleaching process.

Under the first plan, the warp yarns are brought from the mill, and, instead of being reeled, are wound by machinery on large spools; these spools are put on a winding frame called a "bank," and from it the yarn is drawn by the warping machine through a long reed, or rather series of reeds, resembling a grating, and having more or less interstices according to the set or fineness of the fabric to be made. This warping machine has the yarn arranged like the strings of a piano, in fact the linen long-ways, without the cross threads, and folds it thus on a roller. This roller when filled is carried to the dressing-room, where it is passed through a paste made from Carrigeen moss,* or some such substance, and afterwards nicely brushed—this prevents the weft catching on the warp and permits it to slip along more easily.

The warp is again restored to a roller, and then is ready for the power-loom.

Meantime the weft yarn received from the mill has been removed by machinery from the spinning bobbins to the shuttle bobbins, and is forwarded in this state to the girl in charge of the loom. She places the yarn in the shuttle and starts the loom. Perhaps the weft yarn breaks after crossing two or three times, and if the girl is not watching, you think the loom will go on trying to weave. No such thing—though not endowed with animal life, it shows in its clever mechanism the wonderful intelligence of man.

A weaver, named Bullick, invented a peculiar kind of catch-wheel, with a lever ending in a fork, which is arranged so that the weft yarn must gently touch it in passing—if it fails to do so, the catch-wheel stops the loom!

I have alluded to the difficulties at first experienced in establishing the weaving of flax yarn by power.

Mr. Giles Haworth, formerly of Blackburn, and now manager of Messrs. Craig and Co.'s factory, in Belfast, informs me that when brought over some years ago to introduce the system, as it existed in England, for cotton weaving, he found that flax was not an elastic fibre like cotton, and consequently, after repeated trials, the ordinary cotton power-loom, it was found, would not suit without some modification. To overcome the great tenacity and want of elasticity in flax fibre, a vibrating roller was invented, which comes and goes as the "headles" move up and down, and prevents any irregular strain on the yarn. This roller is not used for cotton, and a heavier and stronger kind of loom is required for flax than for the other material.

It is very interesting to watch the various motions in the machinery of a power-loom—the roller gently pulling on the cloth as it is made—the sleigh driving tight home the weft which the little shuttle slips in between the divided yarns of the warp—the headles raising the alternate sets of yarn to receive the next shot of weft; the striker, which represents the weaver's arm, at regular intervals, propelling the shuttle by a blow across to the other side of the loom: a regular game of battle-door and shuttle-cock. All these actions and more going on with each loom, and hundreds of looms in the same building, causing a din equal almost to the roar of a battle-field. In this peaceful strife, however, no blood is shed, but food and raiment are earned by willing hands for themselves and the little hungry mouths at home.

In a hand-loom, two to four of the outside yarns are put in double, to strengthen the selvage; the action of the power-loom is perhaps more trying, and it is found advantageous to use five to seven double threads to strengthen the selvage.

From the power-loom the linen is removed to the lapping-room, where it is crisped, or doubled across, measured, and folded, by hand, or by machinery, and it is then ready for sale; the pieces are generally about 60 yards long, and either 38 or 33 inches wide, but as the goods contract in width at bleach, they turn out when white 36 inches and 31½ inches, *i.e.*, 1 yard and ⅞ths of a yard.

* This moss is strictly speaking a kind of seaweed or algæ; its botanical name is *Chondrus crispus*. It is collected in considerable quantities on the coasts of Ireland. It is first bleached and dried by exposure to the atmosphere, and in this state is sold. When boiled, it forms a highly gelatinous substance, like isinglass or Iceland moss. If linen power-looms continue to increase in numbers as they are doing at present, several thousand pounds worth of this algæ will be required each year for the yarn-dressing described. We sometimes hear of the poor Irish peasants devouring seaweed to mitigate the pangs of hunger, but it is not perhaps generally known that this Carrigeen, boiled with a little milk, makes a most nourishing jelly, and, when nicely prepared, forms a "blanc mange" fit for any gentleman's table.

Linens woven by power, out of *green* yarns, contract in width and come out in length considerably more under the bleaching operation than hand-loom goods; but those made from boiled yarns do not come out or contract much more than the ordinary heavy hand-loom goods, say 2½ to 5 per cent.

In the construction of heavy power-loom linens the yarn must be boiled in soda lye to cleanse and partly bleach them; this is done after the yarn leaves the mill, and causes some more trouble and expense, but I think the result more than compensates for the outlay.

Even in light goods, I very much question whether it would not be wiser to boil the yarn before weaving; presuming the extra cost to be a ½d. per yard, I think the goods intended for bleaching would look, when finished, the difference better; but these are matters of business detail, and not of general interest, so they may be left to the skilful men in the trade to determine. It would, however, appear very evident to any one thinking on the subject, that the chemical compounds in the boiling process, would act far more freely and evenly on the yarn before being woven, than when tight packed together in the cloth. Indeed this fact cannot be disputed, and the managers of weaving factories should not overlook it.

I believe the cost of a power-loom for cotton is £10, that for linen is about £14, which appears a very moderate price indeed for so nice a machine; to this sum has to be added the driving or motive power, and the cost of the buildings, each nearly equal amounts, making the total cost of a good-sized factory about £42 a loom.

The principal factories in Belfast are Messrs. Craig and Co., already referred to, 321 looms; Bedford-street Weaving Co., nearly 400; Messrs. Mulholland, D. Currell and Co., Foster Connor, and Co., J. Murphy and Co., about 200 each. Messrs. Hinds and Messrs. Rowans are also erecting a good many, I am told.

In other parts of Ireland I may mention Messrs. Russel, of Limerick, Messrs. Richardson, of Newry, and Messrs. Murland, of Castlewellan — all three engaged principally in making rather heavy linens, while the Belfast factory owners have given their chief attention to the lighter descriptions of cloth.

The Messrs. Malcolmson, of Portlaw, Co. Waterford, have an immense factory, but their productions comprise only a few linens I believe, the great bulk being pure cotton manufactures. I understand, however, they make what is called "unions," *i.e.*, half cotton and half linen, in considerable quantities for export to foreign countries.

It is not, I think, generally known that 100 years ago the "calicos" of Great Britain were made with linen yarn warps, the weft, or cross yarns, only being cotton. Of course both were hand spun.

About 1767 spinning by machinery began, but only for the weft yarns. Two years afterwards Arkwright's invention enabled the cotton spinners to produce yarn strong enough for warp. The intimate union of linen and cotton was thus almost virtually ended, and a rivalry at once began between the divided pair.

Hand-loom weaving is either carried on in a large factory, where the owner supplies the necessary looms, or it is done by the weavers in their own homes.

The yarn from the spinning mill must be carefully boiled and washed. It is then warped into what is called "a chain," in the same style as for power-looms, and is put on a beam by the weaver ready for the loom.

The weft yarn is also boiled, and the weaver has to see it carefully wound on his shuttle bobbins ready for use, as he may require it. This is done generally by women or children, with the assistance of a hand reeling machine. The factories are generally limited to the weaving of damasks and wide sheetings, as in both these cases the looms are almost too expensive for the weaver to purchase himself. A respectable weaver is often, however, allowed to take the loom on loan to his own house.

The weaving of damasks is still carried on in the Jacquard loom. The series of cards perforated with numerous apertures are the means of giving the pattern to the cloth. How it does so would quite puzzle an ordinary looker on. I shall try to give a definition. Above the loom is arranged a series of wires, shaped like a cross; from these, cords descend to the warp yarn. The cards, perforated to suit the pattern, pass over a square roller, and each card is pressed against the ends of the little wires, so that where the card is solid the wires are pushed back. This motion raises the cords, and, consequently, the portion of warp yarn attached to the cord. The weft now shoots across, and a part of the web not being raised in the warp, the weft escapes it. By this means, instead of all the weft lying alternately between the warp yarns, it is only the plain ground of the damask that is so done. The patterns are uneven in this respect, and this makes them show to the eye when glancing along the cloth. In complicated patterns, an immense number of these little wires are required, and some expensively mounted looms will cost as high as £200; the very common ones probably £10. The arranging of patterns, and the placing of the cards, requires considerable skill, and is almost a special business of itself.

The Royal Manufactory, Ardoyne, Belfast, produces splendid damasks. Messrs. Coulson, of Lisburn, are very long established, and have been very successful. In the neighbourhood of Lurgan, many low-priced goods are manufactured, and offered for sale, on Thursdays, at the Linen Hall; these coarse things are also being made by power-looms, which will probably, in the end, supplant the hand-looms in this class as well as in coarse plain linens.

The sheeting loom is similar to the usual common kind, only stronger, and made to fit wider linen. To see the weaver labouring at one of these pieces of heavy sheeting, perhaps three yards wide, which he is expected to turn out quite even, and without a blemish, for sixty-four yards long, gives one a convincing proof that he, at least, among the sons of Adam, "is earning his bread by the sweat of his brow." One of the best weavers of this class in Ireland has earned as much as 29s. a-week, for four consecutive weeks, at a piece of sheeting 3¾ yards wide, but this is fully double the wages generally realised for ordinary widths.

When a manufacturer is engaged in producing the ordinary ⅞ths and yard wide linen, he has the yarn prepared and distributed among the weavers in the district, or forwarded to another more favourable locality. All Irish narrow linens were once given out in this way. The low goods, 10⁰⁰ to 16⁰⁰, are now greatly made by power-looms, as the wages of skilled manual labour have been yearly increasing in Ireland, and unskilled hands of course spoil the cloth.

The manufacturer should take care, after the yarn is boiled and marked, to have it very carefully handled in the drying, so as to keep the yarns separate, and prevent them adhering to each other.

If this be neglected, the yarn, when woven, will have a rough hairy appearance, like woollen fabrics. This defect in also caused by bad management in the dressing of the yarn in the loom.

The ordinary dressing now used is wheat starch with a little tallow. The latter gives a heavy appearance to the cloth, and if used in excess may be probably a blind to hide a slack-woven, inferior web.

In heavy sheetings, the weaver strikes the weft twice with the sleigh, to insure its going close up to the last yarn put in. Linen cloth is regulated as to fineness by different scales. The ordinary scale is 40 inches, and according to the number of threads used in that space the fineness is determined; however, by one of those curious perversities so common in trade names, the linen is called not by the actual number of threads in the 40 inches, but by the number of bars or reeds through which the warp passes. Now the warp threads do not go through these reels singly, but two through each opening; consequently a web called a 10⁰⁰, is in strict reality a 20⁰⁰; that is

there are 2,000 yarns in 40 inches wide of the cloth before it receives the weft.

In the weaving, the width of 40 inches is reduced to 38, and in the bleaching process this is generally again reduced to 36.

Let us, for example, take a piece of so-called yard wide brown cloth, stated a 15°°, and it will count 15 threads of warp under what is called 38-inch glass. Let us count how many threads are in one inch, we will find them amount, as near as possible, to 79; the web measures 38 inches wide, so $79 \times 38 = 3{,}002$. The total threads in the width is just 3,000, but the reed used has only half as many openings, and the cloth being called after the reed is styled a 15°°. Suppose this web to be bleached, and to measure 36 inches, it would contain about $83\frac{1}{2}$ threads to one inch, as $83\frac{1}{2} \times 36 = 3{,}006$, the exact number being 3,000.

The warp in loom should therefore be counted before weaving by a 40-inch scale glass, after weaving by 38 inch glass, and bleached by 36 inch.

But although this is the ordinary scale to calculate by, different counties in Ulster have adopted different scales. About Ballymena, county Antrim, the scale used is 36 instead of 40, consequently as 36 is to 40, so is the fineness, or set, or count of yarns there to the ordinary standard; thus, Ballymena 9°° is equal to ordinary 10°°, for as 36 : 40 : : 9 : 10. Broad sheetings are also made on this 36 inch scale.

The construction of the glasses I have referred to is not generally understood, even by parties in the linen trade. If, however, we study the facts just given, the following proportions required in these counting-glasses will be apparent. The correct way to reckon fineness would be by the number of threads in the warp of the cloth; but by custom it is the fineness of the reed that is adopted, this being half the number of threads, as already explained; the glass, instead of being 1-100th part of 40 inches, is made 1-200th part of 40 inches. For example, take a web with 2,000 threads in the 40 inches, the reed has only 1,000 openings, and the web is styled a 10°°. A magnifying-glass, with an aperture below, must, in order to be a 40-inch glass, be had to count 10, *i.e.*, 1-200th part of 40 inches, which is 0·20, or 20-100th, or $\frac{1}{5}$th of an inch.

A 38-inch glass is 0·19 or 19-100ths of an inch.

A 37-inch glass is 0·185 or $18\frac{1}{2}$-100ths ditto.

A 36-inch glass is 0·18 or 18-100ths, or 9-50ths of an inch.

With this information before us, any one can easily test and try the accuracy of the counting-glasses offered for sale.

The technical names given by manufacturers to the warp reeds, are 40 yarns, or 20 splits, equal to one beare; five beares make one set, or hundred (splits).

About Ballymena, county Antrim, there are many excellent weavers of light linen, and further north, in the same county, and also county Derry, they are noted for skill in a rather stouter make.

The very heavy linens are chiefly woven in the county Armagh and the adjoining portions of the county Down; Lurgan is noted for cambrics and lawns; in fact, each weaving locality is distinguished for excellence in one peculiar class of fabric.

The earnings of the hand-loom weavers vary according to the skill of the workman and the value of the article entrusted to him. A first-class weaver will generally earn 15s. to 20s. a week, while second-rates would probably only make half as much, and apprentices 4s. or 5s. They generally get a premium for extra well done work, and are also fined if the result shows carelessness or want of proper skill in the manipulation. When trade is dull many of the weavers enlist, either in the line or militia, and consequently, when the reaction comes, they are often in great demand, and obtain higher wages for a time. I believe nearly half the militia recruits in the north-east of Ulster were taken from the weaver class, many not being able to get regular work owing to the frequent panics in trade during the last three or four years, though, just now, I believe the supply of labour in this department is under the actual demand. The hand-loom weavers are fond of a race to stretch their legs, after sitting long at the looms, and they are great patrons of the harriers, or fox-hounds, kept by the country gentlemen; they join eagerly in the chase, and enjoy it so much, that it is quite a proverb to say, in praising an ordinary man's speed on foot, that he can "run like a weaver." The cost of a hand-loom is about 30s. and it requires an equal sum for the headles and reed, making the total amount £3. Some of the best weavers belong to the *fair sex*, though the labour is certainly more suitable for men.

If the Irish linen trade follows exactly in the course of improvement so successfully carried out in the cotton manufactures of Great Britain during the past century, no doubt in time the adoption of the power loom for weaving will be almost universal. It will, however, as already observed, be some years before the perfection necessary for fine linens can be attained.

A power loom can turn out about 2 webs of 60 yards each per week, and one woman can attend to two looms, producing, at least, four webs a week. This production is probably four times the amount produced by a hand-loom weaver, as four to five yards per day of linen would keep him very busy indeed.

This is not equal, however, to the saving of manual labour in the spinning process. A spindle, though in reality not much quicker than a hand-spinning wheel, never tires, and therefore would produce in the week nearly double what a woman could turn off her wheel, while one girl in the mill can attend to 160 spindles. To spin the yarn by female fingers that Ireland alone could now produce in her mills would require therefore 1,303,744 women expressly devoted to the task! a formidable number out of a population comprising only $6\frac{1}{2}$ millions, including, of course, both the sexes, and children of all ages. The enormous saving of expense, and the great regularity of production insured by mill spinning, at once made the transition from the hand-spinning wheel an unavoidable necessity, and also, until very lately, a complete success to the capitalist, in a financial point of view. The saving by power-looms not being nearly so great, the transition state will likely be prolonged over a more lengthened period.

STEEL TROOP-SHIP.

A remarkable ship is now constructing on the banks of the Tees, at the yards of Messrs. M. Pearse and Co., Stockton-on-Tees. It is a steam troop-ship, and, when completed, will be the largest river steamer in the world. It is intended for the navigation of the Lower Indus, and is to draw only two feet of water. She is constructed entirely of steel, and exceeds in length all ships hitherto built, except the *Adriatic* and the *Great Eastern*. The following are her principal dimensions:—Length over all, 375 feet; beam moulded, 46 feet, the paddles projecting 13 feet more on each side, making a total breadth of 72 feet. The extreme depth amidships is only five feet. This is uniform throughout, the vessel being quite flat-bottomed, except at the ends, which are alike, and are spoon-shaped. The paddle-wheels are 23 feet in diameter, and will be driven by engines of 200 nominal, but capable of working up to 800 horse-power. She is divided into compartments by 12 water-tight bulkheads; has two decks, containing three ranges of beds, separated by two passages. These latter are built in two houses, each 100 feet long, in a somewhat similar mode to the saloons of the American river steamers, and leaving a clear gangway outside all round the ship. She will be fitted with 800 iron bedsteads, and have every convenience and comfort for that number of troops, who will be conveyed at 13 knots per hour. The ventilation is to be provided for by a fanning apparatus, and she will be steered by a novel

contrivance. Two blades at each end, diverging from each other at an angle of 70°, are made to dip alternately into the water at an angle of 35° right or left of her course, and the slightest immersion on either side is immediately effective beneath the flat-bottom of the enormous vessel. The necessary firmness to this great but apparently frail structure is secured by two girders, fastened to two parallel keelsons at the sides of the vessel. These are formed of steel plates, and the keelsons are 300 feet long, from which the girders spring in a curve, whose chord is 18 feet. To these the whole framework of the vessel is braced and trussed in such a manner as to give it enormous strength. The weight of the steel plates forming the main part of her fabric is five lbs. to the square foot; and the ribs are of angle steel of 3 inches by 2, to which the plates are secured by steel rivets. The quantity of steel, &c. used in her construction is only 270 tons, and she will, when fitted up with her engines, fuel, stores, fittings, and every requisite for 800 soldiers, besides officers and crew, draw only 2¼ feet of water. The entire tonnage of the vessel is to be only 1000 tons, and her total weight of material only 270 tons, the plates used in the construction of the keel-stroke and girder-stroke being 7 lbs. and 15 lbs. to the square foot respectively, these being the only plates which exceed 5 lbs. She is built under the orders of the Boat Committee of the Indian Board, from the designs of Mr. J. B. Winter, Engineer to the Council of India, and is approaching completion. In a few weeks she will be taken to pieces and fitted up completely on the Thames, and, when perfected, will be again taken to pieces and shipped for Kurrachee, at the mouth of the Indus.

LONDON DISTRICT TELEGRAPH.

A district telegraph for London has been formed on the plan first carried into practice by Mr. Sidney Waterlow for the private use of his firm, as described in the Society's *Journal*, Vol. VI., pp. 85 and 586, the wires being carried over the house-tops. On the first of this month, the Company which has undertaken this service opened their Central Office, 58, Threadneedle-street, with the following district offices:—

Baltic Coffee House, No. 40.
Borough, No. 68, London-road, opposite the Elephant and Castle.
Camberwell-green, (West side).
Camden Town, No. 12, Cornwall-crescent.
Chancery-lane, No. 22.
Charing-cross, No. 7.
Commercial Docks, Rotherhithe.
Corn Exchange, Mark-lane (on market days).
Dalston-terrace, No. 1.
Edgware-road, No. 94, Grand Junction-terrace.
Greenwich, London street, corner of Royal-hill.
House of Commons, Central Lobby (during session).
Islington, No. 7, Rufford's-buildings, opposite the "Angel," High-street.
Kennington-cross, near the "Horns."
Kingsland, No. 1, Dalston-terrace, near Turnpike-gate.
King William-street, No. 3, Adelaide-place, London-bridge.
Knightsbridge, No. 21, Park side.
Lloyd's, Royal Exchange.
London-bridge, Adelaide-place (North side).
Mark-lane, Corn Exchange (on Market days).
" " No. 82.
Mincing-lane, No. 22.
Mile-end, near the Turnpike-gate.
Oxford-street, No. 326.
Regent-circus, No. 43.
Rotherhithe, Commercial Docks.
Royal Exchange, Lloyd's.
Stock Exchange.
Threadneedle-street, Baltic Coffee-house.

Tariff of Charges (inclusive of delivery).

Message of 10 words	4d.
Message and reply (each 10 words)	6d.
Message of 20 words	6d.

The Company state, in their prospectus, that they act as agents for the receipt and delivery of messages to all parts of the kingdom and the continent of Europe, and every telegraph station in the world. The names of eighty other district stations are given as about to be shortly opened.

Home Correspondence.

SCIENCE IN COURTS OF LAW.

Sir,—When Dr. Angus Smith said in his paper that eminent scientific men received "thousands of pounds to support an opinion by their name and their cunning, when men of less name knew it by experiment to be false," I thought that he spoke disparagingly of eminent scientific men. I considered him a self-constituted critic of their integrity, and recommended him to be more charitable than to attribute their conduct to mere cunning and lust of fees. But Dr. Smith now says that he had no intention to utter detraction, and such being the case, I can only apologise to him for having mistaken his meaning.

That I did so mistake him may have arisen in part from another circumstance than his above-quoted expression. In the discussion which followed the reading of his paper, the motives of lawyers and of scientific witnesses were alike assailed. Sir W. Page Wood thought it incumbent on him to deny most specifically the vulgar imputations cast on the characters of lawyers. Now, had Dr. Angus Smith denied in a similarly precise manner the equally vulgar imputations cast on the characters of scientific witnesses, his views could not have been misunderstood, and my protest to you would not have been written.

I am glad to find, however, that Dr. Smith and I, although we differ in our opinions as to the best mode of taking scientific evidence, do not really differ in our estimate of scientific men. I beg to assure him in all seriousness of my respect for him individually, and of my regret for having said anything to cause him annoyance; but as for my having made an unjust attack upon him, as he represents, any reader of my former letter will see that such is not the case.

I am, &c., WILLIAM ODLING.

Guy's Hospital, Feb. 7th, 1860.

MECHANICS' INSTITUTIONS AND THE EXAMINATIONS.

Sir,—To those who have laboured long and arduously in the great work of promoting Mechanics' Institutes, it must be a source of gratification to know that they are peculiar to our age and nation, the distinguishing characteristic of English civilisation when at the height of national prosperity, and at once the cause and effect of that intelligence which has raised Great Britain to the moral empire of the world. Much has been done by the Society of Arts to stimulate to exertion and reward success by the establishment of a system of Examinations, and the award of Certificates, which give the guinea's stamp to the gold of solid attainments; and much credit also is due to local associations which have followed so praiseworthy an example. The truth, however, cannot be too often and too forcibly impressed upon all who feel an interest in the moral and social, as well as intellectual, progress of humanity, that all such endeavours lose more than half their value if they do not meet the hearty and zealous co-operation of the workers in the field of improvement and their several teachers. In vain will the best devised scheme be promulgated, if those for whom it is intended neglect to avail themselves of its advantages; and from year to year the Council of the Society of Arts may offer the most valuable aids to advancement with comparatively little effect, if the managers and members of the several Institutes use little or no exertion to render them available.

The time is now fast approaching when the several local boards which may be formed throughout the country

should hold preliminary examinations in order to test the capabilities of those who may desire to be candidates for the final examinations during the second week in May; but with the exception of those Institutes where the managers display more than ordinary energy, there is a want of knowledge amongst the members of Mechanics' Institutions generally as to the advantages offered, the nature of the attainments required to obtain them, and the means by which they may be acquired. That the system may become as successful as it deserves to be, and realise all the expectations formed of it, the fullest publicity should be given to all the necessary details by those who have the management of the several Institutes. A solitary bill posted in a reading-room may do a little, and too often but little. A great feature should be made of it. Classes should be established for the especial study of one or more of the several subjects; and, that these may not want pupils, a public meeting of the members of each Institute should be held for the special purpose of bringing prominently before them the several advantages which are open to them and the means by which they are to be gained. Such a meeting, with a full and free discussion on the merits of the Society of Arts Examinations, and the advocacy of local zeal and talent, might do much to rouse the indolent, to encourage the timid, and stimulate the irresolute. It is not yet too late to hold such meetings, for there must be many who with their present attainments would require comparatively little preparation to enable them to occupy a respectable position, and acquire a certificate which will prove of inestimable advantage as a testimonial of character, and a passport to remunerative employment.

Nor need such meetings be confined to the more prosperous Institutes in union with the Society of Arts, for by the liberality of the Council the smallest may share in the advantages upon the payment of a very small fee. Wherever a local board is established, due notice, with all necessary particulars, should be sent to every Institute within a reasonable distance, and few thereby be able to plead as an excuse for negligence that they were ignorant of the boon that was offered them. If this plan be generally adopted, and information be thus disseminated throughout every locality where Mechanics' Institutions exist, there can be little doubt that each succeeding year the Examinations will prove more and more a great fact, and the effect will be felt in the increase of educated intelligence, and witnessed in the more rapid growth of Mechanics' Institutions.

The managers of Institutes should ever keep in mind that they are voluntary associations, and that, however great their advantages, or low the cost at which they are offered, men, even for their own good, will not be driven, but may be led. It is this future, however, in their constitution which should be the surest and strongest element of success, for that love of independence, both of thought and action, which is so dear to Englishmen, cannot be more amply gratified than by the support of Mechanics' Institutes, through which learning is promoted and intelligence cultivated, by the voluntary and independent action of those who are the recipients of the advantages. They are at once the means of improvement and the evidence of freedom, and therefore essentially English.

I am, &c.,
BARNETT BLAKE.

Proceedings of Institutions.

Birmingham and Midland Institute.—The annual general meeting of the members of this Institute was held on Monday evening, the 9th January. The theatre, in which the proceedings took place, was nearly filled, and the assembly included a number of ladies. Amongst those who attended were the Right Hon. Lord Leigh, the President for the past year, who occupied the chair; Sir Francis Scott, Bart., Arthur Ryland and J. B. Hebbert, Esqrs. (vice presidents), Alderman Smith, Alderman Blunt, Messrs. Robert Wright (treasurer), W. Mathews, jun. (hon. secretary), P. Hollins, Jaffray, J. S. Dawes, J. B. Gausby, T. P. Salt, J. F. Osler, C. Ratcliff, Jacob Phillips, E. C. Osborne, Drs. Ingleby, Heslop, and Hill, &c. The Hon. Secretary read the annual report, from which it appears that the most important event of the past year had been the gratifying success of the appeal to the public for the special fund of £5,000. This amount had not only been subscribed, but paid, and although the Institute was not free from debt, the Council had been enabled to discharge all the liabilities connected with the erection of the new building, and to place the Institute upon what they trusted would prove a sound and permanent financial basis. With respect to the general department, the Council reported that the specimens from the Museum in Cannon-street had been brought to the new building, and their arrangement proceeded with under the superintendence of Professor Morris. An interesting collection of military arms had been placed in the museum. The patent specification library had continued to be largely consulted, the number of persons who had availed themselves of it during the year being 377, as against 240 in 1858. The duties of attending to the library had so much encroached upon the time of the secretary, that the Council of the Institution thought it right to lay the matter before the Town Council, to whom the library belongs, and that body had undertaken to pay half the salary of a librarian, who had accordingly been appointed, and he employed his spare time in assisting the secretary. The Council had, in conjunction with the Mayor, the Governors of King Edward's School, and the Council of Queen's College, determined to invite the British Association to hold its annual meeting in Birmingham, in 1862. The total number of members at the close of the year was 597, being an increase of 36 upon the number of last year. After announcing the death of Captain Tindal, and paying a tribute to his exertions in behalf of the Institute, the report went on to state that the list of donations had been more than usually valuable, and to mention with thanks the gifts of the portrait of the late David Cox, by the Cox Portrait Committee, of the prints published by the Arundel Society, by Sir F. Scott, and of an anemometer by Mr. A. F. Osler, F.R.S. With respect to the Educational Department, two new classes had been established, one for English Grammar and composition, and the other for singing, both of which had met with success. At the Saturday evening readings the attendance had averaged 120. In compliance with a memorial signed by eighteen clergymen, tickets at a reduced price had been issued to parochial and other schools, for admission to the Institute classes. The result had been a great increase in the number of students. While thanking those gentlemen who had rendered their services gratis as teachers, the Council expressed their opinion that such assistance ought to be considered as of a merely temporary nature, and recommended that as soon as the income of the Institute admitted, paid teachers should be employed. Alluding to the Birmingham examination of the Society of Arts, which took place in May last, the report stated that thirteen certificates were awarded to students of the Institute, and one to a student from the Working Men's College at Wolverhampton, two of the thirteen being first-class. The result of the Institute examinations had been that forty six teachers', and fifteen Council certificates, and three prizes had been awarded. The report respecting the educational department concluded with an allusion to the chemical class recently established. With respect to finance, it was stated that the expenditure for the industrial department, although exhibiting a marked improvement on that of 1858, exceeded the income by £48 1s. 4d., while the expenditure of the general department exceeded the income by £232 15s. 5d. This excess was mainly attributable to the heavy interest charge of £299 10s. 10d., which, in consequence of the collection of £5,000, would be greatly diminished next year. But for

this charge the general department would have met its income. To show the support the Institute received from the public, a comparative statement was inserted, showing that in 1855 the amount of subscriptions was £155 5s., and the lecture admissions £9 6s. 9d. In 1856, they were £295 16s. 6d. and £14 11s. 6d. respectively. In 1857, £433 13s. and £30 5s. 8d. In 1858, £533 12s. and £51 9s. 11d. In 1859, £714 and £52 7s. From the balance sheet it was shown that, notwithstanding the generous response to the appeal made to the public, there was still a balance of £1,041 2s. 3d. against the Institute. Of this sum about £300 was recoverable under the guarantee subscription, thus leaving £700 still to be provided.—Mr. Arthur Ryland moved the adoption of the report, which was seconded by Mr. Osler.—The Chairman congratulated those present on the success of the Institute. The support it had received showed the great interest felt by the people of Birmingham in the progress of education.—Sir Francis Scott and Mr. W. Mathews then addressed the meeting, after which the distribution of the prizes and certificates awarded by the Council of the Institute took place. The election of Sir Francis Scott as president for the ensuing year then took place, as well as of Mr. J. B. Hebbert and Mr. W. Mathews as vice-presidents. The presentation of a testimonial to Mr. Arthur Ryland, on his retirement from the office of vice-president, was then determined upon, when it was proposed that this should be in the form of a portrait of that gentleman. Mr. Ryland expressed a hope that the money subscribed for this testimonial would be invested in the foundation of students' prizes, but it having been explained that far more than was necessary for a three-quarter length portrait of Mr. Ryland had already been subscribed, and that a large sum would remain, which might be invested, if Mr. Ryland should so prefer, in the foundation of a prize fund, Mr. Ryland said he could only say, if that were the case, he must leave the matter in the hands of the committee now formed. He felt bound to add that the great delicacy with which these gentlemen had arranged the matter greatly enhanced the value of the compliment and his gratitude.—The meeting concluded with a vote of thanks to the chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. J. Pittman, "On the Results of the Use of Music in Divine Worship, and their Influence on the Art in General."
Geographical, 8½. 1. Mr. Mickie, "China.—Notes of a Cruise in the Gulfs of Pe-che-li and Leo-tung, in 1859," communicated by Mr. John Crawfurd. 2. Mr. C. J. Anderson, "Africa.—Discovery of a New River flowing to the East, in Lat 17 degrees 30 seconds S., Long. 19 degrees 0 seconds E." 3. Capt. N. B. Bedingfeld, R.N., "Proposed Expedition up the Congo."
Medical, 8½. Dr. Hare, "On the Diagnosis of Cancerous and some other Tumours of the Liver."
Tues. .....Royal Inst., 3. Prof. Owen, "On Fossil Reptiles."
Syro-Egyptian, 7½. 1. Mr. Bonomi, "On the goddess Chiun, mentioned in *Amos V.*, 26; and the god Remphan, *Acts VII.*, 43." 2. Mr. Sharpe, "On the Foreign Venus, and the Cabeiri of Memphis mentioned in Herodotus."
Civil Engineers, 8. Mr. J. A. Longridge, "On the Construction of Artillery and other Vessels, to resist great internal pressure."
Medical and Chirurg., 8½.
Zoological, 9.
Wed. .....R. Soc. Literature, 4½.
London Inst., 7. Conversazione.
Society of Arts, 8. Mr. P. Le Neve Foster, "On Figure Weaving by Electricity."
Geological, 8. 1. Mr. T. Codrington, "On the Probable Glacial origin of some Norwegian Lakes." 2 Mr. T. F. Jamieson, "On the Drift and Gravels of the North of Scotland."
Ethnological, 8½.
Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8. 1. Mr. W. L. Buller, "On a new Hawk (*Falco nocturnus*) recently shot in New Zealand." 2. Rev. R. T. Lowe, "On the Shells of Mogador." 3. Rev. C. Parish, "Botanical Notes made during a tour to Moolmyne." 4. Mr. Charles Knight, "On the *Verrucariæ* of New Zealand."
Chemical, 8. Dr. Guthrie, "On some derivatives from the Olefines."
Royal, 8½.
Fri. .....Geographical, 1. Anniversary.
United Service Inst., 3. Mr. R. Pritchett, "On the Costumes of the British Army from the earliest periods."
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Prof. F. Crace Calvert, "On the Influence of Science on the Art of Calico-printing."
Sat. .....Asiatic, 2.
Royal Inst., 3. Dr. Lankester, "On the Relations of the Animal Kingdom to the Industry of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Session 1857-8.

Par. Numb.
443. National Debt—Return.
497. Cast Iron Experiments—Papers.
98 (B 1). Poor Rates and Pauperism—Return (B).
98 (C 1). Do. Do Do. (C).

Delivered on January 25th, 1860.

Second Session, 1859.

174. Exchequer, &c.—Return.

Delivered on January 26th, 1860.

China—Correspondence with Mr. Bruce.
British Honduras (Republic of Guatemala)—Convention.
Japan—(Treaty of Peace, Friendship, and Commerce).
Morocco (Spanish Occupation)—Correspondence.

Session, 1859.

208 (A 8). Poor Rates and Pauperism—Return (A).

Second Session, 1859.

229. Gold Coinage (Sydney)—Return.

Delivered on January 27th, 1860.

4. Public Income and Expenditure (1857-8 and 1858-9)—Account.
5. Electors.—Amended Return.
8. Proprietors, &c. (Scotland)—Return.
10. Valuation Rolls (Scotland)—Return.
16. General Committee of Electors—Mr. Speaker's Warrant.
2. Bill—Church-rates Abolition.

Delivered on January 28th and 30th, 1860.

2. Ecclesiastical Commission—Return.
7. Population, &c. (Scotland)—Return.
11. Annuity Tax (Edinburgh)—Return.
14. Northampton Hospital—Return.
15. Railway and Canal Bills—General Report of the Board of Trade.
18. Court of Bankruptcy—Return.
20. Lunacy—Account.
23. Court of Session (Scotland)—Return.
26. National Education (Ireland)—Copy of Memorial.
1. Bill—Appeal in Criminal Cases.
3. ,, Endowed Schools.
4. ,, Petitions of Right.
5. ,, Qualification for Offices Abolition.
9. ,, St. Mary in Rydal Marriages Validity.
Private Bills—Statement of Proceedings.
Gloucester Election—Report and Evidence.

Delivered on January 31st, 1860.

3. Dean and Chapter of Westminster—Return.
13. Duchy of Cornwall—Account.
17. Exchequer Bills—Account.
29. Army Grants—Statement, &c.
6. Bills—Highways.
7. ,, Probate and Administration (India).
8. ,, Municipal Corporation Mortgages, &c.
10. ,, Newspapers, &c.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February 3rd*, 1860.]

Dated 21st November, 1859.

2637. J. T. Pitman, 67, Gracechurch-street—An improved method of curing india rubber or gutta percha compounds (A com.)

Dated 15th December, 1859.

2849. W. C. Wilkins, Long-acre, Middlesex—Imp. in lamps for lighthouse purposes.

Dated 22nd December, 1859.

2921. B. Fleet and J. Rawlings, East-lane, and T. Cloake, 6, Saville-row, Walworth, Surrey—Imp. in the machinery for stopping the bodies and wheels of railway and other carriages, and which machinery is an improvement on the machinery already patented by Letters Patent granted to T. Cloake, dated the 1st March, 1859.

Dated 5th January, 1860.

28. A. Horwood, Great Quebec street, Middlesex—Imp. in signalling by electricity, and in apparatus connected therewith, adapted to communicating between railway stations and railway trains, and also applicable to other purposes.
34. J. Fisher, Carrington, Nottingham—Imp. in machinery or apparatus for washing, cleansing, or purifying clothes and other articles.

Dated 14th January, 1860.

108. A. David, Saint Chamond, France—Imp. in jacquard apparatus. (A com.)

Dated 17th January, 1860.

120. J. F. Spencer, Adelaide place, London-bridge—Imp. in steam engines for propelling ships and other vessels, and for other purposes.
122. J. H. Johnson, 47, Lincoln's-inn fields—Imp. in the insulation of submarine electric telegraph wires. (A com.)

Dated 18th January, 1860.

126. H. Medlock, Great Marlborough street, Middlesex—Imp. in the preparation of red and purple dyes.
127. G. J. Barker and T. Barker, Wolverhampton—Imp. in machinery or apparatus for manufacturing shoes for horses and other animals. (A com.)
128. W. Smith and P. Smith, Keighley, Yorkshire—An improved process of hardening cast-iron caps used in machinery for spinning and doubling wool, cotton, silk, flax, mohair, and other fibrous substances.
129. A. Chaplin, Glasgow—Imp. in engines for drawing or conveying heavy loads.
130. W. W. Hewitson and B. Walker, Leeds—Imp. in steam hammers.
131. G. Ermen, Manchester, and J. Platt, Oldham—Imp. in machinery or apparatus for spinning, winding, and doubling cotton and other fibrous materials.
132. S. C. Kreeft, Fenchurch-street—Imp. in the permanent way of railways. (A com.)
133. J. B. Berger, Upper John-street, Fitzroy-square—An improved mode of, and apparatus for, ascertaining the proper course to steer ships or vessels.
134. J. Schuberth, Vienna—Imp. in nails and similar articles, and in preparing materials for the production thereof, and of buttons and various other articles to which the same may be applicable.
135. N. D. Maillard, York-street, Dublin—Imp. in the means for steering and indicating the course or direction, and time, of ships and other navigable vessels at sea, which imps. are also applicable to other purposes.

Dated 19th January, 1860.

137. H. Blair, Kearsley Works, Farnworth, Lancashire—Imp. in the production of carbonic acid gas.
139. J. Needham, Piccadilly—Imp. in the application of the rise and fall of the waves to the propulsion of vessels.
140. A. Bower, Liverpool—Imp. in ship building.

Dated 20th January, 1860.

141. W. Griffith, Hitchin, Hertfordshire—Imp. in propelling vessels and locomotive carriages.
142. T. Gray, Carr's Hill Glass Works, Gateshead, Durham—Imp. in the manufacture of goblets, and other similar articles in glass, and in the apparatus connected therewith.
143. W. Clissold, Dudbridge, Gloucestershire—Improved machinery for grinding vegetable, mineral, and other substances.
144. J. Timmins, Runcorn, Chester—Imp. in the construction of safety cages and hoists for raising and lowering weights in mine and other shafts.
145. P. Moore and P. Moore, jun., Birmingham—Imp. in the manufacture of the dies or draw plates used in drawing wire and tubes, and for other similar purposes. (Partly a com.)
147. G. H. Cottam and H. R. Cottam, Old St. Pancras-road—Imp in the manufacture of chairs, bedsteads, and other articles to sit or recline on.
148. T. K. Callard, 4 Blenheim-terrace, St. John's-wood—Imp. in preparing wheaten flour.
149. F. J. J. de la Ferté, 36, Porchester-terrace, Middlesex—Imp. in reproducing photographic and other pictures, engravings, prints, devices, and designs, on the surfaces of glass, ceramic, and other substances requiring to be fired to fix the same thereon. (Partly a com.)
150. T. F. Allen, 3, Elizabeth-terrace, Hackney Wick, Middlesex—Imp. in bait cans for fishing purposes.
151. J. F. Meakin, Baker-street, Middlesex—An imp. in envelopes.

Dated 21st January, 1860.

153. C. P. P. Laurens, Rouen, France—Imp. in the manufacture of chlorine.
155. J. F. Belleville, Paris—Imp. in steam generators.
157. W. E. Gedge, 4, Wellington street South, Strand—Improved prop for supporting plants. (A com.)
159. B. J. Spedding, Birkenhead—Imp. in apparatus for generating gas from oily and fatty substances, and in coolers and holders or gasometers.
161. R. R. Bevis, Birkenhead—Imp. in marine steam engines.
163. L. E. David and A. Vercher, 29, Boulevart St. Martin, Paris—An improved brake for vehicles.

Dated 23rd January, 1860.

165. M. Rae, Manchester—Imp. in roughening or obscuring glass globes, tubes, or other vessels.
167. M. Anderson, Tollington-park, Hornsey-road—Improved ventilating apparatus.
169. R. F. Finlay, Queen-street, Edge-hill, Liverpool—A new method of reefing and furling the sails of ships and vessels from the decks thereof.

Dated 24th January, 1860.

171. E. L. Gatellier, La Ferté-sous-Jouarre (Seine-et-Marne), France—Imp. in the manufacture of the crucibles, muffles, or pots, used for the reduction of the ores of zinc.
173. J. Calvert, 189, Strand—Improved method of easing and distributing the strain on ships' cables when subject to great tension or pressure.
175. Charles Iliffe, Birmingham—Imp. in double shell buttons.
177. H. Blaxland, Sittingbourne, Kent—An improved churn.
179. J. T. Carter, Sydenham, Kent—Imp. in machinery for tilling the soil and in engines and boilers for driving the same, and other agricultural implements.
181. G. E. Donisthorpe, Leeds—An imp. in making cop tubes.
183. I. L. Bell, Newcastle-on-Tyne—An imp. in supplying hot blast to furnaces.

Dated 25th January, 1860.

185. F. Yates, 31, Parliament-street, Westminster—Improved apparatus for generating certain gases to be used as fuel, and as reducing agents in metallurgic and other operations and imps. in furnaces to be heated and worked therewith.
187. T. Ramspacher and C. F. Schmidt, 2, Rue Ste. Appoline, Paris—Preparing wire gauze to render it applicable to various purposes.
189. T. Donkin, Bermondsey—An imp. in paper making machines.
191. F. A. Kieffer, 23, Rue Oudinot, Paris—Imp. in fabrics suitable for straps for driving machinery and for other purposes.
193. H. J. Huggins, St. Vincent, West Indies—Imp. in filtering and decolourizing cane juice solutions of sugar and other liquids, and in the manufacture of sugar.
195. J. P. Lamar, Bush-lane, London—Imp. in boots, shoes, and similar foot coverings, in fixing the heels and soles thereof, and in apparatus for forming and applying screws for the foregoing and other purposes. (A com.)

Patents Sealed.

[*From Gazette, February 3rd*, 1860.]

February 3rd.

1799. R. A. Brooman.
1800. E. J. Cordner.
1807. N. Berry.
1810. F. W. Beaumont.
1811. W. Thompson.
1815. A. B. Childs & L. D. Owen.
1816. A. T. de Lisle.
1817. E. A. Suwerkrop.
1818. A. F. Delannoy.
1837. P. F. Rolland.
1879. S. Harrison.
1901. H. J. Hyams.
1971. J. Hare.
1981. R. Beverley.
2029. A. V. Newton.
2149. J. Blair.
2187. T. Beards.
2643. T. B. Daft.
2699. J. B. Berger.
2727. W. Betts.
2729. T. F. Brabson.
2805. J. Farquhar.
2873. T. Fairbanks.

[*From Gazette, February 7th*, 1860.]

February 7th.

1824. R. A. Brooman.
1827. B. Baugh.
1828. J. H. Johnson.
1834. N. Kenward.
1838. C. L. J. Dierickx.
1848. J. Waite.
1852. J. Capper.
1854. J. J. Speed, jun.
1856. W. White.
1857. J. T. Pitman.
1861. L. A. Possoz.
1898. W. Grimshaw & S. Mason, jun.
1914. G. W. Petter & T. D. Galpin.
1920. H. Parkes.
1922. O. Maggs.
2028. A. V. Newton.
2058. M. M. Jackson.
2398. R. Hobson.
2442. A. McGlashan.
2720. J. Cocks.
2724. G. Davidson.
2798. W. Betts.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, February 3rd*, 1860.]

January 30th.

292. J. M. Worrall.
311. R. Laming.

January 31st.

356. W. Greenslade & J. Wood.

February 1st.

304. M. A Muir & J. McIlwham.
316. J. Bernard.
328. J. H. Johnson.
341. J. Gilroy.

[*From Gazette, February 7th*, 1860.]

February 2nd.

314. G. White.
402. R. D. Kay.

February 3rd.

354. J. N. V. Cadiat.

February 4th.

366. J. Murdoch.
331. P. Schafer and F. Schafer.
340. R. A. Brooman.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, February 3rd*, 1860.]

February 1st.

307. J. Perkins.

[*From Gazette, February 7th*, 1860.]

February 4th.

316. R. Flosser.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 17, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of RECENT Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

The days for receiving articles (which must be forwarded to the Society's House *carriage paid*), are Thursday, Friday, and Saturday, the 22nd, 23rd, and 24th March, but no article can be received unless space has been previously allotted, for which application should be made to the Secretary without delay.

Illustrated Catalogues of the Society's Annual Exhibitions are published; a short but clear description of all Inventions exhibited will therefore be required for the Catalogue, with an engraved wood block (when possible) for illustration.

These descriptions must be written in a clear hand, on one side only of each half-sheet of foolscap paper, with an inch margin on the left side of the page.

All Drawings exhibited must be framed.

Articles which have been included in previous Exhibitions of the Society of Arts *cannot be readmitted.*

No charge is made for space.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date:—

Charles Brooke, M.A., F.R,S.,	£2	2
C. Wentworth Dilke, Vice-Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Henry Johnson (3rd Donation)	10	10
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

ELEVENTH ORDINARY MEETING.

Wednesday, February 15, 1860.

The Eleventh Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 15th instant, W. R. Grove, Esq., Q.C., F.R.S., in the chair.

The following candidate was balloted for and duly elected a member of the Society:—

Bateman, John Frederic.

The Paper read was—

ON FIGURE WEAVING BY ELECTRICITY.

By P. Le Neve Foster, M.A., Secretary of the Society of Arts.

I have undertaken to bring before the Society this evening a remarkable and ingenious invention which has within the last few weeks been brought into this country by its author, Monsieur Bonelli, a well-known Italian engineer, and the Director-General of Sardinian Telegraphs. The object of the invention is the getting rid entirely of the "cards" of the Jacquard loom, and thereby of all the machinery and lengthy and expensive operations necessary for their production, and by the substitution of the electric agency to enable the loom to effect rapidly, at a comparatively small cost, the same results. It would be out of place on the present occasion to enter into a history of the loom, the various changes and improvements that have taken place in its arrangements and contrivances, but inasmuch as there are necessarily many persons present who are not acquainted with the manner in which the Jacquard apparatus acts, so as to produce the ever varying patterns of our woven fabrics, I must be permitted to give some explanation of it, in order that the meeting may be in a position to follow me when I describe the special invention of Monsieur Bonelli which he proposes to substitute for it.

All are aware of the ordinary operations of plain weaving, for the production of fabrics without patterns, twills, stripes, checks, &c. In these the weft threads, or those which cross the width of the material interlace uniformly among the warp threads, or those which run from end to end of the material. Calicos, linens, and plain silks, are representatives of this kind of weaving, and if examined it will be seen that the cross threads or weft, pass alternately over and under the long threads or warp. This operation is effected by an arrangement worked by the weaver's foot, which causes every alternate warp thread to be raised, thus dividing into two portions the warps, which are stretched horizontally in the loom. By this means the shuttle containing the weft, is enabled to pass between the upper and lower portions of the warps. By a reverse action, the upper portion of the warp is lowered and the lower portion raised, when the shuttle again passes and the interlacing is effected, which produces the desired fabric. Such is the operation of plain weaving, and from this it will be readily understood that if the warp threads are not raised or depressed in the alternate order of succession above described, there will no longer be produced a plain and uniform surface. For instance, in a twill the weft threads do not pass over and under the warp threads in regular alternate succession, but pass over one and under two, over one and under three, over one and under eight or ten, according to the kind of twill intended to be produced. The effect of this is to produce a kind of diagonal ribbed appearance, either on the right or wrong side of the cloth, and a smooth and glossy effect on the other, according as the one thread is crossed above or below by the weft. In order to allow the weft to pass under two, three, four, or more threads at once, an arrangement is adopted, by means of which the weaver can, by the action of his foot on a series of treadles, raise and depress the warps in groups, and in the order of succession required for the particular twill he desires. By various combinations among the treadles he produces many varieties of movements, giving rise to the different kinds of twill. But when in addition to, or instead of a twill, flowers, sprigs, spots, or any kind of figure are required, then an amount of complexity arises which cannot be got over by any manageable number of treadles. The weft may pass over four and under one at one part of the width of the cloth, over two and under two at another, over one and under four at another, and so on according to the part of the figure which may happen to occur at any particular part of the width of the cloth. The next weft threads would

pass over or under in a different order, and hence the warp threads would have to be elevated or depressed in a continually varying order, and to effect this by increasing the number of treadles is obviously impossible; the loom could not contain them, nor the feet of the weaver move them. This difficulty, however, was got over, by what was termed the draw-loom, in which strings were so arranged that a boy, by drawing them, could raise the requisite warp threads in readiness for the shuttle to pass. The principle on which this was done is simple enough, though the draw-loom itself, with its endless variety of strings, appears to a visitor a most incomprehensible piece of apparatus. The warp threads pass through eyes or loops in vertical strings, each thread having one string, and these strings are so grouped that the boy, by pulling a handle, draws up all those warp threads which are necessary to be raised for one particular shoot of the weft; when a different set of warp threads are required he pulls a different handle. It will thus be seen that in order to produce any particular pattern, the arrangement of the strings and handles, and the order in which the latter are to be drawn, must have been previously formed with a view to that especial pattern. To effect this arrangement, which I believe is termed "cording the loom," would employ a man several months, and then of course it could be used for the one particular pattern only. Endeavours were then made to render the room more automatic, and thus get rid of the boy, and his possible mistakes of drawing the wrong handle. One of these, called the "draw-boy," is an ingenious arrangement of mechanism, which enables the weaver, by means of a treadle actuating a curved lever, to raise and depress the warp, the lever travelling along a rack so as to act on the different warps in succession. This arrangement was much used, whilst another extremely ingenious invention for the same purpose, the "automatic carpet loom," by Mr. Duncan, for some reason or other failed to come into use. In this loom the warp threads were raised or depressed by pins inserted in a rotating barrel, the pins being placed in their proper order of succession according to the pattern desired.

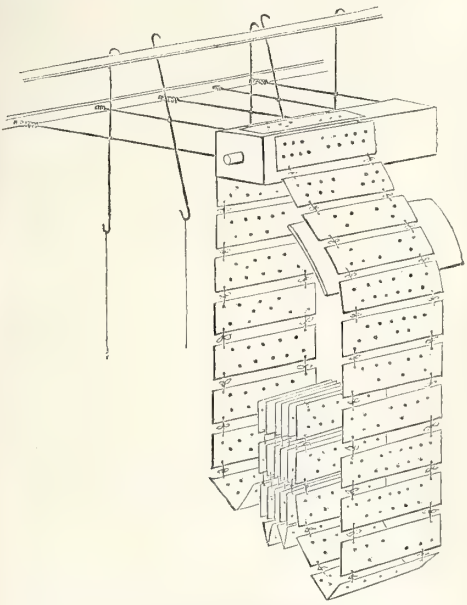
I have dwelt somewhat at length on this portion of the subject because the right understanding of it is essential to a clear appreciation of the wonderful mechanical genius Jacquard displayed in the invention which bears his name, as well as the great ingenuity of M. Bonelli in substituting the modern agency of electricity for certain portions of Jacquard's invention.

Jacquard was a native of Lyons; by trade a straw hat manufacturer.* His father was a weaver; and young Jacquard, being forcibly impressed with the imperfections of the cumbersome and ill-constructed loom of that period, as well as the tedious and painful labour required for its working, and the small remuneration which it afforded, had early determined not to take up his father's occupation. Though apprenticed to the straw hat trade, his mechanical talent did not lie dormant. A reward was for many years offered by this Society for the invention of a machine for the weaving of fishing nets, and a portion of the Society's premium list to this effect having been copied into a French newspaper, it was seen by young Jacquard, who immediately set his brains to work, and, after numberless essays, succeeded in accomplishing the object, and a model was made. This model, unknown to Jacquard, through the agency of a friend to whom he had lent it for inspection, was taken to Paris, where it came under the eyes of Napoleon I., then First Consul. Some weeks afterwards, much to his astonishment, he was summoned before the Préfet, who informed him that, by order of the First Consul, he must at once start for Paris, and that a post-chaise, with a gendarme to compel his attendance, was in readiness to take him there. Jacquard, somewhat alarmed, had no choice, and immediately on his arrival in Paris was taken to the Conservatoire des Arts et Métiers, where he was brought into the presence of Napoleon, and of Carnot, then prime minister. The latter, addressing him in a brusque tone, said:—"Is it you who pretend you can do what no one else can accomplish—tie a knot in stretched cord?" Jacquard, surprised by the tone of the speaker, and awed by finding himself in the presence of such high personages, did not immediately reply. Napoleon, however, with that tact and suavity which he could so readily assume, having asked a few trivial questions, led him by degrees into an animated conversation, and Jacquard was at once installed at the Conservatoire, where he had ample means of cultivating and developing his mechanical talents. His first work was to complete a full-sized machine of the fishing-net loom, which when completed gave general satisfaction. He however never gave up his early and long cherished idea of constructing a loom which should ameliorate the condition of the weavers of his native town. A magnificent shawl, destined for Josephine, had been wrought in a loom of a very complicated nature, which had cost, it is said, more than twenty thousand francs. This loom, the invention of the celebrated Vaucanson, was placed under Jacquard's charge for repair, when he pointed out that he could readily effect its object by much more simple means, and he soon completed a machine in which he succeeded beyond his most sanguine expectations. In 1801, the Jacquard loom was exhibited at the National Exhibition, in Paris. The French Government rewarded him with a pension of a thousand crowns for his discovery, and Jacquard felt assured that he should have no difficulty in establishing the loom in his native city; but mark the treatment he then received. Having, at his own expense, constructed a loom, the Conseil des Prud'hommes were invited to inspect it and give their opinion. Great was Jacquard's dismay when he found they not only opposed the introduction of his loom, but gave orders for its public destruction, which was immediately carried out in the *Place*, amidst the shouts and rejoicings of the populace, and his invention excited such enmity against him amongst the weavers, that he three times narrowly escaped with his life. Nevertheless, in a few years, from the increasing competition with the English, the prejudice of the French began to give way, and in self-defence they were compelled to adopt the loom they had previously despised and rejected.

I will now describe the mode by which Jacquard effected his object, which was to substitute an automatic mechanical action in lieu of the boy, who actuated the warp threads by pulling the handles, as I have previously described. At the upper part of the loom he arranged a series of perpendicular wires, having a hook at each end, to the lower one of which cords communicating with the warp threads were attached. These wires he raised or lowered by means of a treadle raising or lowering a frame, called the "griff frame," which caught the hooks at the upper end of the wires. In order, however, to raise or lower these wires separately, or in groups, so as to form the required pattern, the following contrivance was adopted. Each of the wires was made to pass through an eye formed in the middle of a horizontal needle, one end of which was acted on by a spring horizontally, so as to bring the needle back again after being pushed out of its place. Opposite to the ends of those horizontal needles he placed a hollow quadrangular prismatic box of metal, pierced with as many holes as there were needles. This box, by the action of the same treadle, was at each stroke turned one-fourth round, and its face brought to strike against the ends of the needles, which, being exactly opposite the corresponding holes in the box, would pass into it and be in no way disturbed. To the face of the box, however, a perforated card was attached, the perforations of which corresponded accurately with some of the perforations in the box, whilst the unperforated portion of the card covered over the remaining holes. Hence it is clear that when

* In an anonymous French work, he is said to have been apprenticed to a bookseller; but the statement in the text is given on the authority of Sir John Bowring, in his evidence before a Parliamentary Committee on the Silk Trade.

the face of the box bearing the card is pressed against the ends of the needles, those will be driven back which are unable to enter the box; the needles thus pressed back, act on the vertical wires so as to remove the upper hooks from the reach of the rising and falling griff, which thus acts only on those wires the needles of which have passed into the holes in the box. It will thus be seen that, by varying the holes in the cards, the wires may be raised or lowered accordingly, carrying with them the warp threads, so as to form the pattern. The cards must, of course be carefully pierced in conformity with the desired pattern, and are joined together loosely at their edges, forming an endless chain, and are hung over the hollow prismatic box, which, turning on its axis, and, having a reciprocating motion given to it by the weaver's foot, brings a fresh card forward at every stroke to be presented to the ends of the needles. The accompanying wood-cut shows the principle on which the box and cards are arranged in connection with the needles and hooked wires. A few only of the needles and wires are shown, in order to prevent confusion. The arrangement usually includes from four to six hundred hooks, and sometimes, for very extended and special patterns, as many as twelve hundred, even a double twelve hundred for some patterns. It will at once be perceived that the perforating of a series of cards so as to produce any given pattern is a task which requires some skill, labour, and time, varying of course according to the simplicity or complexity of the design.



JACQUARD ARRANGEMENT.

I will now endeavour to show the manner in which the design is, so to speak, transferred to the cards. The design having been prepared on paper by the designer, is handed to another artist, who prepares from it what is termed the *mise en carte* drawing. For this purpose a paper ruled with lines, crossing each other at right angles, and at a distance of about one sixteenth of an inch apart, is used, every square of which represents the intersection of a warp and weft thread. The design is transferred to this paper, which thus on a greatly enlarged scale represents the formation of the pattern as it should appear when worked in the fabric. This *mise en carte* drawing which I need not say takes some considerable time and skill to prepare, is then put into the hands of the "reader," as he is termed, who takes it as his guide for perforating the corresponding cards. To explain the detail by which this is accomplished would take up too much of your time, nor is it necessary on the present occasion. I would say that it is simply the precisely reverse operation to that by which the card produces the pattern. It is in fact a beginning at the other end of the process, and instead of the cards regulating the action of the needles and through them governing the warp threads; the pattern being formed by hand, the warp threads are made to actuate the needles, which thus form the punches used for perforating the cards. In this I must be understood as not meaning that the actual warp threads and needles of the loom are used for this purpose. The reader forms, in a frame, a series of stout vertical cords, to represent the warps, and with these he interlaces by hand, following the *mise en carte* drawing, a series of horizontal cords representing the weft, thus forming the design of large size loosely and in a very coarse material. As he proceeds in the formation of his pattern, he takes the warp threads which stand forward at each particular portion of the pattern, representing those which would actually be elevated in the loom, and carries them to the hooks of small rods, which represent what in the loom would be the hooked wires of the Jacquard, so that, by suitable mechanical arrangements, when these warps are pulled, a number of small steel punches are driven into a metal plate, pierced with as many holes as a card is made to contain. This metal plate, with its loose punches, is then placed on a table over the card, the whole put under pressure, and as the steel punches are somewhat longer than the thickness of the plate, they are forced through the card, which thus represents accurately the warp threads at that point of the pattern. The next series of warps in the pattern is dealt with in the same manner, until the pattern is exhausted. The cards, previously numbered as they are punched, are strung together in their proper order, and thus form the means of producing the pattern in the fabric in the manner previously described.

I do not pretend to give this process of reading in its details; I have endeavoured simply to indicate the principle on which it is done. I have, however, I think, shewn the great labour, time, and skill which must be employed to produce a set of cards for any pattern, however simple, much more so when an elaborate and extended design is required to be reproduced. Many months in some instances are occupied in this process. It must be remembered, too, that the set of cards thus made serves for the one pattern only, and is useless for any other. Such being the case, it is not to be wondered at that men's minds should have been constantly engaged in endeavouring to devise means for simplifying, or, if possible, getting rid entirely of this tedious and costly, though very ingenious portion of the arrangement, and many contrivances having this for their object, or for the improvement of the apparatus, have appeared. In 1844, an arrangement was rewarded by this Society. It was invented by Mr. W. C. Riding, and was called an "index machine," and was a modification of Duncan's barrel, with shifting pegs for changing the pattern. The pegs in Mr. Riding's apparatus acted in connection with the Jacquard wires. It was, however, applicable for small patterns only, and though brought into use at the time, has not been extensively employed. A loom on this principle was exhibited at the Exhibition of 1851 by M. Moreau. Mr. Barlow also exhibited, in 1851, a double loom in which the cards were made to pass over two revolving prismatic boxes, by which means two fabrics of the same pattern were woven at once from the same set of cards. Subsequently to this, a very ingenious invention for getting rid entirely of the cards, was brought out by Mr. E. Laforest, described in a paper read before the Institution of Civil Engineers. The object of this invention was to substitute a continuous band of perforated paper for the cards. Not only by this means was a great amount of weight and expense got rid of, but by means of a "reader," also the invention of Mr. Laforest, the bands of

prepared paper, it is said, could be cut at the rate of 3,000 per hour, instead of the slow and tedious process of producing the cards. This arrangement, though extremely ingenious, has not, I believe, come into operation, partly, I am informed, from the minuteness and crowding of many of its parts, rendering it liable to get out of order, and partly because it was not adaptable to existing looms, which must be entirely thrown on one side as useless, if the new invention was taken up.

The Jacquard loom did not come generally into use in this country till about thirty years ago, and now it has completely superseded every other description of apparatus for producing figured work in the loom. It is applied to the power-loom, and has been adapted to carpet-weaving and lace-making. Numerous improvements, in detail, have from time to time been made, among which, and in particular, the invention of Mr. Bennett Woodcroft deserves notice, namely, an arrangement by which, while one portion of the warp threads is elevated, the other is not merely left at rest but depressed. This has been found of essential service in certain classes of weaving.

I will now draw your attention to the electric arrangements of M. Bonelli, which have for their object the getting rid entirely of the cards of the Jacquard machine, the other parts of which are in no way interfered with: and this, by the way, is one of the merits of M. Bonelli's system, namely, that it is at once applicable to the loom as it at present stands. The cards are taken away, and M. Bonelli's arrangements subtituted for them.

M. Bonelli, who has been long known as a man of science, as well as a practical engineer, has for many years past had his attention turned to the application of electricity as a substitute for the Jacquard apparatus in the loom, but he has only lately been able so to perfect his arrangements as to bring them before the commercial world in a form which he considers adapted for general use.

So long ago as 1852, M. Bonelli constructed an electric loom, which was exhibited at that time in Turin, but the first trial to which the machine was submitted gave but small hope to those who saw it, that the inventor would succeed in his object. The public trial at Turin, in 1853, in the presence of manufacturers, was not so successful as to remove all doubts as to the merits of the novel apparatus. In the following year it was submitted to the judgment of the Academy of Sciences at Paris, who appointed a committee to examine it, but it is believed that no report was ever made. In 1855, a model of the loom had a place at the Universal Exhibition at Paris, but the lateness of its arrival there prevented any official report being made in reference to its merits. Since then, M. Bonelli has devoted much time and attention in endeavouring to remedy its defects and to perfect its working, so as to render it capable of holding its place in the factory. This M. Bonelli believes he has at last accomplished, and he has brought over to this country not merely a model, but a loom in complete working order, which he is prepared with confidence to submit to the judgment of manufacturers, as a machine which, from its economy and efficiency, may be put in favourable comparison with the Jacquard loom.

In the first place, it must be understood that the special object of M. Bonelli's machine is to do away with the necessity for the Jacquard cards used to produce the pattern at the present time, the source of delay and very considerable cost, more especially in patterns of any extent and variety of treatment. M. Bonelli uses an endless band of paper, of suitable width, the surface of which is covered with tin-foil. On this metallised surface, the required pattern is drawn, or rather painted with a brush in black varnish, rendering the parts thus covered non-conducting to a current of electricity. This band of paper, bearing the pattern, being caused to pass under a series of thin metal teeth, each of which is in connection with a small electro-magnet, it will readily be conceived that as the band passes under these teeth, a current of electricity from a galvanic battery may be made to pass through such of the teeth as rest on the metallised or conducting portion of the band, and from such teeth, through the respective coils, surrounding small bars of soft iron, thus rendering them temporary magnets, whilst no current passes through those connected with the teeth resting on the varnished portions. Thus, at every shift of the band, each electro-magnet in connection with the teeth becomes active or remains inactive according to the varying portion of the pattern which happens to be in contact with the teeth. In a moveable frame opposite the ends of the electro-magnets, which, it should be stated, lie in a horizontal direction, are a series of small rods or pistons, as M. Bonelli terms them, the ends of which are respectively opposite to the ends of the electro-magnets. These pistons are capable of sliding horizontally in the frame, and pass through a plate attached to the front of it. When this frame is moved so that the ends of the pistons are brought into contact with the ends of the electro-magnets they are seized by such of them as are in an active state, and on moving the frame forward, those are retained while the others are carried back with it, and, by means of a simple mechanical arrangement, become fixed in their places; thus there is in front of the frame a plate, with holes, which are only open where the pistons have been withdrawn, and this plate, as will be readily understood, acts the part of the Jacquard card, and is suitable for receiving the steel needles which govern the hooks of the Jacquard in connection with the warp threads as ordinarily used.

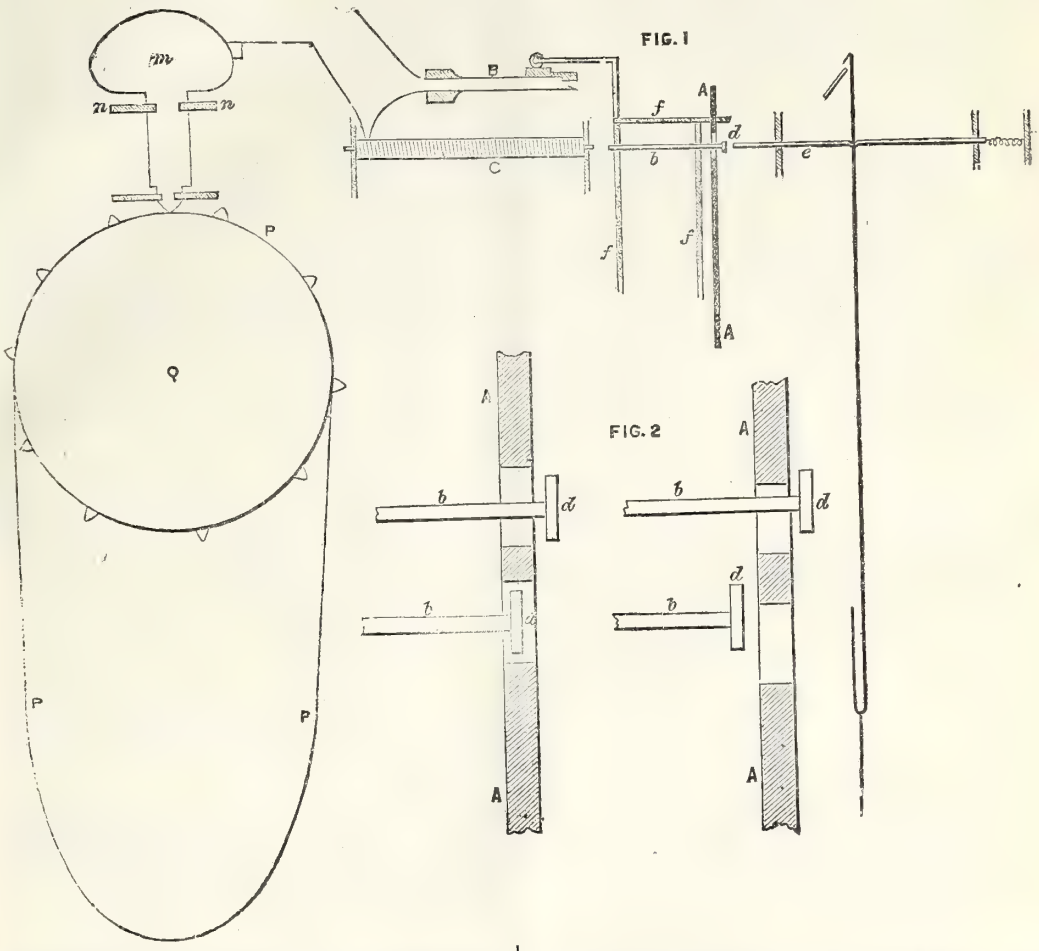
Each shift of the pattern, combined with the backward and forward movements of the frame bearing the pistons, produces a different series of holes in the plate, which thus becomes what may be termed a universal Jacquard card, changing its face each contact, in accordance with the requirements of the pattern. Thus the electric loom gets rid of all those costly preliminaries which are required for the preparation of the cards, accomplishing instantaneously and automatically an analogous operation.

The accompanying wood-cut (see next page) explains generally the arrangements by which the process is effected.

A, Fig. 1, represents the plate pierced with holes, which plays the part of the card. Each of the small pistons or rods, *b*, forming the armatures of the electro-magnets, *c*, have a small head, *d*, affixed to the end, exactly opposite the needles, *e*, of the Jacquard, and are capable of passing freely through the holes of the plate, *A* (See Fig. 2). At a given moment the plate is slightly lowered, which prevents the heads of the pistons passing, and the surface of the plate then represents a plain card. The pistons are supported on a frame, *f f*, which allows them to move horizontally in the direction of their length. At each stroke of the shuttle, the frame, carrying with it the plate, *A*, has, by means of the treadle, a reciprocating motion backwards and forwards, and in its backward movement presents the ends of the pistons to one of the poles of the electro-magnets, and, by means of certain special contrivances, contact with the magnets is secured. When the frame, *f f*, returns with the plate, *A*, towards the needles of the Jacquard, the electro-magnets, which become temporarily magnetised by the electric current, hold back the pistons, the heads of which pass through the plate, *A*, and rest behind it. On the other hand, the electro-magnets which are not magnetised, owing to the course of the current being interrupted, permit the other pistons to be carried back, their heads remaining outside the plate and in front of it. At this moment, the plate, by means of an inclined plane beneath it, is lowered slightly, thus preventing the heads of the pistons passing through the holes, by the edges of which they are stopped, so as to push against the needles of the Jacquard; on the other hand, the heads of the pistons which have passed within and to the back of the plate, leave the corresponding holes of the plate free, and the needles of the Jacquard which are opposite to them are allowed to enter.

The electro-magnets are put into circuit in the following manner: One of the ends of the wire forming the coil of

each of the magnets is joined to one common wire in connection with one of the poles of a galvanic battery. The other end of the coil wire of each magnet is attached to a thin metallic plate, *m*, having a point at its lower extremity. All these thin metallic plates are placed side by side, with an insulating material between them, formed like the teeth of a comb, *n n*. At a given time these thin plates rest with their lower extremities on the sheet bearing the design *P*, which, in the form of an endless band, is wrapped round and hangs upon the cylinder *Q*, and



according as the thin metal plate rests on a metallised or on a non-conducting portion of the design, the corresponding electro-magnet is or is not magnetised, and its corresponding piston does not or does press against the needle of the Jacquard. The wire from the other pole of the battery of course communicates with the band bearing the design, by being attached to a piece of metal, which lies in constant contact with the metallic edge of the band. At *B* is a contact-breaker, which is put in motion by the movement of the frame. Besides this, by means of a mechanical arrangement connected with the treadle, which raises or depresses the griff frame, the band bearing the design is carried forward at each stroke, and the rapidity with which it is made to travel can readily be regulated, by means of gearing, at the will of the workman. By regulating the speed of the band, and by the use of thicker or thinner weft, an alteration in the character of the woven material may be made, whilst the same design is produced, though in a finer or coarser material.

Such are the arrangements by which the loom will produce a damask pattern, or one arising from the use of two colours, one in the warp and the other in the weft. I will now shortly explain the method adopted by M. Bonelli for producing a pattern where several colours are required.

The design is prepared on the metallised paper, so that the coloured parts are represented by the metallised portion of the band, but each separate colour is, by removing a very thin strip of the foil at the margin, insulated from its neighbouring colour. Then all the pieces of foil thus insulated, which represent one colour or shade, are connected with each other by means of small strips of tinfoil, which pierce through the paper and are fastened at the back, and are conducted to a strip of tinfoil which runs along the edge of the band, there being as many such strips of tinfoil as there are colours. Thus each special colour of the pattern, in all its parts, is connected by a conductor with its own separate strip of tinfoil, and by bringing the wire from the pole of the battery successively into contact with the several strips, a current of electricity may be made to pass in succession through the several parts of the design on the band representing the separate colours of the design. Thus, assuming four colours, 1, 2, 3, 4, there would be four strips of tinfoil running the length of the band, insulated from each other, each of which would be in connection with its own separate colour only. At any given moment, the thin plates of metal resting on the pattern would touch it in a line which, as it passes over the width of the pattern, would run through all, or any

one or more, of the colours, but the electric current would pass only through those plates which rest on the one colour, represented by the strip with which the pole of the battery at that instant happened to be in contact.

It must be remembered that when I was describing the previous action of the machine, it was pointed out that, at each stroke of the shuttle, the pattern was shifted forward on the cylinder, and the thin plates of metal acted on a different portion of the pattern. Now, when a number of colours are required, observe the difference, the band, bearing the pattern, is made to shift only at intervals depending on the number of colours. While the pattern stands still the other portion of the loom is at work, and the wire from the pole of the battery is successively brought into contact with the several strips of tinfoil representing the several colours, and at each contact a shuttle with its appropriate colour is thrown, but according as the current passes or does not pass when such a contact is made, (and this will depend on the thin plates resting or not resting on the metal of the pattern representing the special colour at the moment) the warps will be so actuated as to show or conceal the weft thread thrown. As soon as the four threads are thrown, the band shifts and the same process is repeated, the thin plates resting on the one line, while the four shuttles are thrown in succession, and in combination with the successive contacts made on the several strips of tin foil.

All the movements which I have described are actuated by the one treadle which raises and depresses the griff frame. The various ways in which this result may be effected may readily be conceived by any one acquainted with mechanism, it is therefore unnecessary to detail the special modes adopted by M. Bonelli.

There are two points in the working of this apparatus which, though apparently trifling, are practically all important, and, unless provided against, would render the machine, however ingenious in other respects, utterly useless. The one is, the wear and tear of the pattern band by its friction against the sharp ends of the thin plates, and the other, the destruction of the band which would take place from the electric spark occurring when the plates passed from a non-conducting to a conducting surface, or *vice versa*.

The first is provided for by an arrangement which slightly raises all the plates while the band shifts, and the other is prevented by means of a contact breaker, *B*, which keeps the circuit open when the plate rise srom the band, until the band has shifted and the plates are lowered on to it.

The electric power required for the loom is small, and that derived from two cells of a Bunsen's battery of ordinary dimensions is sufficient. The cost of this per day is calculated at not more than one penny,

It is thus that M. Bonelli gets rid of the cards, which we have seen are not only a source of expense, but of considerable delay as well, and by his system the operations are reduced to tracing the design on the metallised paper with a non-conducting varnish. The rest of the operations remain the same. The thin plates passing over the pattern become as it were alive under the action of the electric fluid, feeling out the design and instantaneously and unerringly improvising for the moment the card required for the production of the design on the fabric.

The inventor claims the following as the results of his invention:—

First.—The great facility with which in a very short time, and with precision, reductions of the pattern may be obtained on the fabric by means of the varying velocity with which the pattern may be passed under the teeth.

2nd.—That without changing the mounting of the loom or the pattern, fabrics thinner or thicker can be produced by changing the number of the weft, and making a corresponding change in the movement of the pattern.

3rd.—The loom and its mounting remaining unchanged, the design may be changed in a few minutes by the substitution of another metallised paper having a different pattern.

4th.—The power of getting rid of any part of the design, if required, and of modifying the pattern.

The length of paper required for a pattern depends, of course, on the nature and extent of it, but an idea may be formed generally by recollecting that at each stroke of the shuttle a card of the Jacquard apparatus is brought into operation, while in M. Bonelli's invention, the paper having the pattern moves at the rate of a fraction of a millimètre at each stroke. M. Bonelli gives the following calculations by way of comparison between the old and the new systems.

He takes a damask design on the old system, requiring 4,000 cards, and with 400 Jacquard wires.

The cards will cost, at 12s. per hundred, £24. The time employed for the *mise en carte* of the pattern, the reading it off, and punching 4,000 cards, cannot be taken at less than about five weeks.

On the electric system, the executing the design on the metallised paper, ready for putting on the loom, he calculates at £6. The time employed would be a week, showing a difference in favour of M. Bonelli's system, in this case, of £18 in money, or 75 per cent., and in time of 80 per cent.

Taking a more complicated case, namely, furniture damask, with a simple ground, and two sets of wires of 600 each, and requiring 20,160 cards.

The cards at 15s. the hundred will cost £151 4s. As regards time, assuming that it is desired to get the loom to work quickly, there must be employed a designer, and five persons for the *mise en carte* for one month, and after this, six readers employed for another month, thus making six men employed for two months, or, what amounts to the same thing, one man employed for twelvemonths.

On the electric system:—

The cost of the first sketch.....	£ 4
Putting the design on the metallised paper...	22
Total.....	£26

The time employed by the designer would be one month, showing a difference in favour of M. Bonelli's system of £125 4s. in money, or 81 per cent., and in time of 90 per cent.

M. Bonelli informs me that the cost of the electric apparatus to be adapted to the looms at present in use is about £20, a sum which seems insignificant when compared to the cost of a single set of cards, and those, be it remembered, are of use for one pattern only.

DISCUSSION.

The Chairman said they certainly had nothing to regret in the fact of this paper having been undertaken by Mr. Foster. He had dealt with the subject as clearly as possible. He (the chairman) might say he was almost sorry this was so, because, although he had given some attention to the Jacquard loom, and to the science of electricity, little or nothing was left for him to explain. The subject had been introduced in so clear a manner, that those who had followed Mr. Foster through the reading of the paper could have no difficulty in understanding it. There was, however, this difficulty, which he could not remove—to translate words into machinery required experience. It was not that there was any ambiguity in the words, but it required an acquaintance with machinery itself to be able to convert the language used into the ideas intended to be conveyed. With regard to the Jacquard loom, it was constructed so as to possess the power of selecting the warps. It was, in fact, intended for the weaving of pattern fabrics in contradistinction to plain fabrics. To weave a pattern, they must select a particular number of warps at one time, so that the weft might pass over them and produce the pattern. He believed it might be stated that there was no kind of pattern fabric to which the Jacquard loom did not apply. Take, for instance,

one of the most beautiful applications of the Jacquard loom, Brussels and pile velvet carpets, which were made in such a great variety of designs. The warp was carried over a wire to which it was tied down; the wire, which contained a knife, was subsequently withdrawn, and the terry loop was cut, thus forming the pile. It was the same in the manufacture of velvet. The splendid carpets which they saw at the clubs and other places were formed by the Jacquard loom, and in all those instances the card, as originally invented, was used. He might mention one modification which had been made, by the substitution of the "trap board" for the griff in the old Jacquard loom. As he had already remarked, the old system of cards was, with all its difficulties, still retained. The card itself was not very expensive, but there were the costly and lengthy arrangements for making the pattern and stamping the cards, which complex proceeding occupied a very great deal of time. That, he apprehended, was the main thing to be remedied by the machine before them. They ought not to look at it merely for its beauty, as a novel application of the science of electricity, but they must also see whether it promised to produce such substantial advantage to those who used it as to lead to the probability of its being very generally employed. Upon that subject he could do no more than refer to the statistics of M. Bonelli himself. Taking the case of a large and complex pattern, they got an expense of £151 4s. reduced to £26, and they also got twelve months' labour compressed into a month. Allowing a considerable margin in both respects, if anything like this could be done it was a very considerable improvement upon the old system. It occurred to him, during the early part of the reading of the paper, and before the explanation of it was arrived at, that there was one apparent difficulty, which he could not get over until it was explained. It was well known that wherever the contact was made or broken, in an electric current, there was a spark of electricity, producing a destruction of the metal at that point. If he brought the wires connected with the poles of a galvanic battery together, or separated them, he produced a little spark, and he found that this caused oxidation, and it occurred to him that these wires passing over tinfoil would produce that spark, and, by deflagrating the tinfoil, injure the pattern. But that, he found, had been very ingeniously got over by an arrangement which had been described in the paper. He was happy to see that they had the presence of M. Bonelli, who would no doubt reply to any inquiries as to the details of his invention, and he was sure the meeting would be glad to hear that gentleman's remarks in French, a language which was, no doubt, understood by the majority of those present.

Mr. Thomas Winkworth, said having been in all his early life engaged as a silk manufacturer, and having read in that room one or two papers connected with that subject, it had been suggested by some of his friends that he ought to commence the discussion; but how was he to discuss that which seemed to be scarcely susceptible of discussion? If what had been said of this invention was true (and he had no reason to doubt it), how could they hesitate as to its value, and the revolution it was likely to effect in that important branch of manufacture in which the Jacquard loom was now employed. The papers which he (Mr. Winkworth) had read before this Society, referred rather to what might be called the politico-economical part of the question, and it had not fallen to his lot to have much to do with the mechanical part. He should not do justice to his own feelings if he did not say that the description given by Mr. Foster of plain weaving, and of the various gradations, from the simple twill to the most elaborate patterns, was particularly lucid, and it was very remarkable that a gentleman who, with great modesty, disclaimed any technical knowledge of the mechanical part of so important an invention as this, should, nevertheless, be able to give them so excellent an explanation of all the manipulations that were connected with it. He would avail himself of the invitation held out, to ask a question of M. Bonelli, which seemed to him to be important, looking on this as an invention which was to economise time, labour, and money. He would ask why it was that this invention had been brought to this country instead of to France?

Mr. Foster replied, that M. Bonelli had told him that he was induced to try his invention here because he considered England the first industrial country in the world, and therefore as affording the widest field for its application.

Mr. Winkworth said, that doubtless in this country greater encouragement was given to inventions of this character than in France, and he feared that the same sort of opposition as the Jacquard had met with at Lyons and St. Etienne, would be offered to the introduction of such a machine as this at those places. It was somewhat remarkable that it should have made its appearance in this country at a moment when we were on the eve of such competition in the silk trade as would probably result from the impending treaty between this country and France. They must, however, always bear in mind, that trials on a small scale could not be considered conclusive as to the value of particular inventions; but as far as opportunity had been afforded him of seeing what could be effected by this invention, he must say it promised to be one of the greatest importance, as connected, not simply with the silk trade, but with all other trades in which the Jacquard loom was in use. He could not but congratulate M. Bonelli on his ingenuity, and he trusted he would meet with the encouragement he deserved, even if the machine did not fulfil all the expectations which had been detailed in the paper.

Mr. Foster wished to add, in explanation of the reason why this invention was brought to this country in the first instance, that M. Bonelli was advised by his friends to take that course, because it was considered specially adapted to our cotton manufactures, which were the largest in the world.

Mr. Lavanchy inquired whether this invention was upon the same principle as that which was exhibited in 1855 at Lyons.

Mr. Foster replied, that the machine referred to, although it was the invention of M. Bonelli, was upon a different principle to that now before them. Electricity was used in the one case as in the other, but in the early machine the electro-magnetism was applied directly to the drawing up of the warps, which did not answer. In the present case it was applied simply to draw the pistons and to form the card necessary to produce the pattern. He would add, that the machine which was actually at work in London had never been shown in France, except to the Emperor and Empress. None of the manufacturers in France had seen it, and it had never been publicly exhibited until it was brought to London a few weeks since. It was in operation at the office of the Magnetic Telegraph Company, in Threadneedle-street, and M. Bonelli would be happy to show it to all who were interested in the subject. It should be remembered that M. Bonelli was not a Frenchman, but a Sardinian.

Mr. W. E. Newton expressed his gratification at the able and lucid manner in which Mr. Foster had explained this invention. His object in rising was to draw attention to one or two matters connected with this subject, which he thought it would be interesting to them to know. Allusion had been made in the paper to the invention of Mr. Laforest. That invention had not, as far as he was aware, been practically carried into effect, but he dissented rather from Mr. Foster's opinion as to the reason why it had not been developed. The invention was one perfectly practicable, and could partially effect the same object as that of M. Bonelli. It would dispense with the cards, and by that means get rid of a considerable item of expense, but, at the same time there would be the tedious and expensive operation of reading the pattern. But Mr. Laforest also invented a machine whereby this tedious operation of reading or producing the pattern was much facilitated. The contrivance which Mr. Laforest used was this: instead of

the perforated cards, he employed an endless band of paper, perforated with a number of small holes, corresponding with those in the Jacquard cards. By the simple substitution of a sheet of paper, costing not more than a farthing or a halfpenny, he was enabled to dispense with the costly cards, which had very reasonably been put down at £25 for a moderate-sized pattern. There was no difficulty, as far as he was aware, in applying that invention to almost any machinery for the manufacture of figured patterns. Of course it would be necessary to dispense with certain portions of the Jacquard loom, as was the case with M. Bonelli's contrivance, and the invention of Mr. Laforest could be applied without any considerable amount of expense to the weaving of almost every description of fabric, but he was bound to say, having made an examination of M. Bonelli's machine, that that of Mr. Laforest stood but little chance with it. M. Bonelli not only dispensed with the cards, as was the case with Mr. Laforest, but he also dispensed with the necessity of reading or making the pattern. He drew his pattern upon a metal surface, and caused that to act upon the needles, and thereby drew up, or selected the warp threads intended to form the pattern. About ten years ago he (Mr. Newton) took out a patent for a French gentleman, having the same object in view, namely, the getting rid of the reading of the pattern. The invention was this:—A piece of canvass, closely resembling that used in Berlin wool-work was employed, and upon that canvass the pattern was drawn with a viscous fluid, which filled up such of the holes as were required. This pattern was placed on a cylinder, in the same way as M. Bonelli's metallised band, and was carried backwards and forwards against the needles, thus selecting the proper threads. The pattern was drawn with thick varnish, or other preparation, which filled up the interstices of the canvass as required. It would be understood that this canvass would thus perform the office of the Jacquard card, allowing some needles to pass, and stopping others. It was, he thought, a remarkable thing that that invention had never been practically carried out in this country. Probably one reason why it had not been adopted might be that it was found that the preparation used to fill up the interstices of the fabric was not sufficient to resist the pressure of the needles; but he believed the principal reason was that it had never been properly introduced to the notice of the manufacturers. With regard to M. Bonelli's invention he would state that he had attentively examined it, and he was astonished not only at the great ingenuity displayed, but also at the great simplicity of the machine. It was also a matter of astonishment to him that all this contrivance could be applied to the existing looms for the small sum of £20. He had little hesitation in saying that this invention would cause a complete revolution in the manufacture of figured fabrics. He saw at once its great advantage in the manufacture of cotton goods, damasks, and things in which only two colours were used; but he did not, at present, see the advantage which was gained where it was required to manufacture fabrics with several colours. With regard to carpets containing three or four colours, he apprehended that there must be a separate operation to draw up the warp threads of each colour —first red, then blue, then yellow, and then white, and then the shoot would be thrown. They would see that in this way the electrical apparatus must come into operation several times for one shoot. That would be a very serious inconvenience to manufacturers of carpets, because in the ordinary carpet loom they could throw forty or fifty shoots per minute, and it would be impossible to work at that speed if they required a distinct operation to draw up each separate colour. He saw no reason why this invention should not be modified so as to draw up all the pattern warps at one time, and he had no doubt a little attention to this suggestion would enable M. Bonelli to overcome the difficulty, or at any rate the inconvenience, which he (Mr. Newton) had ventured to point out.

Mr. Peter Graham remarked that, with regard to the variety of colours in carpets, they were entirely in the warp threads, whereas in silks the colours were in the weft threads. He conceived that M. Bonelli's mode of weaving silk would have great advantages, but for the carpet-loom the application of this invention, it seemed, would be an addition of £20 upon the price of the loom, which amounted to 50 per cent., and taking the electricity at the cost of a penny per day, it would very nearly equal the present cost of cutting cards for carpets. Looking at the commercial value of its application to carpets, he did not think it would be a great advantage; but with regard to silks he considered there would be an immense economy, particularly in shawls and all fabrics in which the cards were very elaborate and very costly.

Mr. Topham said he had had an opportunity of making himself acquainted with the details of this invention, from having seen it in operation. The first important advantage which struck him was that this apparatus could be applied to any form of loom now employed, without interfering with the ordinary arrangements. Another great merit of this machine was its extreme cheapness. The specimen before them was not a model, but a full-sized machine, calculated for working a loom, the cards for which would have 400 holes, and could readily be extended to 600 or 1,200, or indeed to any number required. The whole apparatus, ready for fixing in the loom, would cost only £20. One of the greatest merits of the invention, and upon which its success materially depended, was the slight shifting of the sliding plate by which the small rods not acted upon by the magnetic current were kept from sliding back when brought into contact with the needles. That plate was pierced with a number of holes exactly similar to the Jacquard card, either with 400, 600, 800, or 1,200 holes. That appeared to him one of the most ingenious parts of the apparatus. Another advantage consisted in this—great difficulty was found by manufacturers of textile fabrics, particularly those of intricate pattern, that after the design was formed by the artist and brought to the loom, it was impossible to detect any errors in the punching of the cards until the whole pattern was worked out upon the fabric, and then they had to go step by step to ascertain whether the error was through the neglect of the party reading or of the artist who produced the design on the *mise en carte* drawing. In the machine before them no such error could possibly occur. They had the pattern on the metallised paper, and as that was drawn line by line, it was found upon the fabric. It opened a wide field to artists and producers of designs; in fact, he thought it would be quite practicable for this machine to reproduce the magnificent pictures around the room on textile fabrics. It had been the subject of remark that our schools of industry and art were not appreciated as they ought to be. That was mainly owing to the difficulty of the artist producing a pattern which was practically adapted for reproduction on textile fabrics. He would further lay stress upon the saving arising from the use of this apparatus. The cards were, indeed, a most expensive item. He held in his hand a small piece of Damask silk, which had been designed for the covering of ladies' parasols. For the production of that simple pattern upon that piece of damask, 640 cards were required; and these were what were called 600-hole cards, and the preparing of those cards would cost from 18s. to 20s. per hundred. A curious circumstance came under the notice of an extensive silk manufacturer a few days ago. He had a small order for coverings of chairs, and the cost of the cards, including the designs, was 20 per cent. upon the price he received for the manufactured article. It seemed to him that fortune was smiling upon England now. They were on the eve of the abolition of the paper duty, which would have enabled the manufacturers to produce cheaper cards, but whilst that duty was swept away, they had an apparatus which rendered the use of paper unnecessary in the manufacture of textile fabrics. He trusted that this invention would receive the support of this commercial

country, and would recompense M. Bonelli for the time, trouble, and expense he had incurred in producing such an ingenious apparatus.

Mr. Newton begged to correct a statement that had been made. They had been given to understand that the expense of this machine would be £20, added to the cost of the Jacquard loom. That was not the case, inasmuch as some portions of the Jacquard loom were removed, for which credit must be given. The really important advantage was that the cards would be dispensed with. For a moderate-size pattern, the expense of the cards alone, without reference to the reading or making of patterns, would amount to £20 or £25.

Mr. Graham said for a Brussels carpet the expense of the cards would not amount to as many shillings. The cost mentioned in the paper referred to silk fabrics.

Mr. John Wilson said, as one connected with the silk trade for many years, he had heard a remark that evening which startled him. One gentleman had asserted that, by means of this machine, it was quite possible to reproduce the pictures round the room upon a woven fabric. He apprehended that they could do with the Jacquard loom all that they could do with this machine, if they went to the necessary expense. He begged to inquire whether any difficulty was apprehended in the working of this machine on the part of the workmen who would have the applying of it? He knew that when the old Jacquard loom was first brought over to this country from Lyons, there was a difficulty in getting people to understand it. With respect to what had been said as to the applicability of this machine to some branches of manufacture, there appeared to him to be nothing in that. There were, at the present moment, modes of making figured fabrics without the Jacquard loom. The question was whether it would be worth the while of the manufacturers to supersede all other means and adopt this system entirely. He thought the invention was more especially adapted for the silk trade. Carpets did not require many colours, all of which were in the warp and not in the shoot. As far as his own experience went, he knew of no manufacture which had the same amount of colouring as silk weaving. Messrs. Campbell, Harrison, and Lloyd, had goods turned out of their manufactory in which there were ten or twelve colours on the line.

Mr. W. Smith remarked, with regard to the invention of Mr. Laforest, that he thought the reasons given by Mr. Foster for its non-adoption were not sufficient. As far as he (Mr. Smith) was acquainted with the facts, the reasons were the complexity of the machine and the small scale on which it was made, and the contraction and expansion of the paper (which was in a continuous length) destroying the pattern. The effect of contraction and expansion was counteracted in the Jacquard loom by the mode adopted of joining the cards. The first patterns of Laforest were very small, and being upon paper it was very rare for an article to be turned out without the paper band being destroyed, whilst with the use of cards it was not an uncommon thing for a set of cards to last for many years. When thin paper was substituted for cards the pattern was sometimes injured the first time of using. Then, again, the expansion and contraction made it impossible, in different states of the weather, to produce a pattern uniformly the same. With regard to the cards, the great cost of producing them arose from the complexity of the system adopted, but some years ago a "reader" was produced by Mr. Mackenzie, which enabled from 12 to 24 cards to be produced in the same time, with greater accuracy than by the ordinary mode. This reader was worked similarly to the keys of a pianoforte. The inventor of that apparatus struggled for many years with the same difficulties that all inventors in this branch of industry more or less invariably experienced. The machine of M. Bonelli, which he (Mr. Smith) saw at Turin, was in an imperfect state, but he came to a conclusion at the time that it only required the talents of the inventor and those associated with him, to produce thoroughly successful results. The idea was now in a more practical form, but he thought there were still a number of things to be done to make it a thoroughly useful invention. As had been very truly said by the last speaker, when the Jacquard loom was first introduced, it was difficult to find men able to understand it. So it would always be with every innovation of this kind, and he thought the difficulty in that respect would be quite as great in the case of this machine, as had occurred with the Jacquard machine. They must have persons acquainted with the management of the galvanic battery. Then again it had been suggested, that the residual magnetism would be likely to interfere with the pattern, but all these were points which could no doubt be got over. The main question he thought was that of the durability of the pattern, and if it were possible to state that so many thousand yards of fabric had been made from one pattern, it would be sufficient to enable them to judge of how far this difficulty existed. His own opinion was, that this plan, which had been so ably described that evening, would be in very general use during the next ten years. In the meantime, if manufacturers looked to reducing the cost of their articles, they must set about reducing the cost of producing the cards. With the cards they knew already what could be done; and he believed if practical manufacturers had the choice to adopt this substitution or the ordinary cards, they would prefer cards if they could produce them at an eighth or a tenth of the present cost, and it was for the manufacturers to set to work to reduce that cost.

Mr. J. Scholefield begged to make one or two explanations on behalf of his friend, M. Bonelli, which were called for by the remarks which had fallen from various speakers. Any temporary defect in the working could be very speedily remedied; as, for instance, if there occurred any flaw in the metallised paper, it could be remedied by applying another piece of metal. The same might be said of the varnish, and both of these remedies might be applied while the loom was in action. He wished it to be understood that the apparatus could be applied to any loom worked upon the Jacquard principle, and he would further state that the workman had nothing to do with the apparatus. It was entirely self-acting; therefore no difficulty was to be apprehended on that ground.

In reply to a question from Mr. Winkworth—

Mr. Scholefield replied, that the loom was worked in the ordinary way, and this apparatus was disconnected from anything which appertained to the duties of the workman.

The Chairman inquired whether any difficulty was experienced in the making and breaking contact.

Mr. Scholefield replied, no difficulty whatever. It had been stated that there were many inventions for supplying the means of working a loom. He only wished to say that the Chevalier Bonelli was the first inventor of the application of electricity to weaving.

Mr. Robinson said he ventured to obtrude himself upon the attention of the meeting for a few moments, as the representative of that important branch of the silk trade—the Coventry ribbon manufacturers, who naturally felt a deep interest in the subject under discussion. He and others, on looking into the merits of this invention, were convinced that there was a great deal in it, and it would be a grand thing if it could be adapted to the peculiar necessities of that branch of the trade in which he was engaged. Perhaps there was no branch of the silk manufacture in which the changes of pattern were so rapid as in ribbon-weaving. Very fine ribbons were made in the Jacquard machine, but after a month or six weeks' working, an elaborate and expensive design had to be thrown away. A few days since, he put up a pattern himself, which in about eight days would be rendered useless. This went to shew the great value of a perpetual card, which this apparatus in fact was. He appreciated its value, though at the same time, possessing a tech-

nical knowledge of the difficulties of the ribbon trade, he did not see how the machine before them could fulfil all the conditions required. He acknowledged the great value of the machine, and was anxious to obtain further information upon it. They had seen goods made by it with many colours produced by separate shuttles, but nothing had as yet been said in this room, or at the offices where the machine was in operation, which had shown him how patterns were to be produced with all the variety of colours, and with numerous variations in the grounds, at the same time. That was an operation which he imagined could not be easily effected by this apparatus. In the present plan of ribbon weaving, the same threads which made the plain ground in one part of the texture, were required for a part of the figure in another part. Therefore, unless they could produce this result, the invention would fail the ribbon weavers, and as that trade employed some fifteen thousand Jacquard machines in Coventry, the question he had put was, he thought, worthy of consideration. He wished to know whether there was any means of treating each alternate thread, one as the ground thread, and the other as the figure thread, the figure threads often covering six or seven threads of the warp. With every development of the Jacquard machine he was practically acquainted. He had inspected the invention of Laforest, and had strong evidence of its failure. It had one similarity to the present machine, which he thought would prove a difficulty—that was, the crowding of the various parts. The plates which conveyed the electricity in M. Bonelli's machine were in such close proximity that they almost touched, which he imagined would be an inconvenience where a large number of threads were employed. There were 400 of these brass plates in the machine before them, but they would be obliged to have 600 and even 1,200 or more in some patterns. To be informed that this invention would be applicable to all classes of looms, would be valuable to those whom he represented, and he should be rejoiced if he could return to them full of hopes for their trade, and be able to tell them that although they were to lose 15 per cent. by the removal of protection, they were likely to get more than the 15 per cent. by this machine.

Mr. Foster said that as the explanations which Mr. Robinson had asked for could only be given by going into considerable detail, he suggested that the more convenient course would be for that gentleman to have an interview with M. Bonelli, and this was an arrangement which he was authorised by M. Bonelli to say he should be most happy to accede to.

The Chairman, in closing the discussion, said with regard to many of the technical questions which had been put, it was absolutely impossible for any one to explain the details so as to satisfy minds acquainted with various minute difficulties without individual discussion. The only way in which the required explanations could be afforded, would be by having an interview with M. Bonelli. The discussion on this paper had been a valuable one in this respect—that nearly all those gentlemen who had taken part in it possessed a practical knowledge of the subject. Points of commendation and objection had been brought forward, and no doubt these proceedings would have considerable effect in drawing the attention of that portion of the public who were interested in the subject to this machine. They had heard a good deal about the difficulties under which inventors laboured. They had in the Jacquard machine a striking instance of that. But they must not forget that to that question there was another side. Manufacturers who looked to a remunerative employment of their capital, could not be expected to take up inventions without due inquiry and examination; therefore, as long as human invention went on, there would be a legitimate hesitation on the part of manufacturers in substituting for that to which they were accustomed anything to which they were unaccustomed, and he thought that was not so much a subject of complaint as some persons made it. Nature itself presented these difficulties to man. The young plant had to struggle with storms before it grew into a tree, and inventions of this kind would have to struggle to obtain the confidence of manufacturers. But such were the exigencies of trade that it became a matter of necessity to adopt any real improvements that might be offered; so that no man need despair if he had a really good invention. He had no doubt that this invention, having now been brought forward, would have a fair investigation and a fair trial. It would be idle to predict the result of a new invention, because the difficulties it might have to contend with were not direct but collateral. They were not to be predicted, but they arose both in the nature and in the application of the invention. He begged, in conclusion, to propose a vote of thanks to Mr. Foster for the able paper he had read, and also to M. Bonelli, for having furnished the means of bringing so interesting a subject before them.

The vote of thanks was then passed.

The paper was illustrated by a complete apparatus, in working order, and suitable for being adapted to a loom, as well as by various models and diagrams. Specimens of silk and cotton damask, and of fabrics with figures in several colours, produced by the machine, were also shown. The thanks of the Society are due to Messrs. Campbell, Harrison, and Lloyd, for the specimens of design and *mise en carte* kindly lent by them, in illustration of the paper.

The Secretary announced that on Wednesday evening next, a paper by Mr. S. Squire Baxter, "On an Improved Lime Light," would be read. The Light will be exhibited. The chair will be taken at eight o'clock.

PULU, OR VEGETABLE SILK.

By M. C. Cooke.

New products are slowly appreciated in the English market. The first parcel of alpaca wool would have rotted away in the warehouses of Liverpool had it not accidentally come under the notice of Mr. Titus Salt. Within the past year or two; Paraguay tea, two or three dye stuffs (as Gardenia and Nagkassur) cedron, sowa, ispaghool, and cocum seeds, and Towai bark, have, with a parcel of pulu, been treated almost equally with contempt, and most of them are at the docks waiting the fate of a late consignment of cassaripe, *i.e.*, destruction, for the want of a purchaser at a rate sufficiently high to pay for warehousing and freight.

About fifteen years ago, a small quantity of Pulu, or vegetable silk, appears to have been imported into Liverpool from Owyhee, for the purpose of mixing with silk in the manufacture of hats. A specimen was sent to Mr. T. C. Archer, and incorporated by him in the collection of Liverpool imports formed for the Exhibition of 1851. "I thought at that time," writes Mr. Archer, "that it was really the pappus from some composite seed, but in 1852, my attention was called to some beautiful stems of tree ferns, which were landed at Liverpool, some of which had portions of the stipes attached, and these were covered by the very beautiful pulu, which I instantly recognised. These tree ferns were from some of the Pacific Islands, but I do not remember which."

Under the name of *Penghawar Djambi*, a small package of an analogous substance was, in 1856, offered at a London drug sale as a styptic. It consisted, as described by Mr. Daniel Hanbury, in the *Pharmaceutical Journal*, of the lower part of the stalk or stipes of a large fern, native of the island of Sumatra. The stalks, as imported, were in straight

pieces, about a foot in length and an inch in width. They had mostly been split open lengthwise, probably to facilitate their drying. Their most striking feature, however, was the abundant clothing of long, sparkling, golden brown, moniliform hairs, with which the outer part of the stipes were thickly covered, and which, at a first glance, suggested for it an animal rather than a vegetable origin. A bundle of these stalks, as they arrived, was presented by Mr. R. Howard to the Pharmaceutical Society, and may be seen at the museum in Bloomsbury-square, agreeing fully with the description by Mr. Hanbury.

The old fable of the Scythian lamb seems to have originated either with the *Penghawar Djambi*, or an allied fern. In the above named paper, Mr. Hanbury has made apt allusion to this fable in the following terms:—"As I have alluded to the fable of the Scythian lamb, I may be allowed briefly to recall it to my readers, although to cite one-half the old authors, of the sixteenth and seventeenth centuries, who have delighted to tell of its wonders, would be neither an easy nor a profitable task. Suffice it then to say that *Agnus Scythicus, Frutex Tartareus*, or Vegetable lamb, was regarded as a sort of plant-animal, resembling in figure a lamb, whence its Russian name *barometz*. It was said to spring from a seed like a plant, and to be attached to the earth by a root, while in its animal nature it rejoiced in a sort of flesh and blood, browsed upon the surrounding herbs by turning round upon its axis or root, until, having devoured all within reach, it perished a victim to hunger.

"Guillaume Saluste, Sieur du Bartas, represents the astonishment of our first parents at discovering in the Garden of Eden so remarkable a production as a vegetable lamb, and then exclaims with pious credulity:—

"O merveilleux effect de la dextre divine,
La plante a chair et sang, l'animal a racine,
La plante comme en rond, de soy mesmes se meust,
L'animal a des pieds, et si marcher ne peut,
La plante est sans rameaux, sans fruict et sans feuillage,
La plante a belles dents, paist son ventre affamé
Du fourrage voysin, l'animal est semé."

The fable is revived in the following more elegant lines, from the pen of a modern author, but they are not very happy as applied to to the *Sumatran* plant:—

"Cradled in snow and fanned by arctic air,
Shines, gentle Barometz! thy golden hair;
Rooted in earth each cloven hoof descends,
And round and round her flexile neck she bends;
Crops the grey coral moss, and hoary thyme,
Or laps with rosy tongue the melting rime;
Eyes with mute tenderness her distant dam,
Or seems to bleat a *vegetable lamb!*"

Subsequently to the importation of *Penghawar Djambi* on the stipes, another parcel was imported into Liverpool cleared from the stipes, a specimen of which I received from Dr. Edwards of that port. This came, I believe, from the Sandwich Islands.

During the past year an importation reached London, and was offered, unsuccessfully, at the drug sales. Thus, of four consignments to England, not one appears to have been sufficiently successful to have established it as an article of commerce.

From a recent Sandwich Islands newspaper it would seem that Pulu has become, notwithstanding, an established export from that locality. Although its use for pillows, &c., has been known among the natives from time immemorial, and a little may have been exported prior to 1851, yet, as an article of trade, it only dates back to that year.

The Custom House returns of the Hawaian Island give the following amounts of export in each year:—

1851	2,479	lbs.
1852	27,088	,,
1853	12,739	,,
1854	34,031	,,
1855	82,558	,,
1856	247,740	,,
1857	260,560	,,
1858	313,220	,,

It is exported principally to San Francisco, though not confined wholly to that port, some being sent to Australia, Vancouver's Island, and other places. Messrs. Harris, the principal dealers in pulu, became by accident engaged in the trade. In 1854 they had a suit with a storekeeper in Hawaii, and judgment being rendered in their favour, about 8,000 lbs. of pulu was all they could obtain in satisfaction. This material was then worth little or nothing in the market; they however took it and shipped it to San Francisco, where, after some delay, it realised 28 cents. per lb. This circumstance decided them in commencing the trade, and now two-thirds of the exports are supplied by them.

The fern which produces the pulu grows on all the high lands, commencing at an elevation of about 1,000 feet, and extending upwards to about 4,000 feet. In size it frequently attains to fifteen feet in height. Though found more or less on the five principal islands, the trade in it is chiefly confined to the districts of Hilo, Hamakua, and Puna, on Hawaii. The pulu is produced around the stalk where the leaf or stem shoots out from the stock of the fern, and only a small quantity is found on each plant, amounting in weight to about two or three ounces. It takes about four years for a plant to produce this amount.

Owing to the large quantities collected of late years, the article is becoming scarce in the Hilo district, though in the Hamakua and Puna districts large quantities still remain. But as it is farther for the natives to go to obtain it, and as more expense and fatigue is encountered, the cost is gradually advancing, and the probability is that it will continue to advance each year to the extent of a cent. per lb. The number of persons engaged in pulu gathering varies; including men, women, and children, probably from two to three thousand are now dependent on it for a livelihood, receiving generally from 5 to 6 cents. per lb. on delivery.

The labour of gathering pulu is very tedious and slow. When picked it is wet, and has to be laid out to dry on the rocks, or on mats. In favourable weather it will dry in a day or two, but generally in the pulu region wet and rainy days prevail, so that frequently the natives do not get their pulu dry after several weeks, often taking it to market in too wet a state. The dealers have constantly to contend with this inclination of the natives to sell wet pulu, as it makes considerable difference in the weight when dry.

The facilities for drying, packing, and shipping are improving every year, and the article now shipped is generally dry and in good order, closely packed in wool bales. The trade is reduced to a system, and though there is no probability of any great increase, it will doubtless continue a staple export.

Uncertainty still prevails as to the precise species of *Cibotium* which yields the *Pulu* of the Sandwich Islands. Sir W. Hooker, in his *Species Filicum*, describes six species of *Cibotium*:— *C. glaucescens* and *C. assamicum*, from the Eastern hemisphere; *C. Schiedei*, from Mexico; *C. glaucum*, *C. Chamissoi*, and *C. Menziesii*, from the Sandwich Islands. All are characterised by having the *rhizome* and the base of the stipes densely covered with short moniliform hairs. The *Scythian Lamb* was referred by Linnæus, from Louriero's description, to *C. glaucescens*, under the name of *Polypodium Barometz*. Nothing further was known of it, says Mr. John Smith, till about 30 years ago, when the late John Reeves, Esq., sent a living plant from China to Messrs. Loddiges as the true *Barometz*. In 1840 it produced fructification, and was identified as belonging to the genus *Cibotium*, and recorded in Smith's *Genera Filicum*, in 1841, as *Cibotium Barometz*.

Mr. Hanbury examined an ancient specimen of the Scythian lamb in the British Museum, as well as a living plant of *Cibotium Barometz*, Sm., and found them to resemble each other much more than they did the Sumatran *Penghawar*.

Dr. Oudemans refers the *Penghawar* to *C. Cumingii*, a fern of the Philippine Islands, which is regarded by filico-

logists as not specifically distinct from the *C. Barometz* of Smith, and *C. glaucescens* of Kunze.

In reference to this point, Mr. T. C. Archer states, that Lady D. Nevill contributed to the Liverpool Museum a specimen of pulu, which was removed from the stipes of a fern obtained from the Horticultural Society, under the name of *C. Schiedianum*. "I do not think it improbable," he adds, "that other species may produce these curious moniliform hairs, but they do so little resemble the hairs of *C. Barometz* in the few specimens which I have had the opportunity of seeing, that I cannot refer the *Penghawar* to it, and consequently not to *C. Cumingii*, if, as Mr. John Smith says, they are the same species.

If Lady Nevill's *C. Schiedianum* be identical with *C. Schiedei*, Schlecht et Cham, which is a Mexican species, it is far more probable that the pulu of the Sandwich Islands is the produce of one or more of the species described by Sir W. Hooker as natives of those islands, than of *C. Scheidei* or *C. Barometz*.

Mr. D. Hanbury has kindly favoured me with the following notes from his correspondenee with Dr. J. E. De Vry, of Bandong Java, and from other sources, relative to the substances imported from the Indian Archipelago.

Penawar Jambie (this orthography is said to be the best) and *Pakoe Kidang* are not synonyms, though the names are applied to two very similar substances.

I. *Penawar Jambie* is the shining silky hairs of the rhizome and stipes of *Cibotium Barometz*, J. Smith (*Gen. Fil.*, p. 83.), and is produced in Sumatra, and not in Java. This fern is the Scythian lamb of the old writers.

II. *Pakoe Kidang*. This substance, which is also the shining, moniliform hairs of the stipes of a fern, or pieces of the hairy stipe itself, is produced by *Balantium chrysotrichum*, Hassk., of which a plantation exists on the sides of the Goenong Gedek, a volcano in the interior of Java, between 50 and 60 miles from Batavia. The government of the island has exported the produce of this plantation to Holland, where it has been sold at public sale under the name of *Penawar Jambie*. Hasskarl has lived near the Goenong Gedek, so that there can be no doubt that the product in question is really afforded by the fern he has named.

According to De Vry it is this *Pakoe Kidang* that, under the name *Penghawar Djambi*, was analysed by Dr. J. M. Van Bemmelen, in 1856, and it certainly appears to be that noticed by Mr. Hanbury in the *Pharmaceutical Journal* of November in that year.

Dr. Oudemans mentions, in addition to this fern, as a source of *Pakoe Kidang*, *Alsophila lurida*, B. C., and *Chnoophora tomentosa*, B. C.

The hairs of the *Pakoe Kidang* (*Balantium chrysotrichum*) are usually thicker, longer, and less soft and silky than those of the *Penawar Jambie* (*Cibotium Barometz*).

Dr. De Vry has found the former to afford, upon combustion, 6·74 per cent. of ashes, while the latter yielded but 1·53 per cent.

Though new to the English drug market, the *Penghawar* has for some years past been in the hands of the pharmaceutists of Holland and Germany, and has a place in the Dutch Pharmacopœia. As a styptic it may be employed in the same manner as cotton, wool, tow, or beaver nap. According to Dr. J. M. Van Bemmelen, the styptic action of these hairs is solely mechanical. Practitioners have tried the effect of an aqueous decoction of the hairs or of the stem, as a remedy for internal hemorrhage, and the late Dr. Molkenboer was firmly of opinion that it was beneficial in such cases, although the experiments of Van Bemmelen leave little ground for any reliance on the reputed good effects of the drug so applied.

FOREIGN WINES.

Reports received at the Foreign-office from the secretaries of the British embassies and legations in the wine-producing countries, in conformity with instructions issued in 1858 by the Earl of Malmesbury, shew that one effect of the greatly-diminished production of wine in Portugal and France of late years, in consequence of the grape-blight, has been the adulteration of wines imported from Spain, in order to impart to them the colour and flavour of French wines and of port. The British consul at Barcelona reported to Mr. Lumley, secretary of legation in Spain, that the disease had had the effect of causing a considerable quantity of wine to be exported to Cette and other French ports, "there to be mixed up with other matters, and re-shipped for consumption all over the world as choice wines." The wines exported were chiefly strong bodied and of deep colour, but without any special selection of any particular class. The civil governor of Tarragona informed Mr. Consul Baker that a similar trade had been carried on there, and with the like object; and the British consul at Malaga states that large quantities of wine, the produce of that district, have been sent coastwise to the Jerez district for mixing, in other words, for use in compounding a wine to be sold as sherry. It is further stated, in a communication from Cordova, that "a Jerez firm (Senores Gonzales, Dubort, and Co., wine merchants), have established a house here, and they buy our wines, and send them to Jerez, where, I understand, they mix them with sherry, and export them to London; they purchase, however, only the wines of Meriles, a district near Aquilar, which produces wine of a better quality than ours. I do not know whether you are aware that the Jerez people, last winter, bought up all the wines they could lay their hands on, at Constantina, Cozalla, El Pedrozo, and other towns in the vicinity. The quantity purchased was about 125,000 arrobas, and it was brought down in casks by the Constantina oxen carts, to the *barranco de Tocina*, and there put on board vessels and carried to San Lucar. Some portion of the wine, I heard, got to Jerez in the shape of vinegar, but it is very certain a considerable portion was used in the manufacture of sherry for the London market." Mr. Lumley observes that the wine trade of France seems to have been as much indebted to Spain for its existence during the last five or six years as that of Portugal has been; and that, although at Bordeaux, as at Jerez, the stocks of old wine may be still unexhausted, though greatly diminished, there is little doubt that a large quantity of the new wine which, for the last five years, has been manufactured in the south of France, and which has been exported to all parts of the world as French wine of the first vintages, was little else than Spanish wine mixed with French, and "doctored" to suit the market for which it was destined. He gives the following as the approved receipt for making Bordeaux out of Spanish wines:—To one-third of the black Aragonese wine, Carinena, Ribeiro do Ebro, or other of that class, the price of which is about five sous a bottle, add one-third of the light wine of Cahors, and one-third water; the requisite flavour is given to it by the addition of a little orrisroot, and the wine thus manufactured sells readily at fifty sous a bottle. Viscount Chelsea confirms the foregoing statements, remarking that the fraudulent practices of the French wine merchants are of two sorts; first, that which consists in adding water, which is the most generally adopted, and is the least hurtful to health; secondly, the fabrication of wines, to which the name Bordeaux or port is given, by means of a mixture of a very small portion of those wines with other and inferior sorts, water being added, together with spirit and some colouring matter. Another and still more culpable method of adulteration, inasmuch as it is very injurious to health, consists in what is called "sweetening" wines, that is neutralising the acetic acid contained in them. Mr. Fane, secretary of legation at Vienna, reports the existence of similar practices among the export wine merchants of that capital. Not only were the wines of Hungary, where the vine has escaped the disease, extensively substituted for those of Italy and France by the wine merchants of those countries, but wines were, and are, fabricated for exportation in the manner pursued at Bordeaux. This system is

said to have acquired large dimensions of late years, to the detriment of every sort of wine, both light and heavy kinds being produced in this way. "In Austria," says Mr. Fane, "a great distinction is drawn between the adulteration of wine and its improvement, as taught by modern chemistry. The object is, by an artificial process, to develope the flavour and odour of wines, to correct the acidity of some kinds, and to enable them to keep longer. These chemical processes are warmly recommended in Austria, as the wines corrected by them are said not only to be harmless to health, but to be positive improvements in this respect on the natural products." He adds, however, that this method of "improving" wines is not approved of in the north of Germany. A wine merchant in Vienna has for some years been sending large quantities of spurious port to England, *viâ* Hamburg, where it is said to have grown into favour under the name of Hungarian crown wine. This wine is said to be scarcely distinguishable from real port, even by a connoisseur, and to be competing successfully with the genuine article.

EDUCATIONAL UNION FOR SOUTH STAFFORDSHIRE.

A meeting of the secretaries and representatives of the principal Working Men's Colleges, Athenæums, Young Men's Associations, and Mechanics' Institutes in South Staffordshire, was held at the Old Town Hall, Dudley, on Wednesday evening, the 8th February. The chair was occupied by E. Hollier, Esq., the President of the Dudley Mechanics' Institute. There were present Sir Horace St. Paul, Bart., the Rev. J. H. Sharwood (Walsall), Rev. J. P. Norris, her Majesty's Inspector of Schools; Mr. Talbot (Spon Lane), Mr. T. Wright (secretary of Dudley Institute), Mr. Langley (secretary of the Working Men's College, Wolverhampton), Mr. G. Bidlake and Mr. W. Gough (representatives of the Temple-street Institute, Wolverhampton), Dr. Walker (Brierley Hill), Mr. Bennett (Willenhall), Mr. Whitehouse and Mr. Jeavons (Sedgley), and others.

The Chairman opened the meeting by remarking that this was to be considered not a formal but a friendly meeting to inquire into the Examinations instituted by the Society of Arts, and to see how far they might be made available for the members of the different Institutions in the district, and he begged to call upon Mr. Talbot, the energetic mover of the scheme, to explain more fully the purpose of the meeting.

Mr. Talbot gave an account of the good effected by these Examinations in his own district, and stated that forty names had been sent in for Examination this year.

Mr. Langley stated that he believed the institutions represented by Mr. Talbot and himself were the only two in South Staffordshire that were in direct union with the Society of Arts, and that sent up candidates for these examinations. The Wolverhampton Working Men's College only joined the Society last year, and sent up one candidate, who gained three certificates. This year a local Board had been formed at Wolverhampton, and any student of the College of three months' standing would be enabled to compete for these certificates without any fee or expense, as the examinations would be held in the town. To gain this privilege a subscription of two guineas per annum to the Society of Arts was necessary; but, and this was the special point of this meeting, by forming amongst themselves a union, any Institution not numbering more than 75 members, or not possessing an income exceeding £75 a year, may send up any of their members as candidates on payment of 2s. 6d. for each candidate. Thus, the larger Institutes paying their two guineas to the Society of Arts, and the smaller ones paying 2s. 6d. for each candidate, by forming such a union they would be enabled to reach almost any individual in the district who might be anxious to avail himself of the oportunity thus offered. The Society of Arts made no restrictions as to how the candidates shall have gained their knowledge, but it was evident that if the scheme became general, evening classes would become an essential feature in each institution. In the Working Men's College the evening classes were, in fact, the *only* feature, and consequently he (Mr. Langley) hoped that a constant stream of candidates for the certificates of the Society of Arts would issue from that College.

The Rev. J. P. Norris gave a very interesting account of the unions of Lancashire and Yorkshire. These Institutions had found that the main thing was the evening classes. The news room, the library, the lecture, were all subordinate to these evening classes, and to work these classes efficiently, an organising master was essential, who should be well paid, and devote his whole time to moving from place to place, examining and stimulating these classes.

The Rev. J. H. Sharwood also insisted on the importance of this organising master.

After some further conversation the following resolutions were adopted:—That it is desirable that a union of the various educational institutions in South Staffordshire be formed, and that the different Institutions be invited to join such union; that a local board be formed for the purpose of carrying out the Society of Arts examinations in the district, and that Lord Lyttleton be requested to accept the office of president; that Mr. F. Talbot be appointed honorary secretary to the board; that it is desirable that an organising master be appointed, whose duty it shall be to organise evening classes in the different Institutions, to conduct periodical examinations, and to keep the accounts of the union.

As several matters of detail were still requiring consideration, it was resolved that an adjourned meeting should be summoned as soon as possible to take further steps.

Home Correspondence.

PROTECTIVE DUTIES AND THE SILK TRADE.

Sir,—Herewith I send you copy of a letter addressed to the Chancellor of the Exchequer by Mr. John Chadwick, of Manchester, to whom the Society of Arts is already indebted for contributions connected with the history of the silk manufacture of this country, and for improvements in certain manipulations calculated to economise time and labour in spinning the raw material.

In my report to the Board of Trade on Class 21 of the French International Exhibition of 1855, I took occasion to quote at length the "Memorial of the Silk Manufacturers of Manchester" to the then (1852) Chancellor of the Exchequer, as further illustrative of my argument that both principle and experience are in favour of the removal of the remaining fiscal impediments to the complete and profitable development of the silk trade of this country.

That memorial was drawn up by Mr. Chadwick, and the enclosed letter, which he informs me "was written prior to the announcement of a treaty with France being negociated," brings down the history of the British silk manufacture to a very recent period. I am much mistaken if the treaty about to be communicated to us, does not fully recognise and accomplish the policy he has so long and earnestly advocated.

I am, &c.,
THOMAS WINKWORTH.

Gresham Club, Feb. 8, 1860.

The following is the letter referred to:—

To the Right Hon. W. E. Gladstone, M.P., Chancellor of Her Majesty's Exchequer.

Sir,—In 1853, when you held the seals of office as Chancellor of the Exchequer, I took the liberty to call your attention

to the silk duties, and to send you a copy of a memorial which had been forwarded to your predecessor in office, signed by twenty-seven of the silk manufacturers in this city, praying for the repeal of them.

Now that you are again in office, and with colleagues all professedly advocates of free trade, the country and revenue prosperous, the time is opportune for again urging this subject on your consideration.

The question of the revenue arising from these duties it is not my province to deal with, for though the amount is considerable, it is incidental. The duties were imposed for protection, not for revenue, and are so regarded by the world; they are, in fact, a remnant of a mistaken policy which parliament and the country have denounced, and which the intelligent amongst the silk manufacturers themselves now repudiate; and it is in this, their real character, that I wish to consider them.

The restrictive policy is, of course, based on the assumption that the British manufacturers are unable to compete with those of the continent, and, therefore, require the aid of Government. But this assumption is in itself fallacious. I contend, on the other hand, that though the continental manufacturers may surpass us in the production of some classes of goods to which they have long devoted their special attention, we surpass them in others, and that in the bulk of our productions we are the cheapest manufacturers in Europe.

If, however, we were unable to compete with the foreigner, why should Government interfere? Let the discredit be our own.

But protection, as applied to the silk trade, is altogether a delusion. Government can do no good by the adoption of commercial restrictions; it is capable only of evil, and if evidence was still required of this, the history of the trade supplies it.

Nearly two hundred years ago foreign silk goods were admitted free into this country, and this was the most prosperous period in the history of the trade. So successful was it then that we find it recorded: "The manufacture had gone on so steadily increasing as to afford one of the most striking instances on record in which an art, borrowed from a foreign country and employed on the production of a foreign country, should be made to equal, if not to surpass, the production of those countries from which it was derived."

We were then importing from £600,000 to £700,000 of foreign silk goods annually, *duty free*.

In 1697 the vicious system of restriction was applied to the trade, an act being then passed prohibiting the importation of European silk goods. The ground on which this act was asked for and passed was peculiar; it was not that the manufacturers required protection, but that "our manufacturers had attained a greater degree of perfection than was attained by foreigners."

A restrictive policy, however, came afterwards to be looked on as a necessity, and has since that time been adopted in every conceivable form, and with what result? M'Culloch says, "From 1719, twenty years after the protective system had commenced down to 1824, the silk manufacture presents little more than complaint on the part of the manufacturers of the importation of foreign silks—impotent efforts on the part of parliament to exclude them, and combinations and outrages on the part of the workmen. Of the numerous acts passed in reference to this manufacture from 1697 to the era of Huskisson, it would be difficult to point out one that is bottomed on anything like sound principles, or that was productive of anything but mischievous consequences."

The measure of Huskisson, passed in 1824, substituting a duty of 30 per cent. on foreign goods, in place of total prohibition, and reducing the duty on raw and thrown silk, gave a great impulse to the trade. This rate of duty was, however, too high to put down smuggling; and it was found that, of the silk goods exported from France to England, about one-half were smuggled into this country, the other half only paying duty. To remedy this, Sir R. Peel, in 1845, reduced the duty to about the smugglers' charge, or practically to 10 or 12 per cent., retaining, for *protection*, the highest rate of duty it was in the power of Government to enforce. Still, for the last twenty years, the broad silk manufacture of England has been stationary, or nearly so; whilst other manufactures have extended so largely in this country, and this trade has made such rapid strides on the Continent, here it has made little, if any, progress. Surely there must be something radically wrong! If, after the trade has been legislated for and tampered with, or, in plain words, trifled with, by successive governments for upwards of a century and a half, this is its position, it surely evidences that our industry is misapplied in pursuing such a trade, or else that legislative restrictions have been mischievous, and should be entirely withdrawn.

It has been asked, if protection is the cause of this, how is it that the same policy in force on the continent has been attended with such different results? The explanation is this, that up to 1824 we imposed a duty on foreign thrown silk of 14s. 8d. per lb., and a heavy duty also upon raw silk, thus greatly enhancing the cost to our manufacturers, whilst France admitted the same silk for her manufacturers at a merely nominal duty. With this great advantage in their favour the French manufacturers established themselves in the markets of the world, and thus laid the foundation for the large export trade they now enjoy. Thus, our own legislation, under the plea of encouraging and protecting the trade, raised up difficulties which were insurmountable; and though these difficulties have since been removed, the unfavourable impression towards the English manufacturers still exists, and the retention of protective duties perpetuates it.

I now beg your attention to the practical result of the removal of protective duties on the throwing trade.

From the first establishment of a throwing mill in this country, in 1719, this has been a protected trade, and even so recently as 1824 there was a duty on foreign thrown silk of 14s. 8d. per lb. Mr. Huskisson reduced this to 7s. 6d. and ultimately to 3s. 6d. on organzine and 2s. on tram, and allowed a drawback on manufactured goods. He removed also almost entirely the duty on raw silk, and this measure (imperfect as it was) gave such an impulse to the throwing trade, that the throwing mills, numbering 175 in 1826, rapidly increased to 266. After a time, however, this trade again began to flag, and when, in 1842, Sir Robert Peel proposed to reduce the then existing duty, in order to give the manufacturers the material of their manufacture on more favourable terms, the throwing trade was not in a satisfactory state (it was receding rather than progressing), and it was said if the trade cannot succeed with its present protection it will be ruined without it. Sir Robert Peel, however, persisted in his policy; he first, in 1842, reduced the duty, and then, in 1845, removed it entirely.

Up to this period our export of British thrown silk was almost "nil," but a foreign demand then commenced, and has gone on increasing, until for the past year our exports of English thrown silk to the continent have been absolutely much larger than our imports from the continent, and the measure intended specially to benefit the manufacturer has been attended with a directly contrary result; for the price of throwing, instead of being reduced by free competition, has advanced, the wages of the workmen have advanced also, and the throwster, no longer dependent on the home trade, has had a much more successful and an extending business.

I have thus endeavoured to show you that the silk manufacture does not owe its origin or its success in any degree in this country to protection, but, on the contrary, that government restrictions have been the chief cause, if not the only cause, of its unsatisfactory state. These restrictions have diverted the trade from this country, kept down the rate of profit, diminished the wages of labour, and served no interest whatever.

Seeing that a degree of success beyond the anticipations of the most sanguine has attended Sir Robert Peel's free-trade measures, it is surprising that no minister has yet carried out his evident intentions as regards this trade.

It is in your hands to remove this relic of the erroneous legislation of a bygone age; don't allow the silk trade to continue a marked exception to the general policy of this country. In France, the government would establish free trade; the manufacturers oppose it. In this country the silk manufacturers of Manchester have asked for free trade as a boon; it is the government that withholds it.

The silk manufacture is at this moment a signal exception to the general prosperity.

England has set the example of free trade to the world. Let her now set a further example to the continent by the unconditional removal of the protective duties on foreign silk goods.—I have the honour to be, sir, your obedient servant,

John Chadwick.

12, Mosley-street, Manchester, 12th January, 1860.

SCIENCE IN COURTS OF LAW.

Sir,—My attention has just been called to Dr. Odling's letter in the *Journal* of the 27th ult., in which, much to my surprise, I find myself and others assailed by him in the following terms. After having incorrectly accused us of attacking scientific witnesses generally of want of truth

Dr. Odling concludes by recommending "those self-constituted critics of other men's integrity—Dr. Angus Smith, Messrs. Holland, Homersham, and Chadwick—to exercise a little more of that charity which thinketh no evil."

I cannot allow this accusation to pass uncontradicted, that either Dr. Smith or I said or insinuated anything derogatory to the scientific men—a class that we hold in the highest respect—nor did I notice that anything was said by the other gentlemen attacked by Dr. Odling of which he or anyone can justly complain.

Had Dr. Odling attended the meeting he might have heard it said by me, even more emphatically than is reported, that Dr. Smith had not said, and I was sure did not mean to imply, that scientific witnesses did not generally give evidence in strict accordance with their real opinions. No such accusation was intended, or could be truly made; but it was not to be denied that a very dangerous profession was growing up of men employed nominally as witnesses—but really as advocates—to support the peculiar technical or scientific opinions favourable to the cause of those who paid for them. I added, that it did not follow that because men could nearly always be found to give evidence unusually favourable to a particular cause, that such evidence was necessarily untruthful, for the witnesses may have been, and often are selected, by the party because they sincerely hold the opinions they give. Conscious untruthfulness among this class of witnesses is, I am sure, the exception, and, I believe, the rare exception, but it is unhappily true that there are exceptions; that men are to be found who will give contrary opinions apparently according to the interest of those who employ them. Witnesses who profess scientific opinions are as little to be relied upon as statements of barristers avowedly engaged to advocate a cause in which they do not even pretend to believe.

Dr. Odling has himself told us to what temptations such witnesses are exposed. I believe, and am glad to believe, that in the vast majority of cases those temptations are resisted; and if Dr. Odling will seriously assert that the evidence of scientific witnesses is never influenced by their self-interest or partizanship, I will try to believe that too; I do not, however, promise to succeed. In the meantime, it is well worth considering whether Committees of Parliament and Courts of Law would not be more sure of getting unbiased opinions, on subjects out of the range of ordinary education, if in addition to (not instead of) the technical witnesses called by the parties, some one was impartially appointed to tell the Committee, or the Court, what really are the opinions on the subject usually held by those most conversant with the art or science involved.

I am, &c.,

P. H. HOLLAND.

4, Old Palace-yard, Feb. 11, 1860.

MECHANICS' INSTITUTIONS AND DISCUSSION CLASSES.

Sir,—The knowledge of our own language is one of the first and most important ends of education, and should form the prominent feature of adult instruction in the classes of Mechanics' Institutions. This is not implied, nor will it be accomplished by a mere knowledge of the formal rules of grammar. The object to be attained is the capability of speaking and writing correctly, which may be materially promoted by a class for the reading and discussion of essays. It is a means of promoting the practice of English composition, and the emulation excited by an animated discussion often proves to be one of the most attractive features of an institution. Care should be taken to exclude all subjects connected with theology or party-politics, or which are calculated to excite angry feelings; and if a list of questions suitable for discussion be prepared, the difficulty of choosing an appropriate subject, which to the unpractised member too often appears insurmountable, would be in a great measure obviated. In order to assist the committees of Institutes in the furtherance of this object, I subjoin a few brief rules which have been circulated by the Yorkshire Union amongst the 143 Mechanics' Institutes comprised in it.

Rules.—The class should meet on one evening in each week, and elect a chairman for the evening.

Each member should in turn read an essay on some subject, either of history, literature, science, &c., to occupy not more than twenty minutes. It should then be open to discussion by the members of the class, the time occupied by each speaker not to exceed five minutes.

All members of the Institute to have free admission, but only the members of the class to take part in the discussion.

At the conclusion of the discussion, the chairman should sum up the arguments and take the votes of the members on the question at issue.

Any member unable or unwilling to prepare an essay may provide a substitute.

At the close of the season a premium may be awarded for the best essay which has been read.

Hints to the Members.—In the essay it is advisable that the affirmative of the question be maintained. Succeeding speakers should, as far as possible, confine themselves to the salient points of the preceding arguments.

All personalities and egotistical expressions should be carefully avoided.

In discussion, admit as much as possible of what has been advanced by an opponent.

It is important to check the slightest inclination to petulance or ill-temper.

Brevity is as valuable in speaking as in writing.

An opponent should never be accused of acting from wrong motives.

Each argument should be clearly stated, and honestly and calmly answered.

A respectful tone and gentlemanly demeanour should be preserved.

Let me hope that, the attention of those who have the management of Mechanics' Institutions being called to the above few suggestions, it may be the means of stimulating some of them to increased energy. They will not find much difficulty in preparing a list of suitable questions.

I am, &c.,

BARNETT BLAKE.

Proceedings of Institutions.

Chelsea Athenæum.—A conversazione was held at the South Kensington Museum, on Saturday evening, the 14th January, to commemorate the first anniversary of the Chelsea Athenæum. The chair was occupied by Robert Hunt, Esq., F.R.S., F.S.S., Vice-President of the Society, supported by the Rev. J. B. Owen, M.A., Mr. J. Joseph Chapman (the honorary secretary to the Society), Mr. John H. Child, Mr. Henry George Cundy, Mr. George Farren, Mr. Richard Howlett, Mr. George E. Lyon, and Mr. Frederick W. Macdonald, who compose the committee of management. The chairman congratulated the visitors, who mustered to the amount of between 400 and 500, on the increasing prosperity of the Society, which already numbers above 120 members, and on the sphere it occupied for future usefulness, and then introduced Mr. Frederick W. Macdonald, a young gentleman of 18 years of age, who addressed the meeting at considerable length. Mr. George E. Lyon, whose age is 17, also addressed the meeting. The Rev. J. B. Owen complimented both the speakers on the addresses they had delivered. Mr. John H. Child then proposed, and Mr. Joseph Chapman seconded, a vote of thanks to Mr. Henry Cole, C.B., and Mr. P. C. Owen, for their admirable arrangements throughout the evening. Mr. George Farren then moved, and Mr. Macdonald seconded, a vote of thanks to Professor Hunt for his kindness in presiding.

Metropolitan Evening Classes for Young Men.—At a meeting held at Crosby Hall, on Wednesday, the 1st instant, R. N. Fowler, Esq., in the chair, the following proposal was agreed to:—"That as by the sale of Crosby Hall the evening classes are left without a home, a proprietary of £1,000 in 20 shares of £50 each be formed for the purchase of the lease of Sussex Hall, and in the event of this being done, the committee of the evening classes is ready to take the premises at a rental of £230, which will meet the demand for ground-rent and interest of the money, and provide a sinking fund of £50 a year towards liquidation of the principal." In support of this proposal the following gentlemen have each expressed their willingness to take a £50 share:—R. N. Fowler, Esq., Rev. C. Mackenzie, a Friend, per ditto; I. P. Gassiot, Esq., Henry Johnson, Esq., E. F. Leeks, Esq., Wm. Fennings, Esq. (member of the institution), Rev. Richard Whittington, and Master Mackenzie, Thomas Baring, Esq., Messrs, Williams, Deacon, and Co. Two shares will be purchased for the institution with the £100 given by his Royal Highness the Prince Consort in 1857, and three other shares are being subscribed for by the members. The question of a home for the Evening Classes, which has long been a source of much anxiety to the committee, has been so far satisfactorily settled. The formality of removal was gone through at the close of a lecture recently delivered by the Rev. T. H. Bullock, when a considerable number of the members, accompanied by the Hon. Secretaries, the Revs. C. Mackenzie and Richard Whittington, proceeded from the scene of their past labours to Sussex Hall.

Salford Working Men's College.—The annual meeting of the members of this Institution was held on Tuesday evening, the 7th of Feb., in the large hall of the College, Great George-street, Salford. On the motion of Mr. Parry, Mr. David Chadwick, treasurer of the Borough of Salford, was called upon to preside. Mr. G. Parry, the hon. secretary, read the Report, which records the great success of the Institution. It was the opinion of the Council that working men had hitherto been approached too exclusively on the side of the intellect. The Report says:—"This College has fortunately seen the need for the combination of the social and intellectual elements, and the result is that, in this seventh term upon which the College is now entering, it has not less than 200 students; and these 200 are not isolated units, having only a distant class-room acquaintance—they are animated by and made one by mutual good feeling, and in every class in the College friendliness and sympathy on the part of the teacher have been followed by the confidence and respect of the student." The Report then proceeds to narrate the manner in which the present building came into the possession of the College, and its incorporation with the Salford Mechanics' Institution—the classes of the Mechanics' Institute now forming the preparatory classes of the College. The purchase of the present building had been effected by the contributions which had been made towards that object by a large circle of the friends of the College. The classes for writing, book-keeping, grammar, composition, French, algebra and geometry, practical arithmetic, mechanical drawing, chemistry, logic, Latin, elocution, physical geography and rudimentary instruction, have all been in active and efficient work during the past year. It must be said, also, that many subjects which are indispensable in a liberal course of instruction still find no place among the College students. The Council recommends its successors to obtain teachers and form classes for the study of additional subjects, such as history, political geography, astronomy, physiology, and political economy. The Council announces with pleasure that a class for drawing and painting is about to be formed. The Report goes on to say:—"The Council, in order to stimulate the students to increased exertion, as well as to obtain the decision of an independent body on their actual progress, has resolved to place the College in connexion with the Society of Arts, and a Local Board is in course of formation, whose duty it will be to conduct the preliminary examination of candidates for the final examination of the Society." Having paid a tribute of praise to the benefits which have accrued to the College from the work of teaching, by the means of services gratuitously rendered, and referred to the fact that classes to which paid teachers were attached were self-supporting, the Report proceeded to notice the beneficial effects of the social element introduced into the College. "It has been found, that to attach the students warmly to the College it is as necessary to call forth the warm and genial feelings of the heart as to educate the intellect. The more completely a home feeling prevades Institutions such as this, the more certain will be their success." Social meetings had therefore formed a important element in the proceedings. The treasurer's statement on the capital account showed that the receipts had been £756 8s. 2½d., and the expenditure £746 1s. 11½d., leaving a balance in the treasurer's hands of £10 6s. 3d. On the revenue account the receipts were £118 9s. 4d., and the expenditure £147 4s. 2d., leaving a balance due to the treasurer of £28 14s. 10d.; which, on deducting the balance in hand on the capital account, left a net balance due to the treasurer of £18 8s. 7d. The report of the accounts having been received and approved of, Mr. George Parry proposed the re-appointment of Edward Ryley Langworthy, Esq. as President of the College for the ensuing year. Mr. Lynch seconded the motion, which was carried by hearty acclamation. On the motion of Mr. Plant, seconded by the Rev. J. B. Kennerley, the following were selected as Vice-presidents of the College:—The Mayor of Salford, for the time being, J. W. Weston, Esq.; the Lord Bishop of Manchester; Sir Benjamin Heywood; Sir Elkanah Armitage; James Aspinall Turner, Esq., M.P.; and Thomas Bazley, Esq., M.P. The Chairman stated, with respect to the office of treasurer, which he had held from the commencement of the College, that now the Institution was free from debt, and in a successful position, he was anxious to be relieved from the duties of the office. Mr. May said every gentleman in the room was fully acquainted with the able and satisfactory manner in which the treasurer had performed his duties. By his exertions, almost exclusively, the College had been brought to its present gratifying position. He conceived the project of the Working Man's College, and he had been mainly instrumental in carrying it into execution. He had therefore great pleasure in proposing that Mr. Chadwick be re-elected Treasurer for the ensuing year. Mr. Sidebottom seconded the motion, which was put to the meeting by Mr. George Parry, who, in doing so, said they could not find a gentleman whose heart was more truly with them, and whose hands would labour more busily on behalf of the College. The motion was carried by acclamation. Mr. Chadwick, in acknowledging this expression of their approval, said, that having assisted to clear the Institution of its incubus of debt, he had done his best to relieve himself from the office; he had, however, failed in this, and must reluctantly consent to continue his services for another year. Some other business was then transacted and the meeting separated.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Second Session, 1859.

Par. Numb.
229 1. Sovereign Coined at Sydney—Correspondence.

Delivered on February 1st, 1860.

12. Bill—London Corporation.
Budrum and Cuidus Expedition—Further Papers.

Second Session, 1859.

162. Railways—Return.

Delivered on February 2nd, 1860.

1. Public Income and Expenditure (Balance Sheet)—Account.
9. Procurators Fiscal (Scotland)—Return.
19. Kinsale Riots—Return.

22. Ecclesiastical Commission (Ireland)—Annual Report and Account.

Delivered on February 3rd, 1860.

24. Cambridge University—Copies of Statutes.
28. Universities (Scotland)—Copies of Two Ordinances.
36. East India (Loan)—Return.
16. Bills—Public Improvements.
17. „ Warehousing Places—(Manchester, &c.)
18. „ Adulteration of Food, &c.
19. „ Attorneys and Solicitors.
21. „ Annuity Tax Abolition (Edinburgh).
22. „ Savings' Banks and Friendly Societies' Investments.

Delivered on February 4th and 6th, 1860.

32. Westminster New Palace—Account.
41. Bank of England—Annual Accounts.
42. Bank of England—Paper.
12. Game Laws—Return.
27. Westminster Rates—Return.
45. Gold (Australia)—Return.
11. Bills—Roman Catholic Charities.
13. „ Oxford University.
20. „ Tramways (Ireland)
24. „ Church Rates Law Amendment.
25. „ Spirits (Ireland) Act Amendment.
23. „ Prisons (Scotland) Acts Continuance.
26. „ Duchy of Cornwall (Limitation of Actions).

Telegraphic Correspondence in the Mediterranean and with India, &c.—Correspondence.

To Correspondents.

Erratum.—In the *Journal* for February 3rd, page 174, col. 1, in the List of the Local Board for the Glasgow Mechanics' Institution, for "Mr. James Boyce, M.A., LL.D., F.G.S.," read "Mr. James Bryce, M.A., LL.D., F.G.S."

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. J. Pittman, "On the Results of the Use of Music in Divine Worship, and their Influence on the Art in General."
British Architects, 8.
United Service Inst., 8½. Mr. W. Heinke, "Heinke's Diving Apparatus and Lamp."
Medical, 8½. Mr. Price, "On the treatment of certain diseased conditions of the Hip-joint by complete and partial excision of the articulation."

Tues. .....Royal Inst., 3. Prof. Owen, "On Fossil Reptiles."
Civil Engineers, 8. Discussion upon Mr. Longridge's Paper, "On the Construction of Artillery and other Vessels, to resist great internal pressure."
Statistical, 8. Mr. Fred. Hendriks, "On the Recent Statistics of Spain."
Pathological, 8.

Wed. .....Society of Arts, 8. Mr. S. S. Baxter, "On the New Lime Light."
Archæological Assoc., 8½.

Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Philosophical Club, 6.
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.

Fri. .....United Service Inst., 3. Lieut.-Col. E. Hamley, R.A., "The Campaign of Marengo."
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Dr. W. B. Carpenter, "On the Relations between the Vital and Physical Forces."

Sat. .....Royal Inst., 3. Dr. Lankester, "On the Relations of the Animal Kingdom to the Industry of Man."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February 10th*, 1860.]

Dated 1st October, 1859.

2228. A. S. Stocker, Birmingham—Certain imp. in the manufacture of articles to be affixed to boots and shoes, and to the feet of animals, also applicable to chain links, washers, and other suitable articles, and in the dies to be used therein.

Dated 4th January, 1860.

22. E. Thomas, Saint Mellons, Monmouthshire—A self-acting water guage for steam boilers with a regulator for the feed.

Dated 9th January, 1860.

60. J. A. Coffey, Providence-row, Finsbury—Imp. in obtaining and applying motive power by means of ponderous bodies.

Dated 11th January, 1860.

70. W. Cotton, Loughborough, Leicestershire—Imp. in machinery or apparatus employed in the manufacture of looped fabrics.
77. W. E. Newton, 66, Chancery-lane—Improved apparatus for moulding candles. (A com.)

Dated 12th January, 1860.

84. W. Sinnock, Brompton, Kent—Imp. in the arrangements of apparatus for the manufacture of hempen or other fibrous covered insulated wires for submarine telegraph cables.

Dated 16th January, 1860.

110. F. T. Aldridge, 37, Great Dover-street, Southwark—An improved soft waterproof cloth hat.

Dated 19th January, 1860.

136. T. Curtis and J. Haigh, Leeds—Imp. in machinery to be used in finishing cloths or fabrics having nap or pile on their surfaces.

Dated 21st January, 1860.

152. H. Walker, Gresham-street, London—Imp. in putting up or packing needles and other small articles.
154. J. W. Scott, Worcester—Imp. in plates for attaching buttons to garments and other articles, in button shanks and in buttons.
156. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in retorts for the distillation of bituminous schists. (A com.)
158. O. Vivier, Birmingham—Imp. in keyless watches.
162. A. McDougall, Manchester—Imp. in the preparation of materials used for sizing, dressing, or finishing yarns or threads, and woven fabrics, applicable also to sizing paper.

Dated 23rd January, 1860.

164. F. J. Ferry, Rupert-street, Middlesex—Imp. in harnessing horses or other animals to carriages or vehicles.
168. A. V. Newton, 66, Chancery-lane—Improved apparatus for retarding the delivery of yarn from yarn beams. (A com.)

Dated 24th January, 1860.

170. J. Appleby, Manchester—Imp. in arrangements for and in the manner of embossing or finishing the surfaces of woven fabrics, to produce thereon certain appearances, designs, or patterns.
174. C. H. Reed, Sunderland—Certain imp. in the construction of anchors.
176. E. J. Hughes, Manchester—Imp. in the manufacture of certain colouring matters by the oxidation of salts of aniline, and other salts of a similar nature. (A com.)
178. T. Harrington, Gracechurch-street, London—Imp. in steam engines and boilers.
180. W. Hulme and T. D. Hulme, Congleton, Cheshire—Imp. in machinery or apparatus for propelling ships and vessels on the water.
182. J. Barrans, 2, Caledonian-terrace, Queen's-road, Peckham—Imp. in steam boilers.

Dated 25th January, 1860.

184. E. C. Nicholson, Kennington-road, Surrey—Imp. in the production of colours for dyeing and printing.
186. J. Dixon and R. Clayton, Bradford—Imp. in rolling and shaping iron and steel for manufacturing railway wheels.
192. A. G. Hunter, Pentre Alkali Works, Flint, North Wales—Imp. in the separation of sulphur from its combinations with certain metals.
194. G. Ryder, Park-street, Lenton, and J. Clay, jun., Butcher-street, Nottingham—A high pressure stop valve or cock.

Dated 26th January, 1860.

197. W. Brindley, Queenhithe, Upper Thames-street, London—Imp. in the manufacture of paper-board, known by paper makers as "middles," extensively used in the manufacture of boxes.
198. T. Banks, Ipswich, Suffolk—Imp. in gas pipe tongs.
199. A. C. Hempel, Ramsgate, Kent—Imp. in fire escapes.
201. P. Effertz, Manchester—Imp. in machinery or apparatus for making bricks.
202. T. W. Plum, Blaenavon Iron Works, Monmouthshire—Imp. in preparing and fixing iron and other metal plates to ships and other structures.
203. J. J. Maurer, 29, Boulevart St. Martin, Paris—An improved propeller applicable to various purposes.
204. W. E. Newton, 66, Chancery-lane—The manufacture of gold in a new form, and its use in such form for filling or plugging teeth. (A com.)

Dated 27th January, 1860.

208. R. Sykes and P. Sykes, Huddersfield—Imp. in machinery or apparatus employed in spinning, twisting, and roving wool and other fibrous substances.
209. F. Walton, Haughton-dale, Denton, near Manchester—Imp. in the manufacture of varnish, and in treating oils, also in the application of products obtained therefrom.
210. J. P. C. Guerrier, Paris, 29, Boulevard St. Martin—Improved apparatus for splitting and preparing the cane for various purposes.
211. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in inkstands. (A com.)
213. J. Brigham, Berwick-upon-Tweed—Imp. in machinery or apparatus for sowing or depositing seeds in land.
214. W. E. Newton, 66, Chancery-lane—An improved folding frame, designed for umbrellas, parasols, tents, awnings, sun blinds, and other analogous structures. (A com.)

215. W. E. Newton, 66, Chancery-lane—Improved machinery for printing addresses on newspapers and on wrappers and envelopes, also for punching and indenting wooden or other blocks, or plates, from which the addresses are to be printed. (A com.)

Dated 28th January, 1860.

216. J. Nicholson, Middleton's-buildings, Middlesex—An improved main cock or tap for regulating and indicating the supply of gas.
217. J. Wilkes, T. Wilkes, and G. Wilkes, Birmingham—A new or improved method of manufacturing wire for electric telegraphs, and for such other uses as the same is or may be applicable to.
218. A. Gray, Glasgow—Imp. in power looms.
219. J. Lord, Rochdale—Imp. in machinery or apparatus employed in the manufacture of cotton and other fibrous materials, called "roving frames" and "doubling frames."
220. C. N. Nixon, Ramsgate—Imp. in the construction of mangles, the same being also applicable to other machinery for the pressure of textile fabrics and other substances.
221. T. Dunn, Pendleton, near Manchester—Imp. in machinery and apparatus for altering the position of locomotive engines and carriages, and for preventing injury and accidents on railways.
222. J. H. Johnson, 67, Lincoln's-inn fields—Imp. in the steeling and cementation of metals. (A com.)
223. J. H. Johnson, 47, Lincoln's-inn-fields—Imp, in blowing engines. (A com.)
224. E. C. Nicholson, Kennington-road, Surrey—Imp. in the production of colours for dyeing and printing.
225. R. W. Savage, 15, St. James-square, Westminster—Imp. in tidal ladders, and in steps for embarking and landing purposes.
226. J. Jeffreys, Richmond, Surrey—Imp. in sun blinds.
227. T. B. Daft, Tottenham, Middlesex—Imp. in coating iron.
228. W. E. Newton, 66, Chancery-lane—Improved machinery for carding silk, silk-waste, and other filamentous substances. (A com.)
229. E. Langen, Cologne, Prussia—Imp. in steam boiler and other furnaces.

Dated 30th January, 1860.

231. H. Bosshardt and O. Dingler, Paris—Imp. in machinery for treating cotton and other fibrous materials.
232. T. Walker, Birmingham—Imp. in means for cleansing sewage and other waters.
233. H. Hodgson, Ballyreine, and P. M. Crane, Irish Peat Works, Athy, Ireland—Imp. in manufactures from peat.
235. J. Luis, 18, Welbeck-street, Cavendish-square—Imp. in the apparatus for preparing and clarifying resinous substances. (A com.)
236. G. Nurse, Pontymister, Monmouthshire—Imp. in the manufacture of tin or "terne" and galvanised metal plates.
237. H. E. Brown, Woolwich—Imp. in axle carriages.
238. E. Brooks, Birmingham, and H. Waters, Smethwick, Staffordshire—New or improved machinery to be used in the manufacture of guns and pistols, and for shaping metallic and non-metallic substances for other purposes.
239. J. Swain, Hyde, Chester—Certain imp. in fire-bars, and in the means of actuating and shifting the same.
240. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in hot air engines. (A com.)
241. B. Matthewman, jun., Sheffield—Imp. in pen and pocket knives, scissors, and every other description of cutlery.
243. W. E. Newton, 66, Chancery-lane—An imp. in the construction of soldering irons. (A com).

Dated 31st January, 1860.

245. W. Tait, Glasgow—Imp. in distilling apparatus. (A com.)
247. L. Appleton, 25, Clarence-road South, Kentish-town—The arrangement and expeditious removal of patterns, invoices, letters, papers, &c., more particularly tailors' patterns.
249. T. Smith, 9, Gloucester-terrace, Cambridge-heath—Imp. in the manufacture of chenille, and in apparatus employed therein.
251. G. Owen, Bedford-row, Middlesex—Imp. in rocking-horses, see-saws, and other analogous vibrating or oscillating contrivances.
253. R. A. Brooman, 166, Fleet-street—Certain arrangements of machinery for forming slivers as they come from the carding engine into threads, and for winding the threads on bobbins. (A com.)
255. R. J. Cole, 21, Chepstow-villas West, Bayswater—Imp. in pencils and in holders for the same.

Dated 1st February, 1860.

257. W. Hartley, Bury, Lancashire—Certain imp. in steam engines.
259. B. Shaw, Wellington, Salop—Imp. in stench traps, and in the cesspools or pits of sewers.
261. A. Stoddart, Tours, France—Imp. in submarine telegraph cables. (A com.)
263. G. A. Huddart and J. D. E. Huddart, Brynkir, Caernarvon—Imp. in obtaining motive power.
265. W. E. Newton, 66, Chancery-lane—Improved apparatus for retarding railway carriages. (A com.)

Inventions with Complete Specifications Filed.

266. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Improved machinery for stripping and extracting the filaments of textile plants, and applicable to the treatment of fibro-ligneous matters in general. (A com.)—2nd February, 1860.
278. J. Gedge, 4, Wellington-street South, Strand—Imp. in amalgamating metals or producing alloys. (A com.)—3rd February, 1860.
292. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved means of joining surfaces of leather. (A com.)—4th February, 1860.

Patents Sealed.

[*From Gazette, February 10th*, 1860.]

February 10th.

1858. W. Bouch.
1859. D. Hulett and G. Prudden.
1867. D. Campbell.
1871. R. Clegg and R. Fell.
1873. K. Buhring.
1876. E. Sloman.
1885. J. Poupard.
1887. H. Batchelor.
1912. W. Finegan.
1921. E. Abbott.
1941. A. P. Chamberlain.
1979. J. Nuttall.
2088. A. B. Freeland.
2279. W. Benson.
2319. A. G. De Reginald Hely.
2343. G. Price.
2359. R. Smith.
2394. G. Hart.
2559. G. Seymour.
2617. W. Blinkhorn.
2698. H. O. Robinson.
2781. F. C. Hills.

[*From Gazette, February 14th*, 1860.]

February 14th.

1892. J. Sidebottom.
1893. H. Medlock.
1897. A. Yockney.
1903. W. Wilson.
1905. W. T. Henley.
1907. J. Jackson and J. Taorley.
1939. H. Smith & T. W. Ashby.
1945. T. Bird.
1963. W. Clark.
2009. T. Hedgcock.
2075. F. Heindryckx.
2085. G. M. Levi.
2245. R. Brearley, un.
2673. G. E. Donisthorpe.
2945. R. M. McTurk and G. East

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, February 10th*, 1860.]

February 6th.

361. R. A. Brooman.
389. J. F. Watson.
395. H. Heald and A. Heald.
406. G. C. Potts.
431. J. Lawson and S. Cotton.
467. F. B. Houghton.

February 7th.

385. A. Chambers and W. H. Champion.

February 8th.

373. J. Harding.
372. J. Bernard.

[*From Gazette, February 14th*, 1860.]

February 9th.

368. T. F. Johnson and J. Williams.
394. T. Howard.
410. P. H. Desvignes.
416. W. E. Newton.
518. W. Gossage.

February 10th.

424. W. Richardson.

February 11th.

414. I. Blackburn and R. Blackburn.
553. D. E. O. Degrand.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, February 10th*, 1860.]

February 7th.

412. J. Howard.

[*From Gazette, February 14th*, 1860.]

February 7th.

412. W. B. Adams.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,232	Jan. 28th.	Hicks's Self-registering Mercurial Minimum and Maximum Thermometer	James Hicks	23, Hatton-garden, E.C.
4,233	,, 28th.	Improved Photographic Bath Stand	Jas. Alexander Forrest	Lime-street, Liverpool.
4,234	Feb. 3rd.	Rifle and General Cape Over-coat, with Sleeve	Harry Pelling	22, Leigh-st., Burton-crescent, W.C.
4,235	,, 10th.	Combined Ratchet Brace	Easterbrooke and Allcard	Albert Works, Sheffield.
4,236	,, 13th.	Hat	Henry Bowen	High-street, Camden Town, N.W.
4,237	,, 14th.	Apparatus for longitudinally plaiting or folding Ribbon or Tape	Daniel MacArthur	Bothwell-street, Glasgow.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 24, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of RECENT Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

The days for receiving articles (which must be forwarded to the Society's House *carriage paid*), are Thursday, Friday, and Saturday, the 22nd, 23rd, and 24th March, but no article can be received unless space has been previously allotted, for which application should be made to the Secretary without delay.

Illustrated Catalogues of the Society's Annual Exhibitions are published; a short but clear description of all Inventions exhibited will therefore be required for the Catalogue, with an engraved wood block (when possible) for illustration.

These descriptions must be written in a clear hand, on one side only of each half-sheet of foolscap paper, with an inch margin on the left side of the page.

All Drawings exhibited must be framed.

Articles which have been included in previous Exhibitions of the Society of Arts *cannot be readmitted.*

No charge is made for space.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date :—

Charles Brooke, M.A., F.R.S.,	£2	2
Harry Chester, Vice-Pres. (3rd Donation)	5	0
C. Wentworth Dilke, Vice-Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Henry Johnson (3rd Donation)	10	10
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

CHINESE SEA-WEEDS.

In October, 1857, the Society received from Dr. Macgowan, then residing at Ningpo, specimens of sea-weeds, described as follows :—

"1. *Tan-shwui* grass, so-named from the place, on the coast of Formosa, whence it is procured. It is used for making *Yang-tsai* (ocean vegetable), No. 8.

"2. *Niu-mau* (Ox-hair) grass, made into an iced jelly, and sold in the streets in hot weather, sugared.

"3. *Hâi-tâi* (Sea-tape), sent into the interior, wherever fossil coal is used. It is considered corrective of the deleterious exhalations of that fuel. It is usually boiled with pork. This kind comes from Shantung province.

"4. *Tsz'-tsai* (Purple vegetable).—Often eaten as it is, to give relish to rice, or cooked.

"5. *Fah-tsai* (Hair vegetable).—Boiled, either with animal or vegetable articles, forms a broth. Also the gills eaten with sugar.

"6. *Ki-tsai* (Hen-foot vegetable).—Cooked with soy or vinegar. Used by women to make the hair glossy and to strengthen it.

"7. Sea-tape, from Japan. It is preferred to the former.

"8. *Yang-tsai* (Ocean vegetable).—The article marked No. 1 (*Tan-shwui* grass), prepared. Within the past few years the Chinese have learnt the art of preparing this from the Japanese."

Specimens of these weeds have been laid before Dr. W. H. Harvey, of Trinity College, Dublin, by Mr. Daniel Hanbury, who states that Dr. Harvey has determined their botanical names as below :—

"1. *Laurencia papillosa*, Grev.—This sea-weed has been very carelessly collected, and is much mixed with other substances.

"2. *Gelidium corneum*, Lamour.

"3. } *Laminaria saccharina*, Lamour.
"7. }

"4. *Porphyra vulgaris*, Ag. var.

"5. This has the structure of a Melano sperm, and may probably be *Chorda Filum*, Lamour.

"6. (?) *Gracillaria crassa.*

TWELFTH ORDINARY MEETING.

Wednesday, February 22, 1860.

The Twelfth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 22nd instant, Sir Thomas Phillips, F.G.S., Chairman of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Samuel, Lewis Wainwright. | Sparks, George.
Wellington, George.

The Paper read was—

ON A NEW LIME LIGHT.

By S. Sqeire Baxter.

Artificial light is a subject involving such an extensive range of inquiry, and is of so important a character, as affecting not only the comforts and conveniences, but also the necessities of life, that to enter into a minute history of its progress and advancement, as well as of the many phases through which it has passed before arriving at its present state of perfection, would greatly exceed the prescribed limits of a paper such as is usually presented to this Society; and from the cursory glance which the limited time would permit into the practical character of the various examples, which have of late years multiplied so greatly, ample justice could not possibly be rendered to the many ingenious devices for supplying so indispensable an article of social life as Artificial Light in its multifarious forms. The subject, in some of its details, particularly the manufacture and value of candle light, has been so ably treated by one of the members of the Council of the Society, Mr. G. F. Wilson, in a paper contributed by him, as to leave nothing to be desired on that head, and it were only wasting the time of this meeting to enter upon a repetition of it.

Looking at the subject of Artificial Light as one of great practical utility, which is the only view calculated to interest the public at large, it may be remarked that, with very few exceptions indeed, how rarely is it found that the

lighting of public places, whether of amusement or otherwise, is arranged to produce an agreeable tone of light. There is nothing so dispiriting as an insufficiency of light, while, on the contrary, a brilliant light imparts a charm to the occasion, and an elevated tone to everything within the range of its influence, enlivening the spirits, and giving a wholesome zest to the occupations of the ball-room or the study. But it is not to such applications of light that it is proposed to confine the observations of this paper, but rather to draw attention to the more important uses of it, where life and property, to a great extent, are risked, and where its value will be more highly appreciated.

Did time permit, it might possibly be interesting to many to trace the progress of light through the many and varied modes of applying it in earlier times; but it will suffice to consider those modes which more immediately concern and interest the people of the present day, as conducing to the requirements of the continually advancing state of society, whether as regards luxury or utility.

It will be fresh in the recollection of a large portion of the present audience that, but a few years back, the mode of lighting the thoroughfares, even of our principal cities, by means of oil lamps, was just sufficient to render the darkness visible; while the interiors of our dwellings (with the exception of the larger mansions, in which wax candles were used) were constrained either to receive the tallow candle in all its varieties, the mould candle being the chief, or to adopt (particularly on state occasions) the oil lamp as the only resource. It appears now almost a mystery that we should have so patiently submitted to the annoyances attending such a state of things, and that we should have endured a light so variable and objectionable, which entailed the necessity of constant observation and attention, in order to preserve the wick in a state capable of giving even a tolerably uniform amount of light. Every candlestick was of necessity accompanied by the indispensable snuffers, for which, in the humbler dwellings, the thumb and finger were substituted, the dexterous use of which was thought by Charles the Twelfth of Sweden to be the greatest proof of courage.

Wax candles, though in use at this time, were attainable only by the wealthier portion of society, and therefore maintained their aristocratic position. But the wants of the mass were at length supplied by a substitute for wax, and the cheaper sperm candle was introduced for the benefit of those who were disinclined to incur the expense of the other. A still further advance was made in the production of the stearine candle, as an intermediate step between the sperm and tallow. Is was found that stearine (though improperly so called, stearic acid being its proper name) could be obtained from fat or tallow, and from a variety of oils, as cocoa nut, palm, &c., in such abundance as to induce capitalists to embark largely in its manufacture, and it has now become an extensive article of commerce, not only in this country, but in almost every civilised country in the world, many gigantic establishments being engaged in this article, both for home and foreign consumption.

In addition to the improvements made in the quality of the material of which the candle is composed, and upon which the purity and value of the light depends, the disagreeable operation of snuffing was dispensed with by substituting for the old cotton wick one which, from its peculiar construction, gradually consumes away, by bending over towards the side of the flame and coming in contact with the oxygen of the atmosphere. These wicks are very simply formed in braiding machines, with great rapidity.

It has generally been found (though it is not strictly true as a law) that the best light is the cheapest, the best and cheapest material giving the greatest amount of light for a given cost. Thus, for instance, the stearine is a better and cheaper light than its equivalent in tallow candles, and the wax than its equivalent in stearine.

The mechanism of a candle is one of beautiful simplicity, the cup formed on the top of the candle being the reservoir in which the melted material is held, and from which the wick (which performs the office of a retort) gradually feeds itself by capillary attraction, the liquefied matter being continuously volatilized, producing a constant and steady flame.

Succeeding to the class of light just considered, oil was employed where a more powerful light was required than could possibly be produced by any convenient arrangement of candles. Lamps with flat and round wicks were generally employed, but it was reserved for Argand to produce that beautiful combination of parts in the lamp which bears his name, and which has been the type for all those which, under various titles, have claimed the patronage of the public—a list too numerous to transcribe, but with which most are familiar, all proposing to the consumer some advantage in the shape of economy or convenience. The prominent feature of the Argand lamp consists in the annular form of its wick, by which atmospheric air is permitted to come in contact with the interior as well as the exterior of the flame, and thus to produce the most perfect combustion of the gas which is generated at the upper part of the wick, and fed by capillary attraction, in the same manner as the gas in the candle. A modification of the oil lamp was introduced some years ago under the name of the Bude light, and consisted in producing a powerful light by substituting oxygen gas for the atmospheric air with which ordinary lamps are supplied; the wick was in the form of a cross, so as to facilitate the introduction of the oxygen gas to every part of the flame. This lamp, like many others, has not found favour with the public.

Still rising in the scale of importance, the next step in advance was the substitution of gas generated from coal, and, subsequently, from oils, resins, and other substances, for the gas hitherto supplied by the candle and oil lamp.

The gas supplied in a state fit for consumption, in burners of a variety of forms, was cleanly and economical, possessing great brilliancy, and was doubtless the most substantial improvement of modern times, as leading to a complete regeneration of our social system.

By the introduction of gas into our streets and shops, a wholesome revolution has been effected alike in the comfort of passengers and purchasers, and crime, if not actually lessened by it, has been brought within the more complete control of the agents of the law. Gas has passed through many phases of improvement before arriving at its present state of excellence, effecting as great a change in the lighting of our streets, as the substitution of the well-organized police for the ancient venal sexagenarian guardians of the night, which are now remembered only by the few.

If any evidence were wanting to confirm the necessity for still further advances in the production of an economical and powerful light, it would only be necessary to advert to the many attempts which have from time to time been made by enterprising men, at great cost of labour and money, with a view to achieve something as far surpassing gas as gas has already surpassed all its predecessors.

We are now brought to the introduction of the electric light, which, from its great intensity, was supposed (and with great probability on its side) to possess all the requisites for lighting purposes. Large sums have been expended in attempting to render it the "ne plus ultra" of lights. The trouble and uncertainty attending the use of the battery for generating the electricity, and the consequent effect upon the simple and vivid spark of light, render it (as stated by Stevenson), from its inconstancy, unfit for the general purposes of lighting. Of late, however, attempts have been made to get over these difficulties by discarding the use of the battery, and substituting for it a current of electricity derived from magnets, by which means the irregularities of the battery were obviated. A light on this principle is now under trial at the South Foreland Lighthouse.

The next in order, and that from which there is ground for hope, is the light produced by the combustion of oxygen and hydrogen, or carburetted hydrogen gas upon a surface of lime, a sample of which is exhibited this evening before

you. For many years, even as far back as 1820, attempts were made to obtain a safe and intense light by the ignition or combustion of a ball of lime, in the united flames of hydrogen and oxygen gases, and, as then employed for microscopic purposes, it was stated to be equal to about 264 flames of an ordinary Argand lamp (consuming the best spermaceti oil), each of which is equivalent to ten wax candles of four to the pound.* The late Lieut. Drummond, as far back as 1826, was so impressed with its value for purposes where powerful lights were required, that he made many important trials to establish it as a first-class light, and he was, to a certain extent, successful. He employed it on elevated positions, both in Scotland and Ireland, to mark the stations of the ordnance surveys, and succeeded in obtaining a decisive signal between Ireland and England, at a distance of 64 miles, and, in Scotland, from the summit of Ben Lomond to that of Knock Layd, a distance of 95 miles.† He proposed, subsequently to these successful attempts, to apply it for lighthouses, but from the imperfect state of the appliances at that time, it did not possess the requisite volume and continuity, and his proposition was not, therefore, entertained by the lighthouse authorities.

He used, on some of these occasions, oxygen gas and alcoholic vapour, but ultimately substituted hydrogen gas for the latter.

But even Drummond's comprehensive mind failed to overcome the chief obstacles to its introduction as a perfect lighthouse light, although many valuable experiments upon it were made and exhibited publicly by him, and he is therefore entitled to great credit for his persevering pursuit of the subject, and for having thus pioneered the way for subsequent efforts to perfect it. As Drummond left it, its want of volume was one of its main objections, and its want of continuity was fatal to its employment for the purposes of steady and permanent lighting.

The many failures attending the attempts to introduce the electric light, drew attention to and revived the lime light, and many applications of it were made for microscopic purposes. It is now employed for that and other objects in the scientific institutions of the metropolis, as well as the provinces.

For these minor purposes it was sufficient to obtain a steady light for an hour or so, and with extreme care and attention this was accomplished. The lime in these modifications of the light is generally cylindrical in form, and has both a vertical and a rotatory motion, causing the jet of flame which strikes the surface of the lime to describe on the surface of the cylinder a spiral course. Other applications of the lime, very similar in effect, are also in use, the object being to bring fresh portions of the lime continually before and in contact with the jet of flame.

But the extensive and important applications of the Lime Light, proposed by the Lime Light Company, entailed the necessity for providing for many consecutive hours duration of the light with unvarying intensity, and it was therefore imperative to devise a remedy for those defects which had hitherto prevented the successful adoption of the Lime Light; and they determined to avail themselves of Bastable's patented improvements, as fulfilling the required conditions, of which they had satisfied themselves by a course of numerous and rigorous tests.

Before describing these improvements it may be well to refer to the elements of a Lime Light, and the modes of producing them.

It was found by Drummond that many substances were capable of producing light in conjunction with gases, but that of all those which were available for the perfect combustion of the gases, chalk lime was the most suitable material for the purpose, and hence the name of the "Lime Light." It was also the cheapest and most easily attainable in any locality. It was likewise found that several gases, compounds of hydrogen, might be successfully employed in combination with oxygen gas, as well as pure hydrogen.

Pure hydrogen gas obtained from zinc and diluted sulphuric acid, offers facilities in cases where carburetted hydrogen, as supplied by the gas works, cannot be readily procured, but coal gas, where available, is a most desirable substitute for the ordinary applications of the light.

The product resulting from the generation of pure hydrogen gas from zinc and sulphuric acid, is sulphate of zinc, which, from the extensive demand for it, as a material used in the manufacture of paint, &c., will always find a ready sale at a price which will leave the cost of the gas in favourable contrast with other gases which may be used for the purpose.

In the year 1835, Mr. A. Gordon, C.E., patented a very ingenious and elegant process for generating hydrogen gas from zinc and sulphuric acid, which consisted in attaching the zinc to the rising portion of the gas-holder, so that when it was fully charged, the zinc (which had, during the generation of the gas, been immersed in the diluted acid, moving upward with it) emerged from the liquid, and consequently suspended the formation of gas, until by the consumption of the contained gas, the gasholder descended, by which the zinc became again immersed in the diluted acid, and the formation of gas was resumed. It therefore became a complete regulator of the generating process, and insured the utmost economy in the production of the gas. It is obvious that, by this arrangement, the average or continuous generation of gas will be precisely equal to the demand, and not intermittent, as the elements employed will be supplied only in the required quantities, but continuously.

Where it would be necessary to employ oil gas, in localities where coal gas is not available, a device similar to that which has been described for hydrogen has been successfully employed, the regulation for the supply of the oil to the retort being controlled by the ascent and descent of the gasholder.

The use of Leslie's coal gas liquid offers a simple means of procuring this gas cheaply, as it is stated that its cost will be much less than that of ordinary coal gas.

The generation of oxygen gas, which plays so important a part in the production of this light, is a process of extreme simplicity. It is obtained cheaply and easily from a variety of substances, each existing in great abundance, viz. :—Peroxide of Manganese (black oxide), Chlorate of Potassa, Nitrate of Potassa (familiarly known as salt-petre.) There are several other substances, the employment of which for this purpose is, however, precluded by their cost, as oxide of lead and red oxide of mercury; but it is not improbable that these, as well as the other substances mentioned, will yield a residuum, which may become an article of ready and remunerative sale, in which case the cost of the gas produced from them will be so reduced as to be merely nominal.

The Peroxide of Manganese requires simply to be placed in a retort and raised to a red heat, when the oxygen gas is freely disengaged. So soon as the gas ceases to be evolved from the Manganese (which can only be effected practically to the extent of about 11 per cent., although it contains at times 80 per cent.), the residuum, the deutoxide, or sesquioxide of manganese, may be drawn from the retort, and if thrown into water, or exposed at a high temperature to the action of the atmosphere, it will attract oxygen with great avidity, and thus this refuse becomes revivified, or resumes its former state of a peroxide, fitting it by this operation for a repetition of the distillatory process.

This peculiar property of the deutoxide of manganese (of rapidly absorbing oxygen from the surrounding air or other oxygenated bodies brought into contact with it), gives to this substance a great commercial value as a material for producing oxygen gas; for since the actual consumption of the manganese is thus limited by the quantity necessary to provide for the supply of gas during the time required for the revivification of the exhausted material,

* See Stevenson on Lighthouses, p. 65.

† Drummond on Light, Phil. Trans. for 1826, p. 324; and 1830, p. 383.

a comparatively small stock only will be needed to compensate for the unavoidable waste consequent on this mode of operating upon it.

In addition to this source of economy, the demand for the deutoxide of manganese for chemical purposes in glass-making, bleaching, and other processes in the arts, presents a means by which the residuum may be disposed of at a price which will leave the cost of the gas merely nominal. Thousands of tons are imported annually into this country, from the Continent, for the before-named purposes, and hence the disposal of the residuum is a matter of certainty.

The chlorate of potassa is a substance which, though costly at first, is nevertheless a valuable material for the production of oxygen gas, from the facility which it affords to the operator. Owing to the comparatively low temperature required for the disengagement of the gas, and the rapidity with which it is produced, it requires less attention and labour. Hence the cost of the gas is not so great as would at first sight appear, when contrasted with that from manganese. The residuum is chloride of potassium, or familiarly, muriate of potash, and is used in the arts.

A patent was taken out in this country in the year 1858, for "Improvements in Apparatus employed in the production of Light," by Mr. J. H. Bastable (a communication); and subsequently a patent for additional improvements was obtained in the year 1859 by Mr. Prosser.

The object of these patents is to remedy the defects of the former applications of the Lime Light. It has been invariably found, that although, for short periods, for microscopes, and similar comparatively minor applications of the light, the adopted methods of applying the lime were with great care sufficient for the purpose, yet for the general purposes of lighting, the means were totally inadequate to the object, as the lime, when exposed to the action of the heat produced by the combustion of the gases, or to the influence of the atmosphere, unavoidably became cracked or decrepitated, and in this ruptured state, having no support, fell away from the jet of flame, and either rendered the light inconstant or entirely useless; for the ignited gases, without the presence of the lime, possess no illuminating power whatever, though they are in that state most powerful agents for the destructive separation of refractory substances.

To effect the desired object of protecting the lime from crumbling away, and of insuring a practically unlimited supply, the simple expedient of enclosing the Lime in a case or guard, both above and below the point of ignition, was resorted to, exposing only such portion of its surface as was required for the action of the gases; and by giving to the Lime so enclosed a movement within the tube, the retention of the broken portions of the Lime was insured, until by simple means they were allowed to escape without detriment to the light, or were replaced by a fresh supply in as simple a manner as the cotton wick of an Argand lamp, thus effecting with the perfect continuity of the light for any reasonable period (a fortnight or more if necessary) of time, the maximum brilliancy of light.

So simple are the mechanical appliances for producing these results, that they fall as much within the compass of the ordinary attention bestowed on such objects as an ordinary lamp.

Thus, it results that lime, for any reasonable period, may be supplied to the lamp, producing a continuous and steady light so long as the gases and lime are supplied to it.

The two gases are kept under equal and uniform pressure in gas holders, which are connected with the lamp by pipes. The gases are kept separate until they have passed the regulating taps, and then they are mixed, and pass together, through wire gauze protectors (to prevent the regurgitation of the flame), into the jet tube, from the orifice of which they are projected together on to the surface of the lime, producing an intense light.

The carburetted hydrogen gas, where it cannot be obtained from a contiguous gas main, may be procured from oil or Leslie's gas liquid at a cheap rate, the process of generating it being one of extreme simplicity, as it does not involve the necessity for the extensive appliances of a gas works, which, though to a great extent unobjectionable for manufacturers of gas, are, nevertheless, unsuited for private purposes.

Oxygen gas has not hitherto been in demand for many objects, and very little attention has been given to its production at an easy and cheap rate, but there is little doubt that so soon as the demand renders it a matter of commercial value, means will be adopted for producing it at a moderate cost, if not as cheap as coal gas.

The lime is an article of such general use that it may be procured in almost any locality, and from the fact that it may be obtained at any chalk limekiln, and may be converted from the blocks into the required forms by the labour of boys at a low rate of wages, it is obvious that its cost is very trifling, especially when worked by suitable tools.

The five-jet light now exhibited to the members of the Society, embodies all the improvements which constitute a perfect light. The lime placed in and confined by a suitable case or guard is propelled by a simple mechanical movement past the jets of the combined gases, and as each jet is adjusted by separate taps, any desired amount of light within the maximum may be obtained; for although the light as now exhibited is one of considerable power, being equal to 400 fish-tail burners of coal gas, each consuming five cubic feet per hour, or to upwards of 2,000 wax candles of four to the pound, each jet may be so diminished by the regulating taps, that only one-tenth of that light may be employed if necessary.

The peculiar properties possessed by this light are many, viz.:—It is supplied with the oxygen required for combustion from an independent source, and does not therefore abstract oxygen from the surrounding atmosphere, and, consequently, does not render the air unfit for respiration. There is also no evolution of deleterious gases, so that enrichments, paintings, works of art, and delicate fabrics, are not in the slightest degree injured by it. The small amount of heat given off during combustion is so insignificant, that the hand may be held within two inches of the flame without inconvenience. These are remarkable properties, which are possessed by no other equivalent source of light, and they eminently fit it for every purpose where a powerful light is required.

In adapting the light to the purposes of lighthouses, beacons, fairway buoys, shipping, railway signals, the military and coastguard services, the great penetrating power of the light, which is one of its peculiar features, must not be lost sight of, as being invaluable in hazy or foggy weather, when the ability to discern signal lights, even at a small distance, is of incalculable advantage, when ordinary lights are utterly useless.

The advantage of a light which should combine with steadiness, continuity, and diffusiveness, purity, economy, and simplicity, as well as the capability of being managed with ordinary attention, has been universally acknowledged. Such features render it an object of national importance.

The power of the lamp is limited only by the quantity of gas and lime consumed; and while its power can be indefinitely increased, it is so completely under control that it can be regulated with the same facility as a common gas burner.

The continuity of the light is rendered certain by the protection given to the lime, and its economy is insured by the small quantity of gas and lime required for its consumption. Any number of jets may be combined to form one lamp, and thus any desired power given to it, with the most perfect combustion of the whole.

For a great many purposes to which such a light may be applied, is is expedient, for the sake of portability, to use the gases in a compressed form, as in a railway train signal, and for some military purposes.

For the latter service it may be applied for reconnaisances and night attacks, or for marching troops from one station to another during the night, as in India.

The cost of the light may be stated, in general terms, to be one-half the price of its equivalent gas light, all expenses being taken into consideration.

It has already during the last 18 months been used at various places, and is now being permanently exhibited on the south landing stage at Liverpool, and the members of the Society will, in the course of a few days, have an opportunity of witnessing its capability on the first half of the new Westminster-bridge.

The following is a Tabular Statement of the comparative value of light from various substances, compiled from data derived from a series of experiments made by Mr. E. V. Gardner, at the Royal Polytechnic Institution in Regent-street:—

Description of Material.	Particulars of Burners, &c.	Value in Wax Candles, 6 to the pound.	Consumption of Material per hour.	Units of Cost.	Cost per hour for Light of equal Intensity.
			ft.		*d.*
Lime Light, with coal gas	Jet $\frac{1}{16}$ in. diam.	758·	7·2 ox. 7·8 gas.	9	1·00
Lime Light, with hydrogen.....	,, ,,	1167·	6·53 ox. 12·4 hy.	10	1·11
Argand gas light	,, 15 holes	20·18	6·50 cub. ft.	17	1·88
Fish-tail ,, ,,	,, No. 1	0·7	2·41 ,,	18	2·00
Ditto ,, ,,	,, No. 4	6·66	5·00 ,,	40	4·44
Moderator oil ,,	,, 1 in. diam.	19·5	860 grains.	42	4·66
Argand ,, ,,	,, $\frac{15}{16}$ in. diam.	14·16	697 ,,	97	10·22
Bude ,,	,, $\frac{15}{16}$ in. diam.	151·25	4000 ,,	177	19·66
Wax candle ,,	6 to the pound.	1·	130·5 ,,	599	66·55

In the above Table the various substances used to produce the light, are seen in Col. 1. The respective intensities or values compared with a standard (a wax candle), in Col. 3. The consumption of the respective materials, per hour, in Col. 4. The units of cost, in Col. 5; and the actual cost per hour for lights of equal intensity, in Col. 6.

DISCUSSION.

Dr. Letheby said the most important point in the consideration of this subject was the commercial question as to the actual cost of the consumption of the gas which had been exhibited that evening, compared with that of the ordinary coal gas. They had been told that oxygen could be produced at a moderate cost. He thought very few persons acquainted with chemistry, and the mode of producing that gas, would be disposed to agree with the author of the paper in his statement. One mode of producing oxygen was by exposing the peroxyde of manganese to a high temperature, and it was stated that the revivification of the oxyde of manganese could be effected by subjecting it to the action of water, or by exposing it to the atmosphere. He confessed he should very much like to see the peroxide of manganese revivified in such a manner. He would say at once it was impossible. Another mode of producing oxygen was by the decomposition of chlorate of potash. That, he might say, was one of the best means of obtaining it. Now, what was the cost of oxygen produced from chlorate of potash? The chlorate was worth 1s. per lb. If it were brought into use in large quantities, it might perhaps be had at 10d. per lb. 1lb. of the chlorate of potash would produce 4½ cubic feet of oxygen gas. Thus it would take 220·6 lbs. to produce 1,000 cubic feet of the gas. 220 lbs. of chlorate of potash at 10d. per lb. would amount to £9 12s., which would be the cost of 1000 cubic feet of oxygen. Now, with regard to the relative cost of this gas as compared with coal gas. The latter was produced at a cost to the manufacturer of 1s. 6d. per 1,000 cubic feet, as compared with £9 12s. for the oxygen. That was so far as one of the gases only was concerned, allowing nothing for the hydrogen. If they compared the lime light with that of coal gas, and then considered the relative price of the two, then, at a cost of £9 12s. for oxygen, the light ought to be (foot for foot of gas) 128 times as great as that of coal gas; or, even taking the estimate of the patentee, of £3 15s. per 1,000 feet as the cost of the oxygen, the light should then be 50 times as great. Now, 5 feet of common gas per hour were on an average equal to 13 sperm candles, therefore 5 feet of oxygen ought to give the light of 650 candles (at the patentee's estimate), or 1,920 at his (Dr. Letheby's) estimate, whilst, in fact, it only gave the light of 895 candles, which was as 2 to 1 as regarded power and cost. He thought that, instead of this light costing only half the price of coal gas, it would cost, irrespective of other considerations, at least twice the price of coal gas. There was another point to be considered, namely, the leakage from the pipes by which the supply was conveyed. That would form a serious item, and would be in the ratio to the present loss from that cause of £9 12s. to 1s. 6d. The leakage of coal gas was a serious matter at the present time to gas manufacturers, but what would it be with gas at £9 12s. per thousand feet. Again, it must not be lost sight of that there was a vast difference between intensity of light and quantity of light. The same quantity of light given by jets of coal gas around the room would make a very agreeable light. In the present case they had an intense light, which few would like to have constantly before them. It would be likely, in his opinion, to bring on paralysis of the retina. The intensity of light was not what was wanted. The great art in modern lighting was the diffusion of light—quantity and not intensity. This light might answer where penetrating power was required, as in light-houses and signal stations, but for the ordinary illumination of a room it would be excessively dangerous to the sight. He could speak upon this point from personal experience. He found that, after experiments with the oxy-hydrogen light, as well as the electric light, he experienced a sort of paralysis of the retina, and he was sometimes obliged to give up work for a time. If this were to be the common light adopted, it would be most injurious. With regard to coal gas, they could reduce the light to that of a single jet, but with this light it was impossible; there was no means of letting it down to the power of two or three candles for a small room. They must have a light which almost blinded them, or no light at all. Looking at the matter from all points of view, he was struck, in the first place, with the erroneous statements in the paper as to the cost of the light, and, in the second place, as to the way in which it could be commonly used. As far as his own experience went, he believed the light would be a most expensive one, more expensive, probably, than even the electric light—in fact, the most expensive light that could be adopted; and, in the next place, he looked upon it as one of the most dangerous to the eyesight of those using it.

Dr. Bachoffner said, having had more experience with this light probably than any other man, having been engaged in the use of it daily for upwards of 20 years, he might be supposed to understand something about it. As far as the introduction of the lime light for the ordinary purposes of illumination was concerned, he believed it would fail. It was quite impossible that it could supersede any light at present in use for domestic purposes. But he could not entirely agree with the views of the last speaker. He thought he had greatly overrated the cost of the lime light. He did not consider the light exhibited that evening, even when burning at its maximum, to be satisfactory. He should be sorry to use such a light for the oxy-hydrogen microscope. The pressure employed was inadequate to produce the results which he required for his purposes. He never considered the light was a good one, unless it was accompanied by a good deal

of the whistling noise which they had heard at times that evening, and which was caused by the great pressure which he thought indispensable. That was with him the test of a good light. With a pressure of a head of water 13 inches, he obtained a light equal to 25·9 Argand burners, each consuming 6 feet of gas per hour; and he calculated the cost of the lime light produced by oxygen and coal gas, at 1s. 10½d. per hour, whilst the cost of coal gas to produce the same amount of light would be 8½d. per hour. If pure hydrogen gas were used instead of the coal gas, in union with the oxygen, the cost, he believed, would be about 3s. 3¼d. per hour. Speaking generally of the lime light, he considered it was too concentrated to be available for lighting streets, and the shadow it threw was too intense. Although he confessed his retina had not been affected in the way described by Dr. Letheby, he nevertheless thought it quite likely that persons unaccustomed to this light might experience the inconvenience to which Dr. Letheby had referred. As he had already stated, he did not agree with Dr. Letheby in his calculation of the cost of the oxygen gas, viz., £9 12s. per thousand feet. The chlorate of potash had been referred to as one material from which this gas could be produced. He had practised that system for a long time, and found that it was not only a very expensive mode, but was most detrimental to the brass fittings of his apparatus. He found the chlorate of potash very expensive. The cheapest mode of producing oxygen gas was from the peroxide of manganese, but with regard to its revivification, he should be glad if anyone would tell him how to restore it, for he had some tons of it which was useless to him. Then again, it was said that the hydrogen gas cost nothing, because the residuum consisted of sulphate of zinc, which was said to be a marketable commodity. All he had to say upon that was, that he had seen hundreds of tons of that material thrown away, as people would not be at the trouble of fetching it, and he believed it was impossible to give a marketable value to the exhausted peroxyde of manganese. He should be glad to see any description of light which should supersede the present system, but until that was done they must be content with gas with all its inconveniences.

Mr. C. H. Smith wished, before the discussion proceeded further, to say one word upon the subject of cost, not merely with regard to this light, but generally. When there was a great demand for any article, it usually became reduced in value. To take the instance of needles. If they were to ask a person to make a needle who had never made one before, he would probably consider himself ill-paid if he received a guinea for it, yet they knew how cheap needles were. So it was with reference to the cost of producing oxygen and hydrogen gases. There was no substance in the world so abundant as oxygen—it formed one of the constituents of water. He thought it was not impossible that they would find out how to manufacture it in various ways, at a much cheaper rate than from the black oxide of manganese. He thought, therefore, no invention should be thought lightly of merely because it was expensive at first.

Mr. Varley remarked that many varieties of artificial light had been tried by this Society, but he considered the plan by which the room was now lighted, that of rings of gas jets, was the best that had ever been introduced. There could be no question as to the extreme purity of the lime light, but what they wanted was quantity of light without intensity.

Mr. G. F. Wilson, F.R.S., said he thought both Mr. Stone and the author of the paper were reasoning on a fallacy when they assumed that "oxygen gas had not hitherto been in demand for many objects." He thought all chemists present would agree with him that there were an infinity of chemical manufactures in which cheap oxygen was at present a great desideratum.

Mr. Dennis thought that this light was more adapted to lighthouses and the purposes of signalling. It certainly would never do for lighting the streets. He had seen the lime light exhibited in King William-street, and he was quite impressed with its unsuitableness for that purpose.

Mr. Calvert said he saw nothing new in the plan now brought forward, beyond the principle of the old oxy-hydrogen blowpipe. The lime light had been known for many years. He regarded this as an old thing brought forward in a new shape. He hoped before long to see a light which should supersede gas and all other artificial lights yet introduced; but he felt confident that this would not be done by this light in its present form. With regard to the manufacture of oxygen gas from the peroxyde of manganese, he might say that millions of tons of that material were to be procured in Cornwall; but when they had got it, the manufacture of oxygen gas was most expensive. He would suggest that the company by whom the lime light was promoted should try to give them a good practicable light from one gas only, and he would recommend them to look to the purer gas hydrogen, and to the obtaining this by the decomposition of water by more simple means than had been yet arrived at. He thought that they could thus not only obtain light, but heat to any extent. He did not think it unlikely that before long they would see people using, in their fire-places, a can of water instead of a scuttle of coals.

Mr. William Hawes thought justice had not been done to the gentleman who had brought this subject before them. First of all, they had one scientific gentleman who told them that, because at the present time, the materials used for the production of the light were expensive, therefore the light itself must be condemned, and never could be made useful. If this same argument had been applied years ago to coal gas, the prophecy would have been about as true as that now put forward was likely to prove, for it was in the recollection of many, that coal gas was formerly as costly, as compared with candles, as this light was now stated to be, as compared with coal gas at the present time. He would not go into the argument as to the side on which the truth lay, as between the two scien tific gentlemen who had spoken and the inventor of this light, because the two scientific gentlemen differed so much from each other, both as to the cost, and as to its injurious effects on the eye. They were as far from each other in their calculation of the cost, as either of them was from the author of the paper. Then it was said by another gentleman that this was not a new thing. Were not almost all the great discoveries old things reproduced, when accumulated labour, science, and experience had been superadded to render them practically available. Was not that the case with the steam-engine and the Jacquard loom? Were not those the results of the adaptation of old things brought to perfection by the additions which experience had shown to be required? Was this invention to be discarded because other people had been unsuccessful in the use of the materials employed? Was it to be discarded because oxygen gas was dear now, when it was known that the materials for its manufacture were to be obtained at a low price? Let them rather encourage those who brought this light before them, and urge them to press on to the discovery of further improvements, so that in the course of time the light might be as cheap as it was brilliant. They were told that this lime light only consumed 36 feet of the two gases in two hours, whilst the gas with which that room was ordinarily lighted was consumed at the rate of 3,000 feet in the same time. He could not but admit that the light in its present state was not applicable to many of the ordinary purposes, but the tendency of illumination in the present day was to concentrate light in one spot, as was manifested by the increasing use of the "sun-light," which was placed at sufficient height to distribute the light over a large space below; and if the light exhibited that evening had been placed at the top of the room and diffused by proper media, he could not conceive a more perfect light.

Mr. Pearsall remarked that he had seen this light be-

fore, and he was struck with the discrepancies of opinion which existed upon the subject of its cost. He was therefore glad that the matter had been fairly brought under discussion. He quite agreed with the opinions expressed as to the impracticability of revivifying the oxyde of manganese, but he differed from those who thought oxygen gas could not be obtained cheaply if there was a commercial demand for it. Water contained both oxygen and hydrogen, and all they had to do was to decompose that. As to the sources from whence oxygen gas could be derived, it existed in large quantities in nitrate of soda, and by the action of heat in a retort, oxygen would be produced, the residuum (nitrate of soda) being a marketable commodity, which the soap and alkali makers would use in large quantities. Here they had a concentrated light, of great power and brilliancy, and he would ask whether this light could be exposed to the winds and the waters without any covering? because, if that were the case, for light-houses and ships at sea it would be invaluable. He had been informed that the Company had stated that the light was exposed on board the *Great Eastern* during a tremendous storm of wind and heavy rain, and seemed to be unaffected, although completely unprotected.

Mr. Lambert said, that about four years ago some facts came to his knowledge with reference to the manufacture of oxygen gas which he believed had not been made public. He was formerly acquainted with a German chemist, Mr. G. Michiels, who erected works costing some thousands of pounds, for obtaining oxygen from atmospheric air. He constructed an apparatus for passing the atmospheric air, at a moderately high temperature, over hydrate of baryta, which absorbed the oxygen and allowed the nitrogen to pass off. He had a means of ascertaining when the baryta had absorbed all the oxygen it could, and at this stage the temperature was raised still further, and oxygen gas was evolved, and carried into a gasholder. He was able to fill a gasholder one-sixth the size of that room entirely with oxygen gas. It, however, unfortunately happened, that the gentleman to whom he alluded met with his death through an accident in his laboratory, in consequence of which the apparatus was taken down and the experiments ended, but that gentleman assured him that oxygen gas so obtained could be supplied commercially at about the same price as common gas.

Mr. W. E. Newton could not refrain from expressing his astonishment at hearing, amongst a body of scientific men, that anything was impossible in science. There were many things which people thought impossible now which they would find very possible in a short time. They had heard the different processes referred to by which oxygen gas could be produced at a considerably less price than £9 12s. per thousand cubic feet. He thought Dr. Letheby must have argued from his laboratory operations on a small scale, rather than from looking at the matter in a commercial point of view. With regard to the production of oxygen and hydrogen gases from water, it might not be generally known that there had been several schemes patented for obtaining carburetted hydrogen gas from the decomposition of water. The most complete plan for effecting this was one patented by a Mr. White, but he believed it had not been entirely successful. It was found that when hydrogen gas was made from water, and impregnated with carbon by passing it over some hydrocarbon, as it traversed the pipes used for its transmission, the carbon was deposited, and the gas again became pure hydrogen, which would only give a pale blue-light. He had listened to the paper with attention, but he had failed to discover anything new in this plan of lighting. The oxy-hydrogen light had been known since the days of Sir Humphry Davy. It had been in daily use at the Colosseum for years past. He gathered that the only novelty which was claimed in the present case was a contrivance for preventing the decrepitation of the cylinder of lime. He knew that that was a serious matter, for it sometimes happened in the middle of an experiment that a lump of the lime gave way, and the light went out. If the inventor had hit upon a plan whereby he prevented the lime from cracking away, that was an important step in advance. With that exception, he was unable to see what merit was claimed.

Dr. Squire said the cheapest method of producing oxygen gas with which he was acquainted was that described by Mr. Lambert, which consisted in passing air over hydrate of baryta, which then became an oxyde of barium, from which the oxygen could easily be obtained. For the manufacture of hydrogen gas the best method was to pass steam over ignited iron, by which they avoided the formation of sulphate of zinc (as in the ordinary process), which was said to be an unsaleable commodity; and they also got rid of the great expense of the zinc and sulphuric acid. Even if they could reduce the cost of this light to the present cost of coal gas, the question arose whether it would be applicable for lighting the streets. He did not think it would, inasmuch as light decreased as the square of the distance from its source. It was, therefore, evident that in long lines of streets, it was better not to concentrate the lights at one or two points. The only purposes to which he imagined this light was applicable were for lighthouses and rooms in large buildings. Then it became a question whether it would pay to erect a special manufactory of oxyen and hydrogen gases at each lighthouse and public building, for, unless the light was brought into general use for the streets, it would not pay the cost of transmitting the gases through an extended system of pipes.

Mr. Newton added that the plan of Mr. White for obtaining hydrogen gas by the decomposition of water, was to pass the vapour of water over heated iron, which took up the oxygen, and the hydrogen came away.

Mr. Hawes remarked, in reply to the observations of Dr. Squire, that one merit of this light appeared to him to consist in the small consumption of the gases and their portability. A sufficient supply for a service at a church could be conveyed in bags the size of those used for the exhibition of the light that evening.

Mr. McLachlan inquired whether, in the present plan, any additional means of safety were provided as compared with the ordinary oxy-hydrogen light? The communication between the two bags containing the gases was not entirely cut off, and there was a strong tendency for the gases to mingle one with the other. He had known a case in which, owing to a want of proper care with the bags, a serious explosion occurred.

Dr. Bachoffner replied that, wherever oxygen and hydrogen gases were employed, an explosion was possible, though, with proper care, there was no need for fear. The gases might be employed with absolute safety provided there was sufficient length of pipe between the reservoirs and the point of combustion.

Mr. Strode said, it would have been satisfactory to him to have heard some further explanation of the modes by which it was proposed to produce the oxygen gas, as well as with regard to the special arrangements of the lighting apparatus adopted in the present instance. It was important to ascertain the purposes to which this light was applicable, and those to which it was not applicable. He conceived that if the light could be produced at a reasonable cost, it was well adapted for lighthouses and railway signals, inasmuch as it afforded a concentrated and powerful light to be dealt with by reflectors. Although such a light would be invaluable for such purposes, still it would be useless for private rooms, even very large rooms, if reflectors were to to be used. At the same time, it did not follow that it could not be used in large rooms, such as that of the Society of Arts, the light being regulated through proper media. Then there remained the grand question, could it be done at a cost which would render it a practically useful light? That was a point which he was not able to answer, but from what he had heard of the manufacture of oxygen gas, he apprehended there had been an exaggeration as to the amount of that gas which

could be obtained from the peroxide of manganese. In his opinion, Dr. Bachoffner's calculations as to the cost of that gas were nearest the fact. In street lighting he thought this plan would be useless. The trials with the Bude and electric lights were sufficient to show that large central lights did not meet the requirements of the case. They produced an immense glare of light at one point, which made the gloom beyond look the deeper. In street lighting, the size of the light must be diminished, and the number of lights increased.

The Chairman, in closing the discussion, said notwithstanding the differences of opinion which had been expressed as to the merits of the plan which had been brought before them that evening, he was sure the meeting would do that to which the author of the paper was fairly entitled,—viz., accord him their thanks for having brought before them a subject of considerable interest, and which had afforded them, as he believed, a not unprofitable discussion. He agreed with Mr. Hawes, that they had an illustration that evening of a topic which was presented to them a few weeks ago, as to the difference of opinion which existed amongst scientific men. To an unlearned mind it would seem that there could be few discrepancies greater than those which existed between Dr. Letheby and Dr. Bachhoffner as to the cost of producing oxygen gas. Having regard to what was obviously imperfect knowledge, they would come to a conclusion, which was not warranted by the information they now possessed, if they said that this invention could not be applied to any useful practical purpose. Possibly it might not become universally applicable, but it was conceded that, for certain limited objects, it might be an extremely valuable application of light. In those cases where intensity of light was aimed at, it accomplished that object in a very successful manner; and with regard to the purity of the light, they had seen that it was complete and perfect, and the difficulty which formerly existed in respect of the continuity of the light had now been got over. That appeared to be the principal merit claimed by the author of the paper for the invention described. He would now only ask them to convey their thanks to the author of the paper. He was sorry Mr. Baxter was not able to be present to give them any further information they might require; but he was sure in his absence they would accord him their thanks.

The vote of thanks was then passed.

The paper was illustrated by a five-jet Lime Light, on the new principle, by which the room was lighted during the greater portion of the evening.

The Secretary announced that on Wednesday evening next, the 29th inst, a paper "On Stones for Building Purposes, the Causes of, and the Means of Preventing, their Decay," by Mr. George R. Burnell, would be read. The chair will be taken at eight o'clock.

Mr. Lambert, in a letter to the Secretary, written since the meeting, says:—"I had not intended to take part in the discussion, or I should have collected from my friend's papers, which are in my possession, some startling facts in reference to his oxygen apparatus. When I inform you that he charged his retort with 26 cwt. of this baryta, it will give you some idea of the magnitude of his operations. He was one of those men who work silently; he said, 'When I am in a position to prove the commercial value of the invention, then will I make it known.' That to himself he had proved this, I am certain; but his large secretiveness and the suddenness of his death have deprived the scientific world of a mass of information upon this and other subjects, the loss of which is much to be regretted."

ON THE VARIABLE COMPOSITION OF THAMES WATER.

By Wm. Odling, M.B., F.R.S., & Auguste Dupre, Ph.D.

The following is an abstract of a paper read before the British Association at Aberdeen:—

The first table illustrates the differences in general character of high and low water at Greenwich during different periods of the year 1857. The figures represent the number of grains of solid matter contained in imperial gallons of the water:—

		Suspended. Organic.	Suspended. Mineral.	Suspended. Total.		Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.		Total.
March to May, 1857	High	1·28	4·13	5·41	.....	15·00	102·03	117·03	.....	122·44
	Low	1·62	7·12	8·74	.....	5·41	22·30	27·71	.....	36·45
June to September, 1857	High	0·86	1·57	2·43	.....	21·30	268·48	289·78	.....	292·21
	Low	1·21	3·36	4·57	.....	5·67	52·53	58·20	.....	62·77
October to December, 1857	High	0·47	2·46	2·93	.....	7·71	121·83	129·54	.....	132·47
	Low	1·15	2·96	4·11	.....	3·28	27·17	30·45	.....	34·56
Average of year 1857	High	0·91	2·68	3·59	.....	15·37	172·26	187·63	.....	191·22
	Low	1·31	4·35	5·66	.....	4·82	35·32	40·14	.....	45·80

The amount of dissolved matter, organic and mineral, is greater in high water than in low water, in consequence of the contamination of the high water with sea-water; and greater in summer than in spring and winter, in consequence of the greater contamination with sea-water in that season, dependent upon the diminished volume of the fresh stream water.

The second table exhibits the results of ten similar weekly experiments upon high and low water, taken further up the river, at Lambeth Palace, during the period July 15 to September 15 of the following year, 1858:—

		Suspended. Organic.	Suspended. Mineral.	Suspended. Total.		Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.		Total.
Lambeth	High	0·75	2·17	2·92	.....	9·93	129·50	139·43	.....	142·35
	Low	1·47	10·37	11·84	.....	1·95	21·37	23·32	.....	35·16

Here also, as at Greenwich, the difference in the amount of dissolved organic and mineral matter contained in high and low water is very striking.

It is interesting to compare the results obtained at Greenwich and Lambeth.

The average amount of residue in high water at Lambeth between July 15 and Sept. 15, 1858, was found to be about half as much as the average residue yielded by the high water at Greenwich during the corresponding period from June 1 to Sept. 29, 1857. Thus:—

	Suspended. Organic.	Suspended. Mineral.	Suspended. Total.		Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.		Total.
Lambeth	0·75	2·17	2·92	.....	9·93	129·50	139·43	.....	142·35
Greenwich	0·86	1·57	2·43	.....	21·30	268·48	289·78	.....	292·21

Similarly with regard to the low water, thus:—

Lambeth	1·47	10·37	11·84	.....	1·95	21·37	23·32	.....	35·16
Greenwich	1·21	3·36	4·57	.....	5·67	52·53	58·20	.....	62·77

The average amount of residue in high water at Lambeth, between July 15 and September 15, 1858, was found to be rather more than the average residue of the high water at Greenwich during the spring and winter periods of 1857—March 9 to May 25, and Oct. 5 to Dec. 23 respectively, thus:—

	Suspended.				Dissolved.				Total.
	Organic.	Mineral.	Total.		Organic.	Mineral.	Total.		
Lambeth, summer	0·75	2·17	2·92	.....	9·93	129·50	139·43	.....	142·35
Greenwich, spring	1·28	4·13	5·41	.....	15·00?	102·03	117·03	.....	122·44
Greenwich, winter	0·47	2·46	2·93	.....	7·71	121·83	129·54	.....	132·47

Similarly with regard to low water, thus:—

	Suspended.				Dissolved.				Total.
	Organic.	Mineral.	Total.		Organic.	Mineral.	Total.		
Lambeth, summer	1·47	10·37	11·84	.....	1·95	21·37	23·32	.....	35·16
Greenwich, spring	1·62	7·12	8·74	.....	5·41?	22·30	27·71	.....	36·45
Greenwich, winter	1·15	2·96	4·11	.....	3·28	27·17	30·45	.....	34·56

Taking the average of any period, the amount of suspended matter is nearly twice as great at low as at high water, thus:—

		Suspended. Organic.	Mineral.	Total.
Greenwich, March to May	High	1·28	4·13	5·41
	Low	1·62	7·12	8·74
Greenwich, June to September	High	0·86	1·57	2·43
	Low	1·21	3·36	4·57
Greenwich, Oct. to December	High	0·47	2·46	2·93
	Low	1·15	2·96	4·11
Lambeth, July to September	High	0·75	2·17	2·92
	Low	1·47	10·37	11·84

The average amount of suspended matter at Lambeth ..... { 2·92, 11·84 } 7·38

is higher than at Greenwich { 3·59, 5·66 } 4·62

As a rule, the per centage of organic matter in the total suspended matter is greater at high than at low water:—

	Per Centage of Organic Matter in Total Suspended Matter.		
Greenwich, March to May	High	23·66	Mean, 25·04
	Low	18·53	
Greenwich, June to September	High	35·39	24·32
	Low	26·45	
Greenwich, Oct. to December	High	16·07	
	Low	27·98	
Lambeth, July to September	High	25·68	
	Low	12·41	

At high water the per-centage of organic matter in the total suspended matter, in corresponding periods, is less at Lambeth than at Greenwich, and at low water only half as much; or, in other words, the muddiness of the river at Lambeth, more particularly at low water, is due chiefly to silt and mineral *débris*.

In the winter and early spring, when the quantity of stream-water is great, the presence of sea-water scarcely makes itself felt in the high water, even at Greenwich; or, in other words, there is very little difference in the saline matter of low and high water; but in dry weather this difference becomes more and more marked, and is noticeable higher and higher up the river.

		Dissolved Matter. Organic.	Mineral.	Total.
April 7, 1857—Greenwich	High	8·32?	30·32	38·64
	Low	5·05?	17·54	22·59
April 20, 1857	High	7·18?	31·34	38·52
	Low	6·52?	16·53	23·05
Nov. 30, 1857	High	6·50	58·43	64·93
	Low	3·18	27·04	30·22
Feb. 12, 1858	High	4·48	37·78	42·26
	Low	2·56	22·22	24·78
March 10, 1858	High	4·13	51·91	56·04
	Low	2·32	22·91	25·23

These are the lowest amounts of dissolved matter we have found in the low water at Greenwich, except upon two occasions after severe rain.

The largest amounts of dissolved matter at Greenwich, and consequently the greatest differences between high and low water, are tabulated below:—

		Organic.	Mineral.	Total.
July 13, 1857—Greenwich	High	23·63	319·82	343·45
	Low	8·49	52·18	60·67
July 20, 1857	High	27·53	339·47	367·00
	Low	4·81	52·46	57·27
July 27, 1857	High	35·85	421·96	457·81
	Low	5·78	85·70	91·48
Aug. 3, 1857	High	22·22	336·76	358·98
	Low	6·07	82·99	89·06
Aug. 10, 1857	High	32·64	437·17	469·81
	Low	6·41	82·09	88·50
Oct. 5, 1857	High	12·24	481·66	493·90
	Low	4·48	68·29	72·77
Aug. 29, 1858	High	34·03	518·24	552·27
	Low	7·11	102·83	109·94
Sept. 5, 1858	High	25·61	561·88	587·49
	Low	6·12	107·55	113·67

The experiments made at Lambeth have been comparatively few. When the fresh water had already begun to diminish considerably in early summer, we had the following results:—

		Dissolved. Organic.	Mineral.	Total.
July 16, 1858	High	9·28	38·96	48·24
	Low	1·93	21·58	23·51

And at the end of the summer the following:—

Sept. 8, 1858	High	18·21	246·58	264·79
	Low	1·87	24·75	26·62

It is observable that while the amount of saline matter in the high water varied between July 16 and Sept. 15 from 38·96 grains to 246·58 grains per gallon, the amount in the low water varied only from 17·38 grains (the minimum) on July 22, to 26·85 grains (the maximum) on Sept. 15; while out of the ten examinations, in only one—namely, the last—did the amount of dissolved

matter vary more than three grains from the average 21·37.

Early in the present year the existence of sea-water in the river was very perceptible; so much so, that even at Wandsworth a difference between high and low water was observed comparable to that which existed at Greenwich during the winter months. On April 20, 1859, specimens of high and low water were taken at Wandsworth, Battersea Bridge, Lambeth Palace, London Bridge, and Greenwich respectively. In going down the river the amount of dissolved matter in the water and the difference between high and low water underwent marked increase, thus:—

	Organic. Low.	Organic. High.	Mineral. Low.	Mineral. High.
Wandsworth	1·60	2·18	18·82	28·74
Battersea Bridge	1·71	2·37	19·42	40·67
Lambeth Palace	1·44	5·96	19·85	57·76
London Bridge	2·62	7·26	20·91	134·22
Greenwich	3·66	23·19	30·86	313·76

At low water at Lambeth the amount of dissolved matter, mineral and organic, and the total amount of residue, are greater at the sides than at the middle; or the pure stream-water cuts for itself a central passage through the foul stagnant water at the sides. The table gives the mean of three consecutive weekly examinations:—

	Suspended. Organic.	Suspended. Mineral.	Suspended. Total.	Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.	Total.
Surrey side	1·75	8·67	10·42	4·72	54·99	59·71	70·13
Middlesex side	2·21	7·71	9·92	5·57	54·89	60·46	70·38
Mean of the two	1·98	8·19	10·17	5·14	54·94	60·08	70·25
Mid-stream	3·47	5·81	9.28	3·19	40·90	44·09	53·37

The amount of suspended organic matter is greater in the middle than at the sides, while the reverse is the case with the suspended mineral matter.

The same action, though in a much less marked degree, takes place at high water. The upcast flow, largely contaminated with sea-water, forces for itself a central passage through the stagnant sides of the river. The amount of dissolved mineral matter and the total amount of residue are greater at the middle than the sides. Here also the table shows the mean results of three consecutive weekly experiments:—

	Suspended. Organic.	Suspended. Mineral.	Suspended. Total.	Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.	Total.
Surrey side	1·28	12·85	14·13	10·95	125·14	136·09	150·22
Middlesex side	1·56	19·90	21·46	11·72	135·48	147·20	168·66
Mean of the two	1·42	16·37	17·79	11·33	130·31	141·64	159·43
Mid-stream	0·31	6·58	6·89	11·49	157·41	168·90	175·79

It is observable that the amount of suspended matter, both organic and mineral, is greater at the sides than at the middle.

In comparing the down stream at about two hours before low water, it was found that the amount of dissolved matter increased from Chelsea to London Bridge and thence to Greenwich. Thus we have, as the means of several experiments:—

	Suspended. Organic.	Suspended. Mineral.	Suspended. Total.	Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.	Total.
Chelsea	3·76	23·49	27·25	3·85	23·87	27·72	54·97
London Bridge	2·63	15·45	18·08	2·29	31·59	33·88	51·96
Greenwich	1·39	8·37	9·76	6·09	66·32	72·41	82·17

The increase in the quantity of dissolved constituents at London Bridge above that at Chelsea does not depend upon the influx of sewerage poured into the river between those two points—for the effect of the sewerage poured into the Thames during any one hour must be quite inappreciable—but to the increasing admixture of the pure stream-water with the stagnant river-water of the previous up tide.

In the early part of the year, when the body of stream-water is large, this admixture is in great measure prevented, and we then notice no appreciable difference in the amount of dissolved matter at Chelsea and London-bridge, despite the influx of sewerage:—

	Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.
May 19—Chelsea	1·57	18·07	19·64
London Bridge	1·56	19·51	21·07
May 26—Chelsea	2·16	17·91	20·07
London Bridge	1·82	17·71	19·53

Another point of interest is the difference in composition between the surface water and the deep water. During the flow the sea-water runs up underneath the river-water, and, although complete mixture of the two layers eventually takes place, yet a difference between the top and bottom may occasionally be recognised as high up as the Commercial Docks and Thames Tunnel:—

Commercial Dock.	Sp. Gr.	Suspended. Organic.	Suspended. Mineral.	Suspended. Total.	Dissolved. Organic.	Dissolved. Mineral.	Dissolved. Total.	Total.
Surface	1001·76	0·00	0·95	0·95	4·40	146·26	150·66	151·61
Bottom	1002·00	0·00	8·54	8·54	6·85	167·77	174·62	183·16
Tunnel.								
Surface	1001·42	0·00	0·96	0·96	6·43	105·81	112·24	113·20
Bottom	1001·58	1·70	20·81	22·51	5·65	119·21	124·86	147·37

The effect produced on the character of Thames water by a heavy rain-fall is shown most strikingly in the following results, obtained with Thames water at Greenwich in 1857:—

	High Water. Soluble Matter. Organic.	High Water. Soluble Matter. Mineral.	Low Water. Soluble Matter. Organic.	Low Water. Soluble Matter. Mineral.
Oct. 13, 1857	10·18	113·64	2·03	23·08
Oct. 22, 1857	16·20	218·58	2·96	32·91
Oct. 27, 1857	3·20	18·84	5·01	14·01
Nov. 4, 1857	9·95	104·21	2·77	23·28
Nov. 10, 1857	3·16	26·29	3·28	20·24

On Oct. 22 and Nov. 4 there were spring tides, which always increase the amount of dissolved matter in the river by the greater influx of sea-water.

The total rainfall between Oct. 7 and Oct. 22 amounted to less than half-an-inch. In the week preceding Oct. 22 the rainfall was 0.19; but on October 22 there occurred an enormous rain-fall, amounting to 2·57 inches, or one-tenth part of the average annual rainfall. Mr. Glaisher calculated that on that day 20,000,000 tons, or 84,000,000 hogsheads, of water fell on the London districts.

On Oct. 27, after the lapse of four days and a half, we found that the amount of saline matter per gallon in the low water of the river at Greenwich had been decreased to one-half the previous quantity, in consequence of the great dilution effected by the rain-fall; but, despite this enormous dilution, the amount of organic matter per gallon had been nearly doubled, probably from the complete scouring of the sewers, inasmuch as the increase of organic matter was not evidenced in water taken high up in the river. The river was thus rendered so full of fresh water, and the sea-water was so thoroughly driven away, that the amount of saline matter in Greenwich high water decreased from 218·5 to 18·8 grains per gallon. On Nov. 4, there was a rainfall of half-an-inch, which again decreased the amount of saline matter in both high and low-water. The full effect of a heavy rainfall upon the river is frequently not attained until one or two days afterwards.

FALSE LABELS.

At the last annual meeting of the members of the Huddersfield Chamber of Commerce, Mr. T. Mallinson, president, in the chair, Mr. Charles Brook, jun., of Meltham Mills, introduced the subject of the practice of falsely marking or labelling goods for sale, and in a long address showed the general prevalence of the practice of falsely marking the lengths of cotton cloth, cotton thread, ribbons, and other articles. He then detailed the steps he had taken for the formation of an association for the suppression of such practices, and described the opposition he had met with from merchants and others in Manchester and London. Notwithstanding this opposition, however, the association had been formed. Counsel's opinion had been taken, and it was to the effect that where manufacturers sold short lengths to gratify a merchant, the two thus combining constituted a conspiracy for which they might be indicted and punished. He concluded by calling upon the Chamber of Commerce to aid in the objects of the association. Mr. W. Williams then moved—"That in the opinion of this meeting the practice of marking goods with false trade marks and labels is a serious evil, and calls for the strongest condemnation; and this Chamber cordially sympathises with the objects of the association which has been formed for suppressing such practices." Mr. J. Batley, sen., seconded the resolution, which was passed unanimously. It was also resolved that a copy of the foregoing resolution should be forwarded to the Manchester Chamber of Commerce.

Home Correspondence.

SHANGHAI SHEEP.

Sir,—In the valuable paper read before the Society by Mr. Wray, on the 8th inst., particular attention is drawn by the author to the Shanghai sheep.

Thinking that you might like to place before your readers the opinions of Messrs. Waud and Foster, of Bradford, who, at the request of the Chamber of Commerce of that town, undertook to test the merits of the wool obtained from the sheep at the Zoological Gardens, I have done myself the pleasure of enclosing their reports, as given in one of the local journals, which was forwarded to me, with specimens of the fabrics manufactured from the wools, by Mr. Darlington, the Secretary of the Chamber.

Should you wish it, I shall be happy to send you the fabrics for the inspection of those who may be desirous of examining them.

I would beg to take this opportunity of stating, as I am sure my friend Mr. Bartlett would wish I should, that it was at my suggestion that the existence of these sheep and samples of their wool were first brought to the notice of those interested in our woollen industries, in anticipation that, if this wool proved of value, the breed would be of great importance to them.

I am, &c.

DAVID S. PRICE.

Industrial Museum, Crystal Palace.

Reports Referred to:—

THE SHANGHAI SHEEP WOOL.

It will be remembered that, some time ago, the fleece of a Shanghai sheep was received from the Zoological Gardens, London, in order that the wool might be examined and tested as to its purity by the Chamber.

On that occasion Mr. Alderman Waud took charge of the fleece, and offered to have the wool combed, and at this meeting he presented the wool before the Council in the top and in the noil. He said he was prepared to present his report as to the wool. Both the President and himself were not at first favourably inclined with respect to it; but having tested the quality of the wool he was now of opinion that great advantages might flow from their having a supply of such wool. He had found that it was of tolerably fair length, and had an amount of breadth which, from the appearance of the wool, they could hardly have expected. He felt perfectly satisfied that, though it did not participate in the nature of alpaca, this wool came the nearest it to anything he he had seen in point of lustre. It had great lustre, and it was soft. There was a great deal of kemp about it. He thought this wool might become a useful substitute for bright-haired or lustre wool. It was not satisfactory in working, for it had rather what was termed a cotty tendency in the process of washing. The amount of top was not considerable. He had received 2¼ lbs. from the fleece. He found that the top produced from it was 12¾ oz.; the noil 15¾ oz.; and the shorts 2½ oz. So that the waste amounted to 5 oz. He understood there were three flocks of these Shanghai sheep in this country. They dropped three times a year, and some of them had dropped in one year as many as thirteen lambs. If the wool could be produced at a reasonable rate, he thought it would be a great boon to the manufacturing interest. Now, he proposed to carry the experiment a little further. He would see how far it was capable of being applied to manufacturing purposes.

Mr. W. Foster said that he differed from Mr. Alderman Waud in regarding the wool of a quality approaching to alpaca; but they would be better able to form an opinion if he would produce some cloth from it.

Mr. Alderman Waud said that he should be glad to carry the process further by producing from it some finished cloth. He added that what the value of the noils would be, he could not say, seeing that above one-half of the whole bulk was noils.

The Mayor suggested that the wool might be produced in the cloth at the annual meeting, on the third Monday in January.

Mr. Alderman Waud, in answer to an inquiry, said that the noils would be of value in the production of blankets.

The Council then proceeded to examine another fleece from a Shanghai lamb, also sent from the Zoological Gardens, and Mr. Foster consented to take this fleece in order to subject it to a similar test.

New Sort of Wool.

A short time ago, a fleece of a lamb, a cross between a Shanghai ram and a Southdown sheep, was received by the Secretary from the London Zoological Society, in order to the Chamber ascertaining the capabilities of the wool for manufacturing purposes. Mr. Wm. Foster, of Queenshead, took charge of the fleece, and now made a report as to the result of his experiment, in order to ascertain the capabilities of the wool. He read a report, of which the following is the substance:—

Sorting.—Total weight of fleece, 3 lbs. 3½ oz. This produced 6¼ oz. of shorts, very kempy, and only suitable for low clothing purposes; also 14 oz. low combing, and 1 lb. 15 oz. fine ditto—staple four to five inches long, quite as free to open as any English wool, but kempy, part of the kemps being grey. The low combing, besides the breach, included what had grown at the loins, and a skirting from the belly, which parts were more kempy than the rest of the fleece.

Combing.—10 oz. low top, quite unfit for worsted purposes; 2 oz. noils; 2 oz. dead waste; total, 14 oz. low combing, 1lb. 4½ oz., fine tops of a good quality, but not quite clear from kemps. The handle soft, kind, and silky—more so than English wool of the same fineness, 6 oz. noils, containing many grey and white kemps, not worth so much by 2d. per lb. as low

English noils; 4¾ oz. dead waste; total, 1 lb. 15 oz. fine combing.

Spinning.—Low top not spun. This could only be used for moreen weft, or in the make of similar goods. Sample laid on the table of 36's weft spun from the fine top, making a full and soft yarn, quite calculated to spin to 40's or 44's if required, with very little waste.

Weaving.—Pattern laid on the table of plain black Orleans, 18 picks per quarter inch of 36's weft from fine top, making a full handled cloth, and superior to an ordinary English yarn Orleans in this respect, as well as lustre. The kemps were an objection, for if not carefully dyed they showed a lighter colour. Pattern of Cobourg laid on the table, 19 picks per quarter inch of the same weft as the Orleans, making a sightly cloth, the wool, which was not shafty, like bright-haired English wool, being more suitable for this article than for Orleans. Short patterns of Orleans and Cobourg from 36's ordinary English weft were woven with the above, and were dyed at the same times. Sample of fine top of 36 weft from same, sent with the low top noils and shorts.

The wool, noils, tops, yarns, and fabric, presented by Mr. Foster, were examined by the gentlemen present. The wool was said to be adapted for the manufacture of Cobourgs, while the wool pure from the Shanghai sheep was better adapted for Orleans.

Mr. Alderman Rand said that Mr. Foster's report was very interesting, and the Council was deeply indebted to him for it

Proceedings of Institutions.

Birmingham (Messrs. Chance's Library and Reading Room).—The report for the last year states that the average number of members per quarter has been 190, a decrease of 19 per quarter upon the year 1858, but an increase of 17 upon the average of six previous years. The Library now numbers 1,700 volumes; it has been increased during the year, by the addition of 252 volumes. The average number of books taken out per day is about 13, or nearly 23 books per year to each member. A rough analysis of the books taken out during the past year shows that 36 per cent. are works of fiction, 8 per cent. works on science and art, 34 per cent. works on history, biography, travels, &c., 16 per cent. miscellaneous works, and 6 per cent. works of a moral and religious character. The committee regret that they have not been able to see their way to the organisation of courses of lectures. The expense of lectures is so considerable, especially when lecturers are paid, and the interest they excite, and the consequent pecuniary returns so uncertain, that it is extremely doubtful whether this Institution can, at present, hope to carry out this most desirable means of improvement. Two neighbouring Institutions, in West Bromwich and Smethwick respectively, are just now engaged in an experimental effort in regard to lectures of a superior order, and this Institution will watch with interest the result, and avail itself of any opening that may appear to promise a suitable return to its labours in this particular direction. In May last, seven members of the Institution availed themselves of the Society of Arts Examination, and the Committee of the Institution desire to press the subject of these annual Examinations upon the attention of all the members. Up to the present time, the secretary has received twenty-five names of members of this Institution, who purpose to present themselves for Examination in the month of May next. The fourth annual excursion of the members and friends of this Institution took place on the 27th July last, to Liverpool and other places, by the Great Western Railway, and was in all respects satisfactory. The proceeds of the excursion amounted to £20 7s. 4d., which sum has since been expended in an increase of the library.

Lichfield Free Library and Museum.—The first report of the committee states that, on the 26th of April last, the inauguration took place, under the auspices of the Right Hon. the Earl of Lichfield, the Lord-Lieutenant of the county of Stafford, the Members of Parliament, the clergy and inhabitants of the city and neighbourhood. The committee had always been anxious that the news room should be the first department of the Institution available, and it was gratifying to them to be able to open it from the day of the inauguration. Since that time, all classes of the inhabitants have exercised their privilege; the daily attendance has been an average of 90 persons; good conduct and order have been evinced, and not a single complaint has reached the committee. Some delay has taken place in opening the museum to the public, owing to some imperfections in the building; these, however, are now being remedied. The additional expenses thus incurred have much reduced the balance, the produce of the donations of the friends of the Institution. The committee confidently expect that they will, in a short time, be able to place the library within reach of the reader. The number of books now upon the shelves consists of upwards of 1,670 volumes, mostly of a valuable description, and the committee desire to express their sincere gratification at the numerous and well-selected contributions from all classes to this department of the Institution. The collection of antiquities, curiosities, works of art, and local relics, which have been made in less than ten months for the museum, has been pronounced by authorised judges to be scarce and valuable.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. J. Pittman, "On the Results of the Use of Music in Divine Worship, and their Influence on the Art in General."
Actuaries, 7.
Geographical, 8½. 1. Mr. C J. Anderson, "Africa S., Discovery of a New River flowing to the East, in Lat. 17 degrees 30 seconds S; Long. 19 degrees 0 seconds E." 2. Captain N. B. Bedingfield, R.N., "Proposed Expedition up the Congo." 3. Captain Palliser, "Proceedings of the British North American Exploring Expedition, between the Rocky Mountains and Vancouver Islands."
Medical, 8½. Clinical Discussion.

Tues. .....Royal Inst., 3. Prof. Owen, "On Fossil Reptiles."
Civil Engineers, 8. Continued discussion upon Mr. Longridge's Paper, "On the Construction of Artillery and other Vessels, to resist great internal pressure."
Zoological, 9.

Wed. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. George R. Burnell, "On Stones for Building Purposes; the causes of, and the Means for preventing, their Decay."
Geological, 8.

Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Zoological, 4.
Royal Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8. 1. Dr. Anderson, "On a new genus of *Caryophyllæ*, from Aden." 2. Mr. W. Archer, "On the Value of Hairs as a character in determining the limits of subordinate groups of *Compositæ*." 3. Rev. C. Parish, "Botanical Notes made during a Tour to Maalmyne." 4. Mr. R. Spruce, "On the Mosses of the Amazon and Andes."
Chemical, 8.
Artists and Amateurs, 8.
Medical and Chirurg, 8. Anniversary.
Royal, 8½.

Fri. .....United Service Inst., 3. Captain Tyler, R.E., "The Rifle and the Rampart, or the future of Defence."
Archæological Inst., 4.
Royal Inst., 8. Professor H. C. Roscoe, "On the Measurement of the Chemical Action of the Solar Rays."

Sat. .....Asiatic, 2.
Royal Inst., 3. Dr. Lankester, "On the Relations of the Animal Kingdom to the Industry of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on February 7th, 1860.

21. Irish Reproductive Loan Fund—Account.
38. East India (Revenues)—Return.

40. Flogging (Navy)—Return.
44. Opium (Hong Kong)—Return.

Delivered on February 8th, 1860.

50. Navy Estimates, &c.
14. Bills—Corrupt Practices Prevention Act (1854)—Amendment.
15. „ Election Petitions Act (1848)—Amendment.
27. „ Probate and Adminstration (India)—(Amended).
China—Further Correspondence with Mr. Bruce.

Delivered on February 9th, 1860.

33. Naval Prize Money, &c.—Account.
37. East India (Resources of Madras, &c.)—Paper.
Wakefield Elections—Report of Commissioners.

Delivered on February 10th, 1860.

25. Coast Guard Stations—Returns.
47. Flogging (Army and Militia)—Return.
48. East India (Education)—Return.
56. Butter, &c —Return.
59. Poor Law (Metropolis)—Return.
30. Bills—Charitable Uses.
28. „ Registration of Births, &c. (Scotland).
34. „ Law of Property.

Delivered on February 11th and 13th, 1860.

34. East India (Public Works, &c.)—Return.
65. Greek Loan—Account.
66. Sardinian Loan—Account.
67. Public Debt—Account.
58. St. George's-in-the-East—Copy of Correspondence.
62. Railway and Canal Bills—Report from General Committee.
63. Durham Diocese—Return.
70. Steam and Sailing Ships—Return.
33. Bills—Masters and Operatives.
35. „ Endowed Schools (No. 2).
29. „ Marriages (England and Ireland).
36. „ Bribery Prevention, &c.
37. „ Registration of Voters.
France—Correspondence respecting the Negociation of a Treaty of Commerce.
France—Treaty of Commerce.

Delivered on February 14th, 1860.

55. Metropolitan Police—Accounts.
64. Russian Dutch Loan—Account.
75. Committee of Selection—1st. Report
38. Bill—Packet Service (Transfer of Contracts).

Delivered on February 4th, 1860.

60. Army Estimates.
69. East India (Loans)—Return.
78. Gloucester City Election—Return.
39. Bill—Conveyance of voters, &c.
Affairs of Italy—Correspondence.
Tariffs (New and Old Rates of Duty)—Return.
Poor Relief (Scotland)—14th Annual Report.

Delivered on February 16th, 1860.

46. Naval Receipt and Expenditure—Account.
57. Accountant-General (Navy)—Return.
68. West India Islands, &c., Relief—Account.
15. Railway and Canal Bills—(1. Andover and Redbridge Railway—2. Bagenalstown and Wexford Railway—3. Banbridge Junction Railway, Banbridge, Lisburn, and Belfast, and Ulster Railway—4. Bedford and Cambridge Railway—5. Belfast and Ballymena Railway—6. Belfast and County Down Railway—7. Bradford, Wakefield, and Leeds Railway—8. Brecon and Merthyr Tydvil Junction Railway—9. Buckley and Connah's Quay Railway—10. Caledonian Railway (Lanark and Lesmahagow Branches)—11. Cannock Chase Railway—12. Central Wales Railway—13. Chard Railway—14. Cheshire Midland Railway—15. Disley and Hayfield Railway—16. Doncaster and Wakefield Railway—17. Dorset Central Railway (New Works, &c.)—18. Dublin and Drogheda Railway—Dublin and Meath Railway—19. Dublin and Wicklow Railway—20. East Somerset Railway)—Board of Trade Reports.
85. Harbour, &c., Bills (Upper Mersey Dues, Purchase and Conservancy—1. Commercial Docks Act Amendment—2. The Great Ship Company (Limited)—Board of Trade Reports.

Delivered on February 17th, 1860.

43. Anchors—Return.
52. Pauper Children (Scotland)—Return.
73. Roman Catholic Sailors—Return.
74. Sugar, &c.—Returns.
15. Railway and Canal Bills (21. Ely Valley Railway—22. Epping Railway (Dunmow Extension) (Ilford Lines, &c.)—23. Great Western Railway—24. Hay Railway, Hereford, Hay, and Brecon Railway—25. Hinckley and Leicester Railway. 26. Horsham and Guildford Direct Railway—27. Inverness and Ross-shire Railway—28. Keith and Dufftown Railway. 29. Leeds, Bradford, and Halifax Junction, and Bradford, &c., Railway Companies Amalgamation—30. Liskeard and Caradon Railway—31. Llangollen and Corwen Railway—32. London and North Western Railway and St. Helen's Canal and Railway Companies—33. London and South Western (New Line to Bristol, &c.) (New Line to Exeter and Crediton)—Board of Trade Reports.

Delivered on February 18th and 20th, 1860.

77. Oaths—Returns.
84. Trade and Navigation Accounts (31 December, 1859).
90. Railway and Canal Bills—2d Report from General Committee.
91. Committee of Selection—2d Report.
79. Dockyards—Return.
40. Bills—Mines Regulation and Inspection.
41. „ Valuation of Rateable Property (Ireland).
42. „ Religious Worship.
31. „ Window Cleaning.
Military Education—Report of the Council.
French Tariff—Existing and Proposed Duties.
76. Local Acts (1. Inverness and Ross-shire Railway—2. Truro Port and Navigation—3. Waveney Valley Railway—4. Andover and Redbridge Railway (Extension)—5. Dorset Central Railway—6. Ulster Railway—7. Burnham Tidal Harbour and Railway—8. Bagenalstown and Wexford Railway—9. Upsall, Normanby, and Ormesby Railway—10. Wexford Free Bridge—11. Norwich and Spalding Railway)—Admiralty Reports.
15. Railway and Canal Bills (34. London, Brighton, &c. (Croydon to Balham Hill)—35. London, Brighton, &c. (New Deviations and Lines)—36. London, Chatham, and Dover (Metropolitan Extensions)—37. Metropolitan—38. Midland (Station at Saint Pancras)—39. Midland (Use of Railways in and near London)—40. Mid Wales—41. Monklands—42. North Eastern and Newcastle upon Tyne, &c. Amalgamation—43. North London—44. Norwich and Spalding—45. Oswestry and Newtown—46. Somersham, Ramsey, and Holme—47. South Devon—48. South Kensington—49. South London (No. 1)—50. Stockton and Darlington—51. Lymington, Biggar, and Broughton—52. Thames Tunnel—53. Ulster—54. Upsall, Normanby, &c.—55. Waterford and Limerick—56. Watford, Rickmansworth, &c.—57. Waveney Valley—58. West Cork—59. West Somerset—60. Wimbledon and Dorking—61. Ambergate, Nottingham, &c.—62. Aylesbury and Buckingham—63. Belfast, Holywood, and Bangor—64. Birkenhead (Nos. 1 and 2)—65. Border Counties and North British—66. Calne—67. Finn Valley—68. Forest of Dean Central—69. Galashiels, Innerleithen, and Peebles—West Fife Mineral)—Board of Trade Reports.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February 17th*, 1860.]

Dated 21st October, 1859.

2409. J. T. Pitman, 67, Gracechurch-street, London—A method of clearing the bed of rivers. (A com.)

Dated 2nd January, 1860.

4. H. A. Dewar, Union-street, Aberdeen—Imp. in moulding or applying india rubber as the basis of artificial teeth, and in apparatus for the same.

Dated 12th January, 1860.

81. W. H. Orchard, 15, Hatton-garden, Middlesex—Imp. in dressing millstones for cleaning all kinds of small grain having a husk or hull.

Dated 19th January, 1860.

138. W. Dawes, Compton, Staffordshire—Imp. in the manufacture of boots and shoes for beasts of draught and burden, and in the machinery or apparatus to be used in such manufacture.

Dated 26th January, 1860.

196. S. Beardmore, 27, Albion-street, Hyde-park—Imp. in electric telegraphs.
200. J. Ingham and G. Hinchliffe, Bradford—An instrument or apparatus to facilitate and simplify calculations, and particularly adapted for computing the weights of cotton warps, applicable also for woollen and worsted warps, and warps of other fibrous substances.

Dated 27th January, 1860.

205. M. O. Dammann, 13, Queen's-road, Haverstock-hill, St. Pancras—An apparatus with a chemical process producing fumigation for the cure of the gout, rheumatism, nervous debility, and disease of the skin.

Dated 30th January, 1860.

242. G. A. Cator, Selby, Yorkshire—Imp. in machinery for preparing flax, hemp, and other vegetable fibrous substances, for scutching or other manufacturing processes.

Dated 31st January, 1860.

244. A. Ripley, 42, Bridge-street, Blackfriars—The application of the shavings, parings, and refuse of hydes and leather to a new manufacture, and in the process and mode of treating or operating the same, in order to produce the said new article or fabric.
246. G. Smith, Glasgow—Imp. in monuments, fountains, lamps, letter-boxes, urinals, and such like ornamental and public erections in cast iron.
248. A. A. Larmuto, Salford, Lancashire—Certain imp. in "healds" employed in looms for weaving.

250. W. E. Newton, 66, Chancery-lane—Imp. machinery for cutting dovetails. (A com.)
254. E. Walker, London-street—Imp. in windlasses.
256. F. Jossa, Sunderland—Imps. in the manufacture of sal ammoniac from small and refuse coals, and from the gas generated in the manufacture of coke.

Dated 1st February, 1860.

258. T. Hill, Heywood, Lancashire—Imp. in steam boilers.
262. G. P. Harding, Belle-ville, Paris—Imp. in hats and similar coverings for the head.
264. J. W. Matthews, High street, Poplar—An imp. in the manufacture of hats.

Dated 2nd February, 1860.

267. A. Hawkins, 65, Hatton-garden—Finishing machine wrought wood carvings, and also for finishing certain wood carvings rough hewn or cut by hand-labour.
369. L. J. Brethon, Tours, France—An improved press for the compression of bricks, tiles, and similar articles of either plastic or other suitable compressible materials.
270. J. Yule, Glasgow—Imp. in steam boilers.
271. J. Reynolds, 32, St. James's-road, Holloway—An imp. in constructing an endorsing, printing, and stamping press.
273. W. FitzGerald, Fleet-street—The production of bands or strips for application on petticoats and similar ornamental purposes.
274. T. Routledge, Eynsham Paper Works, near Oxford—Imp. in the manufacture of paper.
277. W. H. Tooth, Spring-terrace, Wandsworth road, Surrey—Improved machinery or apparatus to be employed in the manufacture, melting, or refining of iron and steel, and in the manufacture of puddled steel and wrought iron.

Dated 3rd February, 1860.

279. L. P. Barré, 4, South-street, Finsbury—Certain imps. in steam boilers.
280. A. Watkins, 67, Strand—Imp. in time-keepers.
281. J. Harper, Wilson-street, Belfast—Imp. in roving frames.
282. W. Howes and W. Burley, Birmingham—A new or improved method of attaching lamps and whip sockets to carriages.
283. J. Hall, Blackburn—Imp. in sewing machines.
284. T. Blackburn and M. Knowles, Blackburn—Imps. in beams for warping, sizing, and dressing, and weaving machines.
285. R. Adams, King William-street—Imp. in breech loading guns and in making up cartridges for the same.
287. W. Lorberg, 34, St. Mary-at-Hill, London—A new or improved method of employing tan or spent bark for chemical purposes.
288. R. Bodmer, 2, Thavies Inn, Holborn—Imp. in machinery for converting into down or fibres capable of being spun, the remnants or cuttings or other waste pieces of silk or other fabrics. (A com.)
289. W. E. Newton, 66, Chancery-lane—Imp. in piston packing. (A com.)
290. R. A. Brooman, 166, Fleet-street—An imp. in the manufacture of iron, and in furnaces to be employed therein. (A com.)
291. R. A. Brooman, 166, Fleet-street—An imp. in tanning. (A com.)

Dated 4th February, 1860.

293. J. G. Willans, 2, Clarence-place, Belfast—Imp. in the manufacture of soda.
295. A. Kerr, New Heath, near Manchester—Imp. in Jacquard machines.
296. J. G. Dahlke, Kingsland-road, Middlesex—Improved filtering compositions, and imp. in filtering vessels and apparatuses.
297. E. W. Uren, Hoomeavy-Meavy, Devonshire—Imp. in a rotary steam engine.
298. P. Robertson, Sun-court, Cornhill—Imp. in brewing beer, ale, and porter, also in separating brewers' worts from grain and beer, ale, and porter from yeast and other matters, and also in apparatus used for these and like purposes.
300. F. Lespadin, Paris—An improved mode of manufacturing decanters, and other similar articles in glass or crystal, of a rounded form.
301. C. T. Launay and A. M. A. D. de Vernez, Paris—An improved valve or cock for regulating or stopping the passage of gas, steam, water, or other fluids.
302. C. T. Launay and A. M. A. D. de Vernez, Paris—An improved apparatus for carburating hydrogen or other gas for illuminating purposes.
303. J. Inchley, Birmingham—Imp. in propelling canal boats and other vessels.
305. J. Birch, Duren, Prussia—Imp. in the construction of smoke-consuming furnaces.
306. A. V. Newton, 66, Chancery-lane—An improved construction of combination steam gauge. (A com.)
307. A. V. Newton, 66, Chancery-lane—An imp. in the construction of ships' stoves. (A com.)
308. J. Smith, Birmingham—Imp. in the manufacture of handles or knobs for sticks, umbrellas, and parasols, for swords, knives, forks, and other articles of cutlery, for pistol butts and small arms, stocks, and for other similar articles.
309. J. Smith, Birmingham—Imp. in the manufacture of furniture for doors and drawers, bell levers, curtain band, cornice pole, and lamp and chandelier enrichments, and the ornamental part of other similar articles.

Dated 6th February, 1860.

312. J. W. Walton, Esther-cottages, Ponder's-end, Middlesex—Imp in rifles and other small fire-arms.
313. A. V. Newton, 66, Chancery-lane—An imp. in laying submarine electric telegraph cables. (A com.)
314. A. V. Newton, 66, Chancery-lane—An improved mode of producing certain compounds of lead. (A com.)
315. W. McNaught, Rochdale—Imp. in steam engines and an apparatus connected therewith.
316. C. H. Roeckner, Marsh-street, Bristol, Somersetshire—Imp. in the construction of millstones for grinding.
317. T. Tye and C. W. Andrew, Brixton-road, Surrey—An improved method of trapping sinks, especially adapted for kitchen and scullery sinks in domestic dwellings to prevent escape of noxious effluvia therefrom.

Dated 8th February, 1860.

331. G. Jenkins, Tyne Cottage, Hanwell, Middlesex—The application of dovetail joints in iron and other metal, to wooden bedsteads, couches, sofas, and other such like articles of furniture, together with metallic sides, ends, and laths securely fixed thereto by means of dovetail joints.
333. W. Wain, Copenhagen, Denmark—Imp. in steam engines and in apparatus for superheating steam.
335. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in obtaining motive power, and in the machinery or apparatus employed therein. (A com.)
337. W. Pidding, Borough-road, Southwark—Imp. in needles.
339. W. Beard, 62, Cannon-street West—Imp. in adapting beadwork and buglework to harness and whip handles.
341. J. E. Durand, Paris—The manufacture of poppy paper.
343. W. E. Newton, 66, Chancery-lane—Imp. in rails, rail supports, and fastenings, and the nut fastenings of rail-bolts for the permanent way of railroads. (A com.)
345. J. Langford, Orzen-street, Nottingham, and C. Chester, Bloomsgrove, Nottinghamshire—Imp. in cooling liquids.

Inventions with Complete Specifications Filed.

396. S. Copping, 27, Tokenhouse-yard—Imp. in manufacturing coffins. (A com.) 14th February, 1860.

Patents Sealed.

[*From Gazette, February 17th*, 1860.]

February 17th.
1900. A. J. Canu.
1904. P. Salmon.
1910. J. Gregory.
1917. J. J. O. Taylor.
1932. G. Riley.
1934. J. Blake.
1950. C. Hanson.
1984. J. MacKenzie and S. T. Wentworth.
2012. W. Wheatstone.
2030. G. Lowry.
2040. H. Jones.
2052. J. H. Johnson.
2134. W. Clark.
2158. E. Jones.
2316. J. Skertchley.
2574. M. A. F. Mennons.
2803. W. Horton.
2846. G. Hawksley.
2906. J. H. Johnson.

[*From Gazette, February 21st*, 1860.]

February 21st.
1918. H. Spratt.
1926. W. H. Hill.
1928. W. Hollins and F. Hyde.
1931. G. Pearson.
1933. J. Henry and J. E. H. Andrew.
1938. C. T. Judkins.
1987. H. Higgin.
1995. T. Aveling.
2005. S. D. Goff, H. D. S. Strangman, and E. Strangman.
2031. R. K. Geldard.
2051. J. Nicholson.
2063. S. Cornely.
2097. J. S. Slocum.
2217. B. Atkinson.
2247. W. E. Newton.
2249. J. Rawlings.
2749. J. Benn.
2763. A. Turner.
2779. J. G. N. Alleyne.
2983. T. Auchincloss.
2991. J. Slack.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, February 17th*, 1860.]

February 13th.
425. F. H. Sykes.
442. A. Smith.
February 15th.
464. H. Barber.
472. J. Green.
491. H. Y. D. Scott.
499. J. Combe.

[*From Gazette, February 21st*, 1860.]

February 16th.
468. R. B. Cooley.
547. W. Wood.
548. W. Wood.
577. E. Mucklow.
February 17th.
488. T. Clayton.
February 18th.
479. D. Cheetham.
502. W. Zipser and J. P. Klein.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, February 17th*, 1860.]

437. W. Jones.

[*From Gazette, February 21st*, 1860.]

February 16th.
421. C. Watt and H. Burgess.

Journal of the Society of Arts.

FRIDAY, MARCH 2, 1860.

EXHIBITION OF 1862.

On Tuesday, the 28th of February, a deputation from the Council of the Society of Arts, consisting of Sir Thomas Phillips, F.G.S. (Chairman), Mr. John Bell, Mr. W. H. Bodkin, Dr. Chambers, Dr. Chance, Mr. H. Cole, C.B., Mr. Peter Graham, Mr. Arthur J. Lewis, Mr. John MacGregor, Mr. W. T. Mackrell, Colonel H. Cunliffe Owen, R.E., C.B., Mr. Thomas Sopwith, F.R.S., Mr. G. F. Wilson, F.R.S., and Mr. Thomas Winkworth, accompanied by Mr. Le Neve Foster, the Secretary, and Mr. Charles Critchett, Assistant-Secretary, waited upon the Prince Consort, President of the Society, at Buckingham Palace, to communicate the steps taken by the Council for holding an International Exhibition of Art and Industry in 1862.

The deputation laid before his Royal Highness the draft of the trust deed, on which the Council propose to raise a guarantee fund of not less than £250,000. The deed names as the Trustees and Managers of the Exhibition :— Earl Granville, K.G., Lord President of the Privy Council; the Marquis of Chandos, Chairman of the London and North-Western Railway; Thomas Baring, M.P., C. Wentworth Dilke, Members of the Royal Commission for the Exhibition of 1851; and Thomas Fairbairn, Chairman of the Manchester Art Treasures Exhibition; and provides that any surplus arising from the Exhibition is to be applied for the promotion of Arts, Manufactures, and Commerce, in such way as the guarantors may decide.

The draft of the guarantee deed may be seen at the rooms of the Society, and the Secretary is authorised to receive the names of Members willing to guarantee £100 and upwards preparatory to the publication of a first list.

REPEAL OF THE PAPER DUTY.

The following form of Petition has been forwarded to the Institutions in Union, with a request that it be signed and transmitted to the Member of Parliament for each district for presentation. A similar Petition, signed by the Chairman of the Council, has been presented to the House of Commons by the Right Hon. William Hutt, M.P. :—

To the Honourable the Commons of Great Britain and Ireland in Parliament assembled.

The Humble Petition of the Undersigned Members of ———

Sheweth,—That your Petitioners have learnt with much satisfaction that the Chancellor of the Exchequer has laid before your Honourable House proposals for the repeal of the excise duty on paper.

Your Petitioners humbly pray that your Honourable House will be pleased to sanction such legislative measures as may be necessary for carrying those proposals into effect.

And your Petitioners will ever pray, &c.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of recent Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

The days for receiving articles (which must be forwarded to the Society's House *carriage paid*), are Thursday, Friday, and Saturday, the 22nd, 23rd, and 24th March, but no article can be received unless space has been previously allotted, for which application should be made to the Secretary without delay.

Illustrated Catalogues of the Society's Annual Exhibitions are published; a short but clear description of all Inventions exhibited will therefore be required for the Catalogue, with an engraved wood block (when possible) for illustration.

These descriptions must be written in a clear hand, on one side only of each half-sheet of foolscap paper, with an inch margin on the left side of the page.

All Drawings exhibited must be framed.

Articles which have been included in previous Exhibitions of the Society of Arts *cannot be readmitted.*

No charge is made for space.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date :—

John Ball, Examiner in Book-keeping (3rd donation)	£5	5
Charles Brooke, M.A., F.R.S.,	2	2
Harry Chester, Vice-Pres. (3rd Donation)	5	0
C. Wentworth Dilke, Vice-Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Henry Johnson (3rd Donation)	10	10
Sir Thomas Phillips, F.G.S., Chairman of the Council	5	0
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

THIRTEENTH ORDINARY MEETING.

Wednesday, February 29, 1860.

The Thirteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 29th instant, George Godwin, Esq., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Collyer, Robert Hanham, M.D.	Hood, Robert.
Dumergue, Frederick.	Hoskins-Gough, Kedgwin.
Finney, William.	Symons, William.
	Williams, J. W. Hume.

The following Institution has been taken into Union since the last announcement :—

Newcastle-on-Tyne, West-end Literary Society.

The following Colonial Institution has been taken into Union since the last announcement :—

Upper Canada, Board of Arts and Manufactures.

The Paper read was—

ON BUILDING STONES—THE CAUSES OF THEIR DECAY, AND THE MEANS OF PREVENTING IT.

By George R. Burnell, C.E., F.G.S., F.S.A.

In a district of so peculiar a nature as that of the environs of London (where clay of a highly plastic description occurs in great abundance), the style of construction adopted is so markedly characterized by the use of the local material, bricks, that we, inhabitants of London, are apt to forget that other districts are, as it were, compelled by analogous circumstances to adopt a style which is diametrically opposed to our own. In London, and, indeed, we may add in a large majority of our centres of population, bricks are habitually cheap and good ; stone is rare and expensive ; and it thus happens that stone becomes to us an object of luxury, only to be employed in monumental structures, or in the decorative parts of ordinary houses. In France the contrary rule prevails, as it does likewise in some of the cities of Yorkshire and of Scotland ; and there stone is the common material used in building, and brickwork is the exceptional ornament. It has always seemed to me a matter of regret that this should be the case, for, beyond question, the taste of the London builders has been injuriously affected by the small and unbending character of the material they habitually employ ; whilst the grander and more monumental appearance of such towns as Edinburgh, Bradford, Paris, &c., may, to a great extent, be attributed to the fact that in them large ashlar stone is habitually employed. But in addition to this æsthetical inconvenience arising from the absence of ashlar stone as an ordinary material of construction, the builders of such towns as London labour under the more serious one of being less acquainted with the nature and properties of stone than are the builders of more favoured localities ; and we, therefore, find that even when the former do resort to the more costly materials, they frequently employ them under such circumstances, and in such positions, as to expose them unnecessarily to danger and decay. Emphatically this has been the case of late years with respect to many of the London buildings, and it may, under such circumstances, be desirable to dwell for a short time upon the nature of the stones which usually appear in our market, and upon the various injurious actions to which they are exposed.

The building stones employed in London are capable of being divided, according to their mechanical properties, into two classes, namely, those which can only be worked by the pick or by wedges, and those which can be worked by the mallet and chisel—the latter being known by the name of freestones, in contradistinction to those which do not work freely. These classes, in their turns, are susceptible of numerous subdivisions, such as, in the first class, the granites, porphyries, basalts, whinstones, and the countless varieties of the plutonic and volcanic formations ; the quartz rocks, mica schists, gneiss, and the more dense altered quartzose sandstones, the quartzose conglomerates, and the grès or agglutinated sandstones of the secondary and tertiary strata. The slate rocks, perhaps, might be grouped as a sub-class of the stones not workable by the mallet and chisel, for they present too decidedly marked a cleavage to allow of their being worked freely, though they are susceptible of being sawn, or even worked on the edge, in the same manner as the freestones themselves. In the second class, or the freestones, are comprised the marbles, sandstones, limestones, (both carbonates and sulphates) in all their endless modifications. The bituminous rocks furnish materials which may be classed as a sub-variety of the freestones, in an analogous manner to the classification of the slate rocks in the preceding division.

Now of the stones above described as being of the first-class, the London market consumes large quantities of granite from the Channel Islands, Cornwall and Devonshire, Mount Sorel in Leicestershire, Aberdeen and Peterhead in Scotland. The whinstones, basalts, and volcanic tufas are hardly ever seen here—unless in the form of the pozzolanos and trass, which are occasionally imported from Italy and Germany for making artificial hydraulic cements —whilst the quartz rocks and the quartzose sandstones, the mica schists, &c., are never used. The quartzose conglomerates, such as the Bramley Fall stone, are occasionally employed in engineering works, and the tertiary grès, or sandstones, of Windsor forest are used in the neighbourhood of Windsor as paving materials for streets and stables, just as the grès of Fontainbleau, their geological analogues, are used in Paris. The advantages offered by the best of these various materials consist in their extraordinary hardness, their density of texture, their non-absorbent properties, and, generally speaking, their powers of resisting atmospheric influences; but the whole of this class is exposed to the serious objection that the labour upon all its varieties is very costly; and that from the mere fact of their being composed of heterogeneous ingredients in the far greater number of cases, they are also exposed to the action of causes which are able to produce either disintegration, or decomposition, of their elements.

Thus, for instance, the Cornish and the Devonshire granites, and some of the porphyries and elvans from those counties, frequently contain a notable proportion of felspar ; and when they are exposed to the action of rain-water, containing (as it usually does) carbonic acid in solution, that felspar decomposes, and is then easily removed, leaving the quartz and the mica in relief without any cementing material. Illustrations of this mode of decay may be observed in the granite used in parts of Waterloo or London Bridges, or in the granite piers of the crypt under the Hall of Christ's Hospital; but the process is very slow, and it would seem to be subject to some laws not hitherto discovered; for the decay of the felspar does not take place according to any known rules. The more crystalline, in fact, the felspar of any of these bodies may be, the more perfectly does it resist the decomposing action of the atmospheric agents ; and we shall have occasion again to allude to the influence of this mechanical state of natural substances upon their durability. In the meantime it may be added, that in the Bramley Fall and in the analogous stones, the silicious conglomerates, the same phenomena may be observed. The cementing material frequently decomposes, and is washed away from the ingredients it naturally held together, and then the latter as certainly fall asunder, or the cementing material decays, and in so doing it produces a dangerous disintegration of the mass. It follows, from these observations, that the smaller, and the more uniform in dimensions, the materials of these heterogeneous rocks may be, the greater is the probability of their duration, and in the case of granite especially, it is essential to select those descriptions which do not contain large crystals of felspar. It is singular that some of the granites of Normandy, Brittany, and the North of Spain, present identically the same mineralogical peculiarities as

the granites of Devon and Cornwall, and they are equally susceptible of decay. The varieties in the lithological characteristics of the Bramley Fall stone, and in those of the quartzose conglomerates, are still more hard to define than even those of the plutonic rocks; in the same quarry, and even in the same bed, the qualities of these stones will change within a very small distance, and the great irregularities of this description of stone form, in fact, the most serious objection to its use. Nevertheless, when the Bramley Fall or the silicious conglomerates are well selected, they are extremely valuable for engineering purposes, on account of their hardness, and of their power of resisting crushing weights. They yield to atmospheric influence when the silicious cement exists in the form of soluble silica, and is of an amorphous character; if, on the contrary, the cement assume a crystalline character, it becomes unattackable even by caustic alkaline solutions, and the silicious conglomerates are then as durable as the best descriptions of granite themselves. Of the granites which are used in London, those obtained from Aberdeen, Peterhead, and Mount Sorel are the most valuable; but also, on account of their hardness, the most expensive. They can be obtained of any required dimensions, and are capable of receiving any desired form, and thus are admirably adapted for the construction of buildings of a simple monumental character, designed "not for an age, but for all time;" their colours moreover, are agreeable, especially those of the rose tinted granites of Peterhead and Mount Sorel. The best silicious conglomerates used in London for building purposes are extracted from the lower members of the Yorkshire coal field; their colour, it may be added, is far from being as agreeable as that of the good granite, and at times, when there is much oxide of iron in the cementing material, the colour of the conglomerates becomes unpleasantly foxy.

For the reason above cited, namely, the difficulty of working the first class of stones, the other, or the freestone class, is the one most generally used in building operations, the selection of the variety employed in any locality being too often only regulated by the consideration of its ultimate cost. In London, the freestones commonly used may be stated to be as follows:—Amongst the sandstones, the Cragleith, the Dundee and Arbroath, the Yorkshire stones, and the sandstones furnished by the Wealden deposits near Tunbridge Wells, or by the subcretaceous formations of the neighbourhood of Godstone, Maidstone, or Folkestone; amongst the magnesian limestones, the Anston and Bolsover stones; amongst the carbonates of lime, the Portland, Purbeck, Ketton, Barnack, the Caen, Ranville, Aubigny stones, are to be met with in commerce without difficulty, whilst it would be easy to increase their number by the introduction of the remarkably valuable tertiary limestones of the Paris basin. In some localities, even the common chalk becomes so indurated as to allow of its being used as a building stone; less frequently, it is true, in England than in France, for in the valley of the Lower Seine this material is extensively used in the best buildings, as at Rouen, Vernon, Louviers, &c. I dwell a little upon this detail of our subject at present, because I am convinced that a process for the preservation of building stones, which I shall have the honour to bring before your notice, would enable us to convert, to useful purposes of construction, the immense stores of chalk with which we are surrounded. I would add that the sulphates of lime are occasionally used for ornamental purposes in interiors, but that they are almost invariably so unfit to resist the action of the atmosphere externally, as only to be of value from the fact of their yielding the important material known by the name of the "Plaster of Paris." The argillaceous limestones do not often occur under such conditions as to warrant their use as building materials in other than in the localities where they are found, and this sub-class is only resorted to, for the London market at least, for the purpose of obtaining the hydraulic limes of the blue lias, or the Roman cements, made from the septaria nodules of the Oxford, liassic, or London clays.

The Cragleith stone, of which the majority of the buildings of Edinburgh are constructed, is occasionally used for foundation or basement works in the metropolis, or for the execution of staircases exposed to great traffic, but the hardness (and the consequently high price of labour) of this stone limits its use to such situations. It is obtained from the carboniferous formations, and is composed of minute grains of quartz, with occasional plates of mica, united by a silicious cement, containing usually about 98 per cent. of silica, 1 of carbonate of lime, and 1 of bituminous and other miscellaneous ingredients. The weight of a foot cube of the Cragleith stone is about 146 lbs., and it is stated to resist a crushing weight of 5,800 lbs. on the inch superficial. Generally speaking, the colour is of a greyish white, and, in consequence of the density, and the non-absorbent character of the material, it retains a clean appearance for a very long time. The London atmosphere has very little action upon it.

The Dundee and Arbroath stones, obtained from the red sandstone series on the eastern coast of Scotland, are sometimes employed in London, the former as an ordinary building stone, the latter principally as flag pavement. The colour of the Dundee stone hitherto brought to London is rather disagreeable, for it is of a dark purple brown, or a deep oxide of iron tint, but the stone is hard, and resists weather very satisfactorily; in consequence of the colour, however, this material is never used in ornamental buildings. The Arbroath stone is of a denser character than that obtained from Dundee, but it is more decidedly "flaky," to use a workman's phrase, and it is therefore almost exclusively used for the purposes above mentioned. Occasionally, however, blocks of the largest dimensions, and of very uniform character, are obtained from the Arbroath quarries. They are hard; they resist weather satisfactorily; the stone is easily worked, and its colour (a light greenish grey) is far from being disagreeable. I am not aware of any observations upon the specific gravity of this stone, or of the crushing weight it would bear, but, judging simply by the eye, I should be disposed to class it in these respects with the Yorkshire sandstones, to be noticed hereafter. As Arbroath lies immediately upon the seaboard, it is strange that the stone from that locality should not be more commonly used in the metropolis.

There are several varieties of the Yorkshire sandstones used in London, of which the most generally known are the flagstones from the neighbourhood of Halifax and Huddersfield, and the compact stones from the neighbourhood of Leeds, commonly called the "Park Springstone." The normal composition of the whole of this series of rocks is that of a fine-grained quartzose sand and decomposed felspar, with an argillo-silicious cement, and with numerous flakes of mica in the planes of stratification; sometimes the mass is coloured by the presence of the oxide or of the silicate of iron, and the colour varies from a decided blueish-green to a light ferruginous-brown. The weight of a foot cube of the paving stone is about 145 lbs.; and the crushing weight it can support may be considered to be nearly equivalent to that of the Cragleith stone, a remark which, by the way, may be extended to the Arbroath stone. It is worthy of especial notice that although the Yorkshire flags absorb water freely, and part with it in as easy a manner, they do not suffer from the action of frost; it may be because their distinct lamination allows the expansion of the water to take place freely in a horizontal direction. But when the Yorkshire stones are used in elevation (that is to say in vertical walls) they are not able to resist the singular destruction which takes place at the extremity of the zone of capillary action in almost all porous stones. They do not, in fact, to use another workman's phrase, "stand well between wind and water," and should not, therefore, be used in the basements, or in plinths, of buildings immediately in contact with damp earth, or in positions to which water has access at irregular intervals.

The Tunbridge sandstone has been occasionally introduced here, but with very unsatisfactory results. No doubt it would be possible to select stones from the Weal-

den deposits of Tunbridge or elsewhere, which would resist the action of the atmosphere; but with the exception of the limestones of this series of deposits, to be noticed hereafter, the materials derived from these beds are of far too irregular and too dangerous a character to allow of their being used at any distance from the place where they are obtained.

The sandstones of the subcretaceous rocks are also of a very irregular character, and even when of the best quality they are but ill qualified to resist alternations of wet and dryness. Nevertheless, the Godstone and Maidstone firestones, as they are called, are of great value in the arts, on account of their powers of resisting the action of fire, through the large quantity of soluble silica they contain, in connection with a certain proportion of the carbonate of lime. When these stones are used for ordinary building purposes they require to be kept above the ground, or from the influence of capillary attraction upon the moisture it may contain, and also to be protected from rain, by being covered with some impermeable material. If these precautions be observed the firestones do not rapidly decay; and in some of the oldest parts of Westminster Abbey, or of the Temple Church, specimens of them may still be seen in a fair state of preservation. For internal elaborate Gothic tracery, the firestones may be advantageously employed, because the ease with which they are worked reduces the cost of labour of such decorations. The colour, a greyish light-green, is far from being unpleasant.

Whilst thus speaking of the subcretaceous building stones, it may be as well, even at the risk of a little departure from the strictly logical classification according to the nature of the materials, to call attention to the Kentish rag, which is now so extensively used in the modern revival of mediæval architecture. This stone is a limestone, with a very small proportion of earthy matters, frequently subcrystalline, but ordinarily of a confused texture, the beds from which it is obtained varying from about 6 inches to 3 feet in thickness, and the colour varying from a lightish-green to a deep-blue. The stone is, when well chosen, very hard and dense; and indeed the labour upon it is so expensive that it is very rarely that the ragstone is used for anything but rubble masonry, in districts remote from the quarries. It is the custom, at the present day, on account of the expense of working this stone, to execute all the moulded or decorated parts of churches, &c., in Caen or Bath stone, and even to carry up the quoins of those materials, whilst the intervening spaces are filled in with the hard rag. In other words, the exposed parts of such fashionable specimens of construction are executed of soft and yielding materials, whilst the protected parts are executed of hard and durable ones. However, the walling thus produced is certainly picturesque in its effect; and if some of the processes for the preservation of the softer stones, to be noticed hereafter, be applied to the Caen and Bath quoins and copings, or weather-tables, there can be no valid objection to the use of the Kentish rag in connection with them, on the score of the durability of the work, at least.

Of late years, in consequence of the report of the commission named for the selection of the building stones for the new Houses of Parliament, the magnesian limestones, from the Anston and Bolsover quarries, have been largely used in the metropolis—in some cases, as in the Museum of Economic Geology, with tolerable success; in others, as in the Lincoln's-inn Library and the Houses of Parliament, with a precisely opposite result. This discrepancy proves at least that the magnesian limestone is quite as much exposed, as any of the formerly used building stones, to great varieties of composition; and therefore much attention must be paid to its selection and mode of application. The colour of the best varieties of this stone is of an agreeable light-warm and slightly ferruginous brown; its density is rather greater than that of the oolites; the labour upon it is intermediate between that upon the Yorkshire or the Portland stones, and it can be obtained in blocks of any required dimensions. For many reasons, the use of a stone presenting the external characters of the magnesian limestones would be very desirable, and it must be a subject of sincere regret that so little care should have been displayed in the selection of the varieties employed for the important buildings we have above referred to. The decay of the stonework in the Houses of Parliament is really painful to witness—I had almost said shameful.

With the exception of the Purbeck stone (which is obtained from the local modification of the Wealden deposits found in the Island of Purbeck, the Isle of Wight, and near Petworth), the other freestones, before cited as being used in London, are obtained from the oolitic series. It must not, however, be understood that the oolites are the only valuable sources of supply, for very valuable limestones, adapted for building purposes, are to be found amongst the transition rocks and the mountain limestone districts of Devonshire and of the Midland counties; whilst the blue lias itself is frequently adapted to such uses. But, in the first place, the materials yielded by the transition, and by the mountain, limestones are so hard, and so difficult to work, that they are never able to be used beyond the immediate neighbourhood of the quarries; and in the second place, the purer varieties of the limestones from the blue lias series, are so irregular in the thickness of their beds and in their powers of resistance, that they are equally avoided in general use. The tertiary limestones of the Paris basin might no doubt furnish building materials of a very superior description to those usually employed; but they are, comparatively speaking, unknown in England, and certainly they never appear in the London market. In fact the only limestones habitually used in the metropolis, are those obtained from the oolitic series, and amongst them the Barnack, Ketton, Ancaster, Portland, Bath, and Caen stones, are those which are most generally known to our architects and builders.

Of these stones, the Barnack stones, obtained from the oolite of Northamptonshire, figure to some extent under a false name, for the real Barnack quarries have long since been abandoned, and in their place the Casterton stone is now commonly employed. Both the original Barnack and the Casterton stones are of a lightish brown colour, and they are composed of a tolerably pure carbonate of lime, of a compact but oolitic character, and containing an infinite number of fragments of shells and corals. Their specific gravity is about 2·09; the crushing weight (instantaneous) would seem to be about $\frac{1}{4}$ of that of the Cragleith stone, though there are some marked discrepancies between the results obtained from the respective materials. Nearly all the mediæval structures of Cambridgeshire, the Isle of Ely, and the North of Suffolk, were executed in the Barnack stone, which certainly has resisted atmospheric influences in a very remarkable manner, when care had originally been taken to select for the more dangerously exposed positions the less earthy varieties.

The Ketton oolite, which was largely used in the construction of the numerous beautiful churches in Northamptonshire, and has even of late years appeared with successful practical results even in London itself (as in the tower of St. Dunstan's-in-the-East), is very much like the Barnack stone in colour, but it is more regular in its characters, harder, and more difficult to work, and from the singular apathy of the quarry holders it seems even to be more costly in the first instance. The Ketton stone is of a rather warm cream colour: its specific gravity is about the same as that of the Barnack stone, and the crushing weight it will bear is rather greater than that required to destroy the latter. If this material could be brought at a cheap rate to London, there would be little doubt of its being extensively used; for the original colour is decidedly pleasant, and the London atmosphere seems, from the state of the tower of St. Dunstan's, to have very little action upon the Ketton stone, either in producing decay or in changing the colour.

The Ancaster oolite is obtained from Lincolnshire, and it is largely used in our midland counties, on account of

the beauty of its grain, its pleasant colour, and the ease with which it is worked. Its specific gravity is greater than that of the Barnac stone, and its cohesive force is also greater. This stone is, however, but little known in London, and until it has been exposed for some time to our peculiar atmosphere, it would be dangerous to pass a decided opinion on its merits. In Lincolnshire and the Midland Counties, the Ancaster stone, it may be observed, has resisted the ordinary causes of decay very satisfactorily, and with proper care, there can be no *primâ facie* reason why it should not succeed in London.

The Portland oolite is the material which is most frequently used for the higher class of buildings in London, and which certainly has stood the action of time and atmospheric changes more satisfactorily than any other stone introduced on a large scale. It is, as its name implies, obtained from the upper members of the oolitic series in the island of Portland, at least for the London market, but there are outlying patches of the same formation at Upway, near Weymouth, and near Tisbury, in Wiltshire, which might be rendered serviceable, now that the railway communication with those parts of England has been so much improved. The colour of the Portland stone is at first of a rather cold chalky white, and indeed it is always rather objectionable, though the rapid accumulation of soot which takes place in London renders the consideration of colour one of very minor importance. Blocks of any required dimension can be obtained from the Portland Quarries, and the stone is hard, dense, usually free from shakes or vents of a serious character, and yet it is easily worked either by the chisel or the plate saw. The ordinary weight of a foot cube of this material is 147lbs., and the load it would bear is stated to be about 3,279lbs. per inch superficial. The upper beds of the quarries are used in some public works, under the name of "roach;" they are specifically lighter than the common beds, very full of fossil shells, less distinctly oolitic in character, and from the more perfectly crystallised character of the carbonate of lime, which forms the cementing material of the mass, they are better fitted to resist alternations of dryness and moisture. It is for these reasons that the Portland roach is so extensively used in docks, piers, or other hydraulic works. The stone obtained from the eastern side of the island of Portland is very inferior in quality to that obtained from the western side, a fact of which the architects of the time of Sir C. Wren seem to have been aware, but which did not seem to have attracted the attention of their successors of some thirty years since, for the stone used in St. Paul's, the City churches, Somerset House, &c., has stood remarkably well, whilst that used in the gates and screen of Hyde and Green parks has decayed. The former was obtained from what are locally called the West Cliff quarries, the latter from the East Cliff, or near the extremity of the island.

The Bath stone is obtained, as its name implies, from one of the members of the great oolite in the neighbourhood of Bath. In colour this material is more agreeable than the Portland stone, and its texture is very similar, but it is softer (so much so indeed as to allow of its being worked with the tooth saw), and more absorbent; and, therefore, unless precautions are observed in the manner of using the Bath stone, it is exposed to rapid decay. Some very painful illustrations of this fact may be witnessed about London, and amongst others the restoration of Henry the Seventh's Chapel may especially be cited. The weight of the foot cube of Bath stone is about 123lbs., and the load it will bear before crushing is estimated to be 1,800 to 2,000lbs. per inch superficial.

The Caen stone is obtained from the great oolite of Normandy, near the town of that name, and is much used in building operations in London, on account of the beauty of its grain and colour, and of the ease with which it is capable of being worked; for when freshly quarried the Caen stone can be cut with the toothed saw and carved with ordinary carpenters' chisels, even more easily than the Bath stone itself. The upper beds of the quarries near Caen yield stones of small dimensions, but of a much more durable nature than those furnished by the lower beds. Unfortunately, however, the requirements of architects have induced the stone merchants to abandon of late years the material of superior quality in order to secure the large blocks now so universally called for; and thus the reputation of the Caen stone has rather unjustly suffered. But it is perhaps advisable here to remark that in the public buildings of the town of Caen, the local material is not usually employed in positions where it would be exposed to the rainfall, or be able to absorb water by capillary attraction; and that the basements, or the exposed parapets, towers, or steeples, are built of other and more resisting stones. The weight of the Caen stone is about 120lbs. per foot cube, and its crushing weight about 2,000lbs. per inch superficial.

In addition to the Caen stone, the oolite of Normandy supplies the London market with a material of great beauty, known by the name of the Aubigny stone, which is harder, finer in its grain, more crystalline in its structure, and able to support a greater crushing weight than the Caen stone. From the fearful state of decay of the mediæval buildings of Falaise, the town in immediate proximity to the Aubigny quarries, it may, however, be suspected that this material would not be of a durable character, notwithstanding the fact that the supply is now obtained from different beds to those formerly worked. But there are other stones to be obtained from Normandy, which might furnish our builders with extremely valuable resources, such as the Ranville, Fontaine Henri, Creuilly, Courseulles, and Quilly stones; unfortunately, they are little known amongst us, and the prejudice against the use of Caen stone, (in consequence of its failure when injudiciously employed in such buildings as Buckingham Palace, Mr. Hope's mansion, &c.,) has extended to the whole group of Norman stone.

All these varieties lately mentioned as coming from the oolitic series, are characterised by the remarkable purity of the carbonate of lime which constitutes the basis of the stones. The carbonate is often sub-crystalline, and generally speaking assembled in minute globules, similar to the roe of fishes, from whence the formation derives its name. Many shells, and vegetable and animal remains occur in some of the varieties, and they give rise to some peculiar and hitherto unexplained conditions of durability in the stones. Thus, when the *test* of the shells has been replaced by the decidedly crystalline carbonate of lime, they assume a remarkable degree of hardness, and if present in sufficient numbers they communicate great powers of resistance, as in the case of the Barnack, and the Roach Portland; but this influence of the shells may be imperceptible if the cementing material should happen to be of an earthy, or of a soluble character, and if much organic matter should be present, it would allow the formation of certain salts when the stone is exposed to air and moisture, which would seriously endanger its cohesion. The fossils also tend to define and separate their beds, and thus to render it more than usually necessary to pay attention to the practical law, that "stones should always be used bedwise;" and here it may be advisable to remark that whenever the materials of a stone have not been affected by their proximity to any source of igneous action, they will not admit of the stones being used in false bedding, although some varieties of the Jurassic limestone, or of the tertiary deposits of the Paris basin, are occasionally used in such positions without any immediate or apparent risk. Nearly all the oolites yield a pure rich lime, of great service in agriculture, but of little real value in building operations (on account of the solubility of the lime), unless mixed with some form of soluble silica. The blue lias lime, which contains a large proportion of the silicate of alumina, is, however, much used for hydraulic works.

The Purbeck limestones were formerly much used in London for paving footpaths, and some varieties were worked for sinks, troughs, or cisterns, under the name of

the Purbeck Portland, but the irregularity of hardness, and the small dimensions of the Purbeck flags have led to their almost universal abandonment in favour of the harder and more uniform Yorkshire stones. The Purbeck and Petworth marbles (which are composed of an agglomeration of freshwater univalve and bivalve shells, united by a crystalline carbonate of lime, of a pleasant green colour, and some considerable beauty) were formerly much used in ecclesiastical decoration, and, when placed bedwise, they have resisted the action of time very satisfactorily, provided always that the earthy variety had not been used. Some of the shales of the Wealden series are occasionally used to cover the roofs of buildings in Sussex, but their weight, and their very irregular texture, oppose their general application at a distance from the quarries.

Now, the conditions under which the stones above described decay when they are placed in a building, are partially mechanical and partially chemical. Of the former, the most important are, 1st, the dissolving properties of atmospheric moisture, in its various forms of rain or mist; 2nd, the disintegrating action of changes in atmospheric temperature. Of the latter, the most important are, 1st, the chemical reactions which take place in the ingredients of the stones themselves; and, 2nd, the new forms of matter which are superinduced from without, of a nature to affect the stability of the original combination.

The dissolving power of atmospheric moisture seems to depend greatly upon the quantity of free carbonic acid gas it holds in solution, and though this quantity in any given volume of water be extremely minute, in course of time every substance which has an affinity for it will yield more or less to its action. The silicates of potash and soda, for instance, which are present in the igneous rocks (or, to dwell especially on the class of materials under our notice, in the Devonshire granites), are easily decomposed when rain-water falls upon them; and, the felspar being removed mechanically by any of the countless actions of nature, it leaves the other ingredients of the material exposed to the mechanical disintegration of changes of temperature. The simple carbonates of lime, again, sometimes absorb carbonic acid with much avidity, and pass into the state of the soluble bicarbonates, and thus, in proportion as the original face of a stone is removed, does the lower surface become exposed to the action of the rain. The rain-water of such a town as London not only does contain large quantities of free carbonic acid, but it also contains sulphuric acid and ammonia, which are capable of exercising a very deleterious influence upon the carbonates of lime. In discussing, however, the effects of these agents upon building stones, it is essential to bear in mind the fact that the mechanical state of the elements of those materials greatly modifies their resistance. Those which are of a crystalline character do not yield so readily as those which are amorphous, and the crystallisation produced by volcanic or plutonic influence appears to be even more permanent than that which takes place in the ordinary way.

It follows from these considerations that the stones of an irregular, confused, earthy texture (which are able to absorb considerable quantities of moisture, and which contain silica in a soluble form, or the carbonate of lime), should never be employed in positions where rain water could lodge upon them, beat against them, or be taken up from external sources by capillarity, or any other action. In positions exposed to any of the above dangers, none but non-absorbent, and decidedly crystalline, materials should be used, and as those qualities are almost exclusively possessed by dense stones, it may be considered that the mere specific gravity of a stone is a *prima facie* indication of its constructive value.

But atmospheric moisture, when absorbed into building stones, acts upon them quite as much through the changes in its own volume, in passing from the liquid to the solid state at the time of frost, as it does by the chemical dissolution it produces. If the stone should be placed in such a manner as that water should accumulate in any perceptible quantities between its various layers, and if the position of those layers be such that the expansion of the water in freezing cannot take place freely, the respective layers containing the water will be violently detached from one another. Now all stones, even the crystalline limestones and slates, have certain planes, or directions of cleavage, or of stratification, along which water flows more readily than in any other course. If the stones be placed in a building with those planes in a direction likely to retain rain falling upon, or absorbed through, the surface (which is the case when stones are placed "bed to weather"), disintegration must ensue, unless the edges of the beds be left free, and even in that case there is danger of frost detaching one layer from another. It is indeed a primary law of construction that every stone should be laid "bedwise;" and few modern theories have produced so much practical mischief as the one lately propounded, that "it was a matter of little importance in what direction of the bed a stone was laid." Fortunately, even unpractised eyes can detect the bedding of the majority of the London building stones, either from the position of the fossils, or the variety of texture, or of colour; in the less distinctly marked stones even, practised eyes can detect the planes of cleavage, and a good workman will hardly ever be mistaken in his judgment. It is unfortunate that the modern system of competition throws so great a temptation in the way of the practical builder, as to render it a mere matter of chance whether the constructive law, above-mentioned, be observed or not, unless a costly system of supervision be organised, and thus the precautions often taken by the stone merchant, to indicate the upper bed of the material he delivers, are defeated.

In the stones which present distinct traces of bedding it often happens that a difference of the chemical, and even of the mechanical structure may be observed to exist in the respective layers about the lines of separation; under such circumstances, when the stones are laid bedwise, it is by no means rare to see the softer parts, near the lines of bedding, removed to a considerable depth from the surface. This action may be observed, amongst other instances, in the Purbeck marble of the pillars of the choir of Westminster Abbey, quite in the protected parts of the building. It would seem that, in this particular case, the more earthy particles upon the planes of bedding are decomposed by the action of the moisture they absorb from the vapours suspended in the atmosphere, and that the cohesion of the various particles being thus destroyed, they gradually fall away. Westminster Abbey furnishes also numerous illustrations of the danger of placing stones, of whatsoever description they may be, in any other than the natural bed; for even a glance at the sheltered parts of the north transept, in the Church-yard, would enable anyone to detect, by their conditions of decay, the stones which have been laid well or ill.

The chemical reactions which take place in building stones, (other than those resulting, in the interior of the country, from the agents directly presented by atmospheric moisture in the form of carbonic acid gas, sulphur, and ammonia, or upon the sea shore, in the form of hydrochloric acid, or of common salt itself, in minute particles,) are mainly those arising from the oxygenation, or the hydration of the various ingredients of which those stones are composed. Thus, if the oxide of iron be present in any notable proportions, it is likely to undergo changes of a nature to disturb the stability of the compound, and even the crystalline sulphates of lime are exposed to chemical decomposition, in consequence of the liberation of the sulphuric acid gas they contain. The other mineral salts, such as the silicates and the sulphates of iron, so often met with in building stones, are at times susceptible of very injurious decomposition, and the soda, potassa, or the organic matters the stones may contain, as frequently give rise to the formation of new salts; mainly under the action of the atmospheric moisture, it is true, but also under the influence of the partial decompositions which take place around them. It is to be observed, however, that the danger to building stones from this peculiar class

of influences, is very small and very slow in its action, compared with the dangers arising from the mechanical disintegration produced by atmospheric causes; and that, with the exceptions of the action of free carbonic acid upon the felspar of granites, of the changes of state produced in limestones by the same agent, and the modifications of the abundant salts of iron in some peculiar stones, there is little practical necessity for dwelling upon this interesting but obscure branch of applied chemistry.

The actions capable of affecting the stability of the composition of ordinary building stones, by reason of the new forms of matter they superinduce, may principally be considered to be those resulting from the absorption of the gases of the atmosphere, and especially the extraordinary process known by the name of "salpetering," or more correctly speaking, of nitrification. This process displays itself in the formation of minute crystals, efflorescing from the interior to the exterior of the stone, and it leads to the destruction of the exposed surfaces of the latter, through the gradual removal of the minute particles, in consequence of the disintegration produced by the expansive action of the crystals in process of formation. It is supposed that the organic matter diffused through nearly all stratified deposits gives rise to the formation of certain nitrates (such as the nitrate of lime, or the nitrate of soda,) under the influence of damp, and of air, and of light of certain descriptions—for nitrification certainly takes place most abundantly near damp ground, rising in a wall *pari passu* with the range of the capillary attractions of its materials, and upon the northern or shaded faces of the said walls. Not only does this nitrification throw off the minuter and less adherent particles of the building materials themselves, whether they be stone or brick, but it is also able to detach any protecting coat which may be put upon them, if the adhesion of that coat to the subjacent material should not be of a very energetic nature. Let the adhesion, however, be ever so energetic, if once the action of nitrification should have been established, it must run its course, and the amount of evil it is capable of producing will simply depend upon the quantity of organic matter originally contained in the materials, or susceptible of being absorbed by them from the atmosphere. The secondary limestones which have not been affected by plutonic action, the loamy clays, some kinds of pit sand, sea sand, and some descriptions of natural cements, are particularly exposed to the danger of nitrification in damp positions; and whenever it is once established, it is in vain to expect to be able to preserve any mural paintings, or even any culpture of a delicate character. Dumas and the French chemists appear to consider that the atmosphere itself would be capable of furnishing the nitrogen required for the production of the effect under consideration, but there is hardly any occasion to resort to so extreme a supposition, when we reflect upon the extraordinary diffusion of the remains of animal life in stratified deposits. It is also to be remarked that nitrification will frequently take place in the most dangerous manner precisely in those materials whose exposed surfaces are covered with coatings impervious to the air; and that in houses or buildings of that character it is most energetic on the interior faces of the walls, or precisely on those which are the least exposed to the atmosphere. In fact, it is mainly in consequence of the absorption of moisture by the building materials, and of the chemical changes thus produced in the organic matter those materials may contain, that the peculiar form of decay which accompanies "saltpetering" arises.

Practically then, the great agent of destruction of building stones, in any of its modes of exhibition, is the damp, or the water supplied by the atmosphere, either directly or indirectly, and the efforts of those who seek to prevent this destruction must be directed to combating this primary source of evil. Fortunately the precautions to be observed for this purpose are very simple, and they only require a little common sense on the part of the builders charged with their application to the materials at least which have been long before the public.

The first and foremost rule is never to employ a porous absorbent stone in the ground or in elevation; unless, in the former case, it be maintained constantly wet; or unless, in the second, the absorption of moisture from the ground be prevented by the interposition of some impermeable material. Stones of the description just mentioned, should never be employed for the copings, parapets, window-sills, weather beds of cornices, plinths, strings, or other parts of a building where water may lodge. Care must also be taken to bed such stones with mortars which are not exposed to develop in themselves, or are not likely to excite in the stones the efflorescence of any of the nitrates of soda, potassa, or of lime. If porous or absorbent building stones must, however, be used in exposed positions, and no efficient precautions be taken to prevent their decay, it will be found that the decay will commence, and be most apparent in the zone of alternate dryness and humidity, or, as the workmen say, "between wind and water." The stonework about that zone should therefore be executed in such a manner as to allow of its being easily replaced, if requisite, and in case the exhibition of the decay should take place towards the interior, care must be taken to isolate the decorative plastering, or wall linings from the surfaces which are likely to be covered by efflorescence. These precautions are, after all, only very unsatisfactory palliations of an evil which ought never to exist, and it is therefore advisable to direct the attention of our English builders to the practise of their French neighbours, who use different stones according to their position in a building. In Caen itself, for instance, the plinths or basements of houses are executed in granite, or in the Ranville Cherence, or Creuilly stones, which are practically non-absorbent; and, moreover, in the best buildings the Creuilly stone is used for the exposed parts of the elevation, although the Caen stone is found at the very gates of the town.

But even when every precaution has been taken to prevent the absorption of moisture from the ground, or the actual rainfall, it is necessary to protect the exposed surfaces of the soft and absorbent, (or, to use a technical phrase, of the hygrometric stones,) by some coating which shall prevent their taking up the injurious moisture from the air. This is done in various ways; 1st, by painting; 2nd, by impregnating the exposed surface with oleaginous or fatty matters; 3rd, by washing the face with some solution able to convert the material itself into an insoluble non-absorbent substance; and, 4th, by filling in the pores of the stones with an insoluble material which should effectually exclude water.

1st. The objection to oil paints consists in the fact that in proportion as the oils which serve as their vehicles evaporate, the particles of the stone they originally protected become again exposed, and even the absorbent powers of the stone itself contribute to this action. It, therefore, becomes necessary to repeat the painting frequently, and thus in the end, the delicacy of any mouldings or carving must be effaced. The unequal rates of expansion of the stone and of the oil paints in time of frost, tend to increase the danger of irregular and unequal exposure above attributed to the evaporation of the oil.

2nd. As to the injection of oleaginous, fatty, or waxy matters, it must be evident that it likewise can only act mechanically by closing the pores of the stones; and, therefore, although instances may be cited in which when the surface so protected is maintained at a constant moderate temperature, the system of injecting those materials has succeeded; yet, if the protected surfaces be exposed to extremes of heat and cold, the heterogeneous materials thus affected must be acted upon in very different manners. Experience has confirmed this theoretical inference, and it has been found in practice that the protecting coats of any of the materials alluded to, are gradually detached from the stone, and that they require to be renewed quite as frequently as oil painting itself does, when used on the exterior of buildings.

3rd. One of the most successful attempts yet made to prevent the decay of soft building stones, by washing their ex-

posed faces with a fluid able to affect their nature, is the process lately introduced by M. Kuhlmann,* in which the carbonates of lime are washed with a solution of an alkaline silicate, with a view to converting them into silicates of lime, through the elective affinities of the lime and the silica. In some cases this ingenious and beautiful system has succeeded, and very great hardness, very resisting powers, have been communicated to the stones operated upon. But, unfortunately, the action of the silicic acid is a very slow one; and when the surfaces washed in the manner described are exposed to rain, it is by no means rare to find that the solution is carried away. There is another very serious objection to the use of the simple alkaline silicates, namely, that when they do act upon the subjacent stone, the soda and potassa (which are generally used) are left free, and in efflorescing, they are likely to carry away the finer details of the sculpture or moulding; at the same time, as they form, to some extent, deliquescent salts upon the face of the stone, they attract to it a dangerous amount of humidity.

4th. The problem of protecting the surface of a soft building stone, after every precaution has been taken, be it observed, to prevent the internal absorption of moisture, seems to me to have been the most successfully solved by Ransome's last patent process. In this process, a fine precipitate, clothing the whole of the pores of the surface of the stone, is produced by firstly cleaning the stone carefully from dust, or other extraneous matters; then the stone is made to absorb as large a quantity as possible of the silicate of soda or of potassa, and when this solution has dried into the stone, a second wash is applied, consisting of the chloride of calcium or of baryta. In practice, Mr. Ransome uses the most frequently the silicate of soda and the chloride of calcium; and the effect of the respective applications is, that a double decomposition takes place in the washes, giving rise to the precipitation of a finely crystallised silicate of lime or of baryta, in the pores of the stone, and an efflorescence of extremely soluble salts of the chlorides of soda or of potassa. The former remain in the pores, the latter are speedily washed away by rain. As the rate of contraction and expansion of the silicate of lime is, as nearly as may be, the same as that of the stones it is intended to protect, there is no danger of the precipitate being detached by this cause. It may be added that Kuhlmann's process is only applicable to the preservation of the carbonates of lime, whilst Ransome's process is equally applicable to that class of materials, or to the sandstones, or even to bricks, or plaster, or cement. It was precisely to this process also that I referred when speaking of the use of chalk as a building material, and I am convinced that, by its application, that abundant and economical substance might be very advantageously applied to our daily wants.

Perhaps it is going a little beyond our immediate subject, but I cannot refrain from saying that the principle of the double decomposition applied by Ransome to stones, might be applied to the precipitation of a soluble glass upon woods or textile substances, and even to the protection of timber from the attacks of the boring worms.

Finally, I repeat what I have said elsewhere, namely, that the common sense of the whole matter is to use only such stones as have been proved by secular experience in the locality of the building to be little exposed to decay. I use the term "secular experience," because the Commission appointed to select the building stone for the Houses of Parliament (which Commission is said to have cost the country £11,000 for its report, and, perhaps, £200,000 extra on the price of the labour of the building), recommended an untried stone, mainly upon faith in the indication of Brard's test, which had, even in those days, been seriously challenged. The consequences of this unfortunate error are now notorious, and it is worthy of remark that the newest parts of the Houses of Parliament, viz., the west front, are precisely those which are the most seriously affected.

* See *Journal*, Vol. VII., pp. 521, 532, and 584.

There are, however, many economical and constructive reasons for resorting occasionally to the use of soft, easily worked, and, as such, almost always perishable stones. In such cases, those stones must be isolated from ground, or other damps, as effectually as possible, and their exposed surfaces covered at once with an efficient protecting coat, before the process of saltpetering can commence. I believe that Ransome's process is the best which has been yet presented to the public for this purpose; but, at the same time, I equally believe that if any internal decay, or any organic decomposition, so to speak, be once allowed to establish itself in a building stone, it will be impossible effectually to arrest its progress. The efflorescence produced by any serious tendency to nitrification, will, in fact, continue, however effectually the exposed surface of the stone be closed by a mechanical or a chemical deposit, and it is precisely on this score that we may explain some of the equivocal results of even Ransome's process for preserving stones, which are said, I believe untruely, to have taken place. Whatever process may be adopted for protecting the surfaces of soft stone, it is, moreover, necessary to pay attention to the constructive law of laying them upon their true bed, and also to protect the more exposed portions of the work by covering them with harder, more resisting, and impermeable materials. Even the latter materials themselves are at times exposed to decay between wind and water, and, therefore, every possible precaution should be observed to limit the range of the absorptive powers of the stones—the first and foremost precaution for basement works being to establish an effective drainage all round the building, at such a distance from it as to prevent the capillary action of the stones themselves from obtaining any supply of moisture from the ground. In the upper parts of a building it is equally essential to prevent the rain from lodging upon any portions of the stone work, especially when absorptive stones are used above projections likely to arrest falling water.

DISCUSSION.

The Chairman said the subject introduced by Mr. Burnell's paper was so very important, that he was sure they would feel thankful to him for having brought it before them, and for having collected so large an amount of valuable information bearing upon it. No one could walk through the throughfares of the metropolis, or any other large city, without observing the remarkable effect which the tooth of even a very young Time had had upon nearly all our modern buildings. He had no doubt most persons present could recal to their minds some building or other which had been re-faced, even by the same parties who had originally erected it. It was of the utmost consequence, not only that the public should fully feel the necessity of selecting a good stone in the first instance, but that, if possible, some means of indurating the softer stones, which we were driven by economy to use, should, if possible, be discovered. There were a number of points offering themselves in this paper on which he had no doubt they would hear comments. There were texts for many essays, and perhaps there were some sentiments to which gentlemen present would take exception. He was not quite certain whether the expression which Mr. Burnell made use of, that the decay of the stone in the Houses of Parliament was very painful, not to say shameful, was quite justified, because he rather thought Mr. Burnell considered it more easy to distinguish between a good stone and a bad stone than most persons found it in practice to be. In fact his impression was—and it was borne out by the opinions of many practical men—that when a stone was once out of the quarry, it was almost impossible to say whether it was a good stone or a bad one. It would perhaps have been well if Mr. Burnell had dwelt to a greater extent on the numerous varieties of Bath stone, because that stone, when taken from some quarries, stood very well, whilst that from other localities, not far distant, would not answer for external work in England—certainly not in

large towns. Touching the Caen stone, it was clear that much of it was really good; but the conduct of the Caen stone quarry owners seemed to him to be of the most suicidal character. Not many years ago, having occasion to use Caen stone in large quantities (although he had not himself recommended it), he visited the quarries in company with Mr. C. H. Smith, and they then made an examination into the condition of the beds. As many of them knew now, although it was not so well-known then, more than one of the beds of that stone were notoriously bad. It would not stand when exposed externally. Those beds yielded much larger blocks; they were easily worked; and they offered great temptations to builders, and, consequently, this inferior quality was sent to London and other places indiscriminately with the good stone. Mr. Smith and himself called together some of the quarry owners, and suggested to them that they should mark the stone from the soft beds, so that it might only be employed internally, and if it was used externally the fault would be the builders'. Only one firm would promise to do that. The other quarry owners said "What are we to do with it? Some persons think it is the best stone. We must send it wherever they will have it." The announcement that that one firm had made the promise had had the effect of increasing their business; but whether they had ceased to carry out that suggestion, or whether the amount of bad stone sent was so much larger than the better qualities, certainly the Caen stone which was sent to this country could not now be depended upon, and ought not to be used for external work. He had himself been grievously disappointed with it, and should fear, under ordinary circumstances, to use it. With regard to Buckingham Palace, where Caen stone was used, that was perhaps the most remarkable failure that ever was witnessed. He recollected seeing the new front of that palace about a year or a year and a half after it was finished, and he found many parts in a state of perfect ruin. Large masses of stone were in the habit of falling from the cornices to the great danger of the sentries below, and the result was the necessity of knocking off vast portions of the decorations and making them good with cement, painting them several times, with a frequent necessity for repeating that costly process. The late Mr. Thomas Cubitt felt this most acutely, and he (the chairman) alluded to it rather in justice to the memory of that gentleman, who was not to blame in the matter. The circumstance affected him deeply, although he had not determined upon the use of the Caen stone, and had employed every means to obtain it of good quality. Touching those processes which had been brought before the public from time to time to harden this and other descriptions of stone, only one or two were now at all spoken of—only one, he believed, besides the two mentioned by Mr. Burnell. He had watched with considerable interest the application of Ransome's process, especially in the case of the chapel in Bloomsbury; and he should be delighted to find, when sufficient time had elapsed to enable them to judge properly, that it had the effect which theoretically they might justly look for. He thought he should now best discharge his duty by abstaining from further remarks, and by inviting gentlemen to favour them with their experience upon the subject treated in the paper.

Professor Ansted, F.R.S., said, as he had taken considerable interest in the subject of building materials, and the decay and preservation of them, he would offer a few remarks. He would say but little with regard to the materials themselves,—so many of which had been described in the paper, although some had been left undescribed, more particularly some varieties of English stone. The variations in the Bath stone were very remarkable. He had seen many cases in which that stone was used with success, whilst stone from the same quarry had decayed in other situations almost immediately. He proposed to confine his remarks to the two points—the causes of decay, and the means of preservation. Mr. Burnell had remarked that the decay of granite arose from the decomposition of the felspar which it contained. There could be no doubt that those felspars which contained soda generally decomposed, whereas those which contained potash did not. There were, however, exceptional cases, arising from peculiar conditions of hardness, which affected all crystalline stones in a remarkable degree; but here there was a doubt as to whether the conditions of hardness which exhibited themselves in the stone when taken out of the quarry were those which could be depended upon for future durability. He thought, generally speaking, those granites of which the felspar was hard, and did not contain soda, might be depended upon to last for an indefinite period, and that, too, without reference to climate. It was, perhaps, as little affected by climate as any stone. With regard to the causes of decay of limestones, they were, to a great extent, mechanical. Limestones must absorb more or less of water. They always contained water. It was quite impossible, under any circumstances, to get limestone that did not contain water; but all limestones that were used for building were decomposed partly mechanically and partly chemically. These stones were partly crystalline, and this often caused an irregularity. Some of the oolite limestones were so variable in their character that no one stone could be taken as a sample of the rest. In other cases the crystallisation had gone on more regularly; there was more evenness in the condition of the stone, and the decay would not be so irregular; but still there was in all the limestones used in England—whether those of our own country or those imported—a great amount of irregularity in the grain and in the amount of absorption. In this the great difficulty lay. The dolomite limestones, being composed partly of carbonate of lime, and partly of carbonate of magnesia, were in a different state. Where the carbonate of lime prevailed, the stone was apt to take a powdery character, and consisted of grains in a fine state of division, which were easily separated as soon as a mechanical change took place, and those were combined with more crystallised portions, which consisted principally of the carbonate of magnesia; it was one of that class of stones that was selected as being the best adapted for the construction of the Houses of Parliament. So long as those stones were crystallised they were the best stones that could be taken, and the specimens examined in the churches in the neighbourhood of the quarry selected went to prove this, but unfortunately the quarry from which the stone for the churches had been taken, was not found to be in such a state as to supply so large a quantity as was required for the Houses of Parliament, and they were obliged to go to another quarry in the same neighbourhood, which was not of the same quality of stone as that which had been experimented upon by the commissioners. No doubt that was the correct history of the matter. With regard to the decay of sandstones, that arose chiefly from the cementing materials of the particles of sand; if the cementing material was pure carbonate of lime, or mixed with oxyde of iron, it would undergo the same changes as other carbonate of lime would. It would be acted upon by moisture and the carbonic acid gas which prevailed in the atmosphere of large towns, and those causes must produce a certain amount of decomposition. One great danger arose from the stone not being put in such a position as to have the full benefit of its stratification. If this were done the stone would peel off, whereas this could not happen if it was laid bed-wise, which was the only proper position in which a stone should be placed. Now as to the modes of preservation. This was a very simple thing to talk about, but a very difficult thing to accomplish. It was easy to see that if a stone could be coated in such a way that moisture could not get into it, and provided there was no moisture in the stone already, the thing was done. But the difficulty was to manage this, and it arose from the fact that no paint, no substance that contained organic matter, could by possibility be long of any use. It might last for a time, but if it was capable of being acted upon by the atmosphere, and became

oxydised, then after a time it failed. The surface peeled off, and the moisture got in. The moment the moisture got into the stone the mischief began, and the work of destruction would go on as much as if the stone had never been covered at all. The difficulty was to find some material which would form a permanent coating upon the stone, preventing the entrance of atmospheric moisture, and doing so in such a manner that it was not liable to decay from the atmospheric influences to which the stone was exposed. Those were not altogether mechanical, though to a great extent they were so; the chemical conditions must also be carefully considered, when the materials of the stone or the particles with which the grains of the stone were cemented together, were exposed to the action of the atmosphere. The injurious atmospheric influences consisted partly of carbonic acid gas and partly of sulphurous acid—ultimately sulphuric acid in a diluted form; and there were other substances present in the air which had not yet been sufficiently examined. Those were enough to injure by dissolving the material of which the stone was composed. Now came the question of the irregularity of the grain of the stone. The moisture would eat away the more granular parts of the stone faster than the other parts, and by the capillary attraction between the grains of most stones, the moisture containing the acids would be absorbed through the crevices into the stone to some depth, and there would do its work till it produced a larger crevice, and made way for the water to act in a more direct form, and then, with the temperature of the moisture below 38 degrees, it expanded, until the water took a solid form, and disintegration ensued. Then came the question—How was this to be prevented? The old method adopted with stones and cement, was to paint them, but that would only do under certain circumstances. It was an expensive process, and was unfitted for large public buildings. The next thing was to find some material which would form a coating upon the surface of the stone, and prevent the absorption of moisture. That had been tried over and over again. Kuhlmann's process, although very ingenious, was not a modern one. Kuhlmann believed that, by washing the surface of the stone, or soaking into the substance of the stone a solution of silicate of potash or soda, or "water-glass," as he termed it, a permanent surface could be produced without much difficulty, Kuhlmann believed that by putting in that solution of silicate of potash, he should produce a chemical change in the limestone, and form a silicious carbonate, or perhaps a silicate of lime. As far as the silicate was concerned, it would only be in a granular form. When silicate in this form was produced, it was deposited in detached grains, therefore he feared but little good would result from this process. It was true that it succeeded, by a slow process of change in a dry atmosphere, in obtaining a hard and durable surface, and he thought that perhaps when this process was very carefully adopted—when the material from which the soluble silicate was made was pure, and the operation was carried out in a dry atmosphere, it might be successful, but it was clear that that method could not be adopted in any building in our own climate. It had been tried in the less humid atmosphere of France, and failed, and if it failed in France it would do so more rapidly in England, because the climate of the former country was better adapted to help forward the process. Mr. Ransome had re-invented Kuhlmann's manufacture of soluble glass. Mr. Ransome tried the same experiments and found them fail, and then it suggested itself to him whether, after all, he could not produce an effectual process, which should be independent of the dryness of the atmosphere; and, by combining the first wash of the soluble glass with a subsequent wash of chloride of calcium, he seemed to have succeeded—theoretically he had been, no doubt, successful. The double decomposition took place immediately, and the result would, of course, be the formation of a chloride of sodium and silicate of lime. What was the silicate of lime? They had only to look at the specimens of mortar which they found in old buildings to see the effect of this silicate of lime deposit. The cause of that peculiar power of the mortar to attach different pieces of stone together was, that the grains of sand which were made use of in mortar became coated with a silicate of lime, and the surface also to which the mortar was applied was coated in the same way; and this silicate of lime adhered so strongly to substances foreign to it, which it attached together, that practically the most perfect junction was effected; and when the mortar was very old the substance of the stones would separate more easily than the mortar. If they could deposit this thin film of silicate of lime they would do all that was required. In large quantities silicate of lime was not so available as in smaller quantities. There was something in this thin film attaching itself to a foreign body; and it was the particles attaching so strongly to each other which produced the remarkable effect which was found in old mortar. But still no doubt time had something to do with it. The deposit of the thin film of silicate of lime, he imagined, was hardly in a crystallised state, but no doubt this deposit was the whole secret of the success. There could be no doubt but that the silicate of lime was deposited, for all who looked at that part of the Houses of Parliament which had been washed by Ransome's process, after having been exposed for four winters, would see how the case stood. It appeared that there was too much of the silicate put in, which had given an unsightly appearance to the stone. That, however, had been corrected since. The surface there was very distinctly coated with a substance which was so hard that he could not scratch it with a knife; and though there was considerable efflorescence upon the surface acted upon in this way, yet this could be washed off. The efflorescence came off easily from the whole surface; therefore, as far as the test of these four years were concerned, the results must be regarded as satisfactory. The other instances of the application of Ransome's process with which he was acquainted were not so old as that to which he had just alluded, and of course were not of so much value. But he believed there had been no efflorescence in the case of the chapel at Bloomsbury; and of the other cases he could not say more than that they had the appearance of being in a satisfactory state.

Mr. C. H. Smith wished in the first place to correct the statement made in the paper with regard to the expense of the commission which was appointed to report on the best description of stone to be used in the construction of the Houses of Parliament. He was one of the four commissioners appointed, and he was able to state that, instead of the cost being £11,000, it was under £1,400, and the commissioners were travelling exactly 50 days whilst occupied in their investigations; and inasmuch as specimens of all the descriptions of stones brought under the notice of that commission had been deposited in the geological museums of England, Ireland and Scotland, he thought the money had not been entirely thrown away. With regard to the selection of magnesian limestone for the Houses of Parliament, he believed that if other parties had to conduct the same investigation over again, they would come to the same decision; but in this case no person was appointed to exercise a supervision or inspection of the stone as it was delivered from the quarry. They need not, therefore, be surprised that the quarrymen pushed in all the stone they got; and there was a great temptation to use bad stone when there was nobody to object to it. The commission to which allusion had been made consisted of Sir Henry De la Beche, Dr. William Smith, Sir Charles Barry, and himself, and they were occasionally assisted in their investigations by Dr. Buckland and Professor Phillips, and in the chemical department by Professors Daniell and Wheatstone. Seeing there was no supervision of the stone as it was delivered for use, his only surprise was that things were not worse than they were. As examples

of the same description of stone, he might mention the Museum of Practical Geology in Jermyn-street, in which there was scarcely a bad stone; also the offices of the Amicable Life Assurance Company, in Fleet-street. The latter building was finished within about seven months after the return of the travelling commission, and in the stone of that structure there was scarcely a trace of decay; indeed, it was sent from the quarry as a specimen of the best to be found there. When the defective state of the stone used in the new buildings in Lincoln's-inn was discovered, he (Mr. Smith) having been at that time sent by the Government to see whether the quarries were being worked well, took the opportunity of inquiring of one of the foremen where the stone used at Lincoln's-inn came from, and he was taken to two particular beds. Upon putting his finger upon the stone that was then being quarried it left an impression, which showed the stone to be in a state of decay, even while in the quarry; and the reply to his inquiry, how that stone came to be used, was that the builder would not have any other, because it yielded him the best profit. He might mention the case of another building in London, of magnesian limestone, viz., the manufactory of Messrs. Day and Martin, in Holborn. It appeared that one of the partners, having an interest in some particular quarry, insisted upon that description of stone being used for the building. It decayed so rapidly that it had to be plastered up in many places, and had been often painted since. Mention had been made of the decay of granite. He believed that was occasioned by the decomposition of the felspar, and this was evidenced by the enormous beds of sandstone in which there were the grains of sand, the plates of mica, and the clay which he thought indicated the decomposition of the felspar of the granite. With reference to the Portland stone, he considered it was one of the finest in the world, and owing to the facilities for water carriage was well situated for the London market and England generally. Previously to the decision being given as to the description of stone for the Houses of Parliament, there was some doubt expressed whether the merchants would be able to supply a sufficient quantity of Portland stone for these buildings, and it happened that, at the same time, Sir Charles Barry was about to build the Reform Club-house in Pall-Mall. For this building Portland stone was selected, and as the decision with regard to the Houses of Parliament was then doubtful, the quarry proprietors naturally supplied the best stone for this club, wishing to gain for it a favourable reputation. He did not think there was a bad stone in the whole stauctire, and though exposed to three different aspects for upwards of twenty years, it had stood perfectly. It seemed to have been a mania, of late years, for architects to use soft stone, and spend large sums of money to preserve it from decay, which in the end cost as much as if the best stone was used. With reference to the Caen stone, Mr. Burnell had alluded to Mr. Hope's mansion in Piccadilly. He (Mr. Smith) thought that was one of the best specimens of Caen stone to be found in London, and that it had stood well. The chief cause of defective stone being used rested with the architects. A young architect would like to make as much display as he could for little money. To make a great show he used a cheap description of stone. It was generally put into the contract that the best materials only should be used, but it might be a question whether young architects, or even old practitioners, knew what was really good stone, and they would not apply to those who did. The builder naturally preferred a soft stone, because it was easily worked, and yielded him the largest profit. With reference to the bedding of stones, allusion had been made to a remark which had fallen from him some years ago, that it did not matter which way the stone was put upon its bed. What he stated was, that sandstones would be sure to decay if they were placed (as he had seen Craigleith stones) edgewise, because that stone would always, more or less, laminate; but with regard to oolitic stones he thought the most experienced in such matters could not say which way the bed was. With reference to the effect of sea air, and salts, and alkalies, upon stone, he would remark that sea air was not injurious to good stone, and bad stone would decay, put it where they would. An extraordinary specimen of the Portland stone exposed to the sea air was to be found in Sandysfoot castle, near Weymouth, which had stood since the time of Henry VIII., and at every storm and high tide was washed by the spray, and yet that structure externally was as perfect as ever. With reference to the "saltpetreing" of stone, he thought this must come from the brickwork behind, and it was not confined to any one description of stone. In the analysis of the stones examined by the commission before alluded to, as shown in the report of the commissioners, they did not find a trace of any salts in the stones which could produce this action, but efflorescence would come through a stone, however thick it might be. Mr. Smith mentioned the results of some experiments he had made with limestone, by exposing it to the most violent tests of alkalies and salts, much more severe than any that could act in nature, and, as he showed by specimens, hardly any perceptible effect had been thus produced. In coating stone with any of the preparations named for preserving it, the great difficulty was to get the preservative material deep enough into the stone to be of use. If it was put merely upon the surface he considered it would have an almost injurious effect. If it did not penetrate deep enough into the stone to be beyond the influence of wet, the stone would come off in sheets. He had observed that in both the Conservative and Carlton Club-houses; all the projections were not protected from the wet by lead or slates; he had, however, advised the architect of Mr. Hope's mansion to avoid this error, and the result had been that none of the projections of the building exhibited any symptoms of decay. An immense number of patents had been taken out for the preservation of stone from decay, which were accompanied by hosts of certificates of a recommendatory character. Trials almost without end had been made upon the Houses of Parliament,—in most cases without success. Indeed, until time and weather had operated upon them, it was impossible to say how they would answer. Nature found out means of decay which the most scientific chemist never thought of. He had endeavoured for years past, in association with eminent chemists, to trace those causes, but even when they had found out the causes, it was doubtful whether they could find a remedy. As far as his own knowledge and experience went, the process of Mr. Ransome appeared to possess an advantage over all others. He had strongly advised Mr. Ransome to afford such a public test of his process as would, by comparison, place the question beyond all doubt, and this had been done by coating half the surface of a stone which was admitted to be in a state of decay. The effect of the process could thus be rigorously tested. Amongst the various wild schemes which had been put forward, there was one which recommended that every stone, before it was put up, should be confined in an air-tight chamber, then put into an oven to be baked, and then put into a boiling solution for eight hours. He need hardly say how impossible it would be to carry out such a suggestion.

Mr. Robert Hunt, F.R.S., was desirous of correcting what he considered an error, into which the author of the paper, his friend Professor Ansted, and the last speaker had all fallen with respect to the decay of granite. It had been stated, as the opinion of those gentlemen, that the disintegration of the granite was due to the decom position of felspar. He was prepared to maintain that it was not due to that course. Mr. C. H. Smith had stated that the China clay was produced by the decomposition of the felspar with the granite, and that this was going on at the present time. He (Mr. Hunt) was prepared to prove that such was not the case. He was prepared to prove that the China clay, so far as human observation could go, never was true granite; and also, that atmospheric decomposition acting upon felspar

had never gone to the depth of 300 feet, at which depth they found finer China clay than they did nearer the surface. He could take them over miles of country strewed with felspar. The quartz was gone, but the felspar remained. Passing from that subject, they had entered upon the consideration of the means by which the decomposition of the ordinary sandstone was effected. Let them see what were the conditions. If they went to the old abbeys and churches, they found stones which were taken from quarries now in use, upon which the marks of the tools of the workmen made 800 years ago were still perfect, and yet they found stone from the same quarries, when taken to London, Liverpool, Manchester, and elsewhere, in a short time showing a lamentable decay. Let them ask themselves how that arose? There appeared to be one set of circumstances which had been overlooked by those who had been called upon practically to attend to the matter. They must remember that in all large towns an atmosphere was produced which was more or less impregnated with gaseous exhalations, and they found the water—the dew and the rain—impregnated with sulphate of ammonia and carbonic acid. If they took any porous body—sandstone, or any body analogous to it—as had been shown by the investigations of Prof. Graham, they found that it had extraordinary powers of absorbing within its pores gases which were brought into contact with it. Moreover, if they took any of those sandstones, and used them as a filter, and passed through them water impregnated with any of those salts or gases, and tested the water after it had passed through, they would find that by the mere mechanical action of those pores, those salts and gases had become separated from the water, and were retained in the stone, and by-and-bye chemical action gave rise to a decomposition which was constantly being noticed. A careful series of experiments in this direction would be very important. Discussion was comparatively of little value; there must be extensive experiments made before they could arrive at the truth. But seeing that it was the porous condition of the stone which they had to deal with, the great question to be decided was, how they were to prevent that extraordinary porosity? It was true that theoretically Kühlmann's process should answer, because they knew if they placed a stone in a solution of silica there was a process of substitution, by which they got it thoroughly silicified into a compact mass. But this took time, and during that time the silicious solution was frequently washed off. His attention had been called, during the last two or three years, to Ransome's process. It appeared to him more satisfactory than any other he had met with. There they had a silicate of potash applied to the stone, the surface of which had been rendered as clean as possible. The result was, absorption. They then applied to the surface ordinary muriate of lime, which penetrated within the stone by two different actions, the one being the force of capillary attraction, the other of chemical affinity. Chloride of potassium and silicate of lime were formed; the one being soluble was removed by rain, and the other remained to fill the pores. The great success of this operation, which after all could only be decided after a lapse of years, depended upon the fact that by filling up the pores with this silicate of lime, they prevented the osmose action going on within the pores of the stone. He was satisfied that they could only come to a correct conclusion upon this question by experiments, which the Institute of Architects would be wise to undertake.

Professor Tennant remarked that it appeared to him that architects ought not to confine themselves to the stones already used, but in a country like England, intersected by railways in every direction, they might get a supply of new materials. It was only prejudice which caused people to adhere to the old system. He was acquainted with numerous limestones which might be worked at small cost and brought into the market; but when he had spoken to parties upon the subject, the reply was that architects would only use those stones which had already been introduced, nor would the builders use any other. But with the lines of railway intersecting the country they were not left to the system which obtained at the time their splendid old cathedrals were built. If they went back to the days when those magnificent structures were raised, what were their conditions then? They had no railways or canals. If they looked into any old encyclopædia, they would find that the cost of conveyance from London to Windsor was put at the small charge of £3 10s. per ton, in consequence of the canal that was made. A ton of goods would now be conveyed the same distance for a few shillings, and in as many hours as it before occupied days. If they had a geological map before them, they might point out a wide area, and new fields for observation. His own experience convinced him that there was no place where they used worse building materials than in London, both bricks and stone.

Mr. Warington said it appeared that in London two classes of magnesian lime-stones were used for building-purposes—a compact one and a porous one. The compact stone, from the aggregation of the particles, withstood the influence of the atmosphere, whilst the porous stone underwent those remarkable changes of which they had heard an account that evening. When he considered the state of the atmosphere of London, and its action upon magnesian limestone, he was not surprised at the assertions made. About three millions of tons of coals were consumed annually in London for manufacturing and domestic purposes, and taking the quantity of sulphur evolved from that amount of coal at the very low computation of 1 per cent., they might calculate the vast quantity of sulphurous acid gas that was diffused through the atmosphere. He had examined specimens of the efflorescent salts upon the surface of the stone in the Houses of Parliament, and, on scraping it with a knife, great quantities of the stone came away in a powdered state. He had also taken the efflorescence from the surface of stones treated by Ransome's process, and he found that where the grain of the stone had become indurated by this means, the efflorescence took place without disintegration of the stone itself. The process seemed to resolve itself into this:—The porous stone absorbed the wash of silicate of potash which was placed upon it. When this was dried upon the stone, the solution of chloride of calcium was applied. Wherever the solution of the silicate of soda had gone, it had coated every exposed particle of the limestone. Directly the chloride of calcium came upon the coated particles it converted that silicate of soda into a silicate of lime. This was at first a thick gelatinous coat, but by drying it became indurated, and the older it was the more perfect must be the induration.

The Chairman said he was sure they would consider that the advantage which Mr. Burnell had conferred upon them by reading his paper had been increased by the excellent discussion it had evoked. Mr. Ransome's process had had witnesses in its favour of no common ability and position, and he most sincerely trusted that time would confirm the good opinion which had been expressed of it. He asked them now to give their best thanks to Mr. Burnell for the paper he had read.

The vote of thanks was then passed.

The Paper was illustrated by a collection of building stones commercially known in this country.

The Secretary announced that on Wednesday evening next, a Paper "On the Application of Town Sewage to a large Agricultural Area, comparing its Strength and Dilution with the ordinary Farm Manurial Resources, with considerations of its effects on Farm Profits," by Mr. Alderman Mechi, would be read. On this evening Mr. J. Bennet Lawes, F.R.S., will preside. The chair will be taken at 8 o'clock.

UNSINKABLE SHIPS.

The following letter has been addressed to the editors of the *Mechanics' Magazine* :—

Woolwich Dockyard, 20th Feb., 1860.

Gentlemen,—With reference to Mr. De la Haye's apprehensions that the project of "Unsinkable Ships" may have died a natural death, and the kind offer of his "services as chief mourner in the absence of the originator taking that task upon himself," I beg to express the hope and expectation that the cause of progress and of humanity may yet be promoted by the practical maturing and working out of the principle of unsinkable ships. That cause would not, however, in my opinion, be promoted by my publicly re-agitating the subject at the present time; the idea has been initiated—it has been sown broadcast in good ground—the *Society of Arts Journal*, the *Mechanics' Magazine*, the *Artizan;* many minds are now being directed to it and to the requirements of its realisation; it may, therefore, for a time, be left to fructify, more especially as the Armstrong and Whitworth guns are now pleading the cause of "Unsinkable Ships" with greater eloquence and argumentative power than can be expected of any other advocates.

I am, Gentlemen,
Your very obedient servant,
CHARLES ATHERTON.

THE PAPER DUTY.

By W. Stones.

Probably no financial speech ever produced more excitement than the statement of the Right Hon. William E. Gladstone on the evening of the 10th February, 1860.

Gentlemen, in the late trains that night, who had listened within the House of Commons, or caught the echoes without, anxiously poured their remembrances into the listening ears of fellow-passengers, and on the following morning the fortunate possessors of the daily papers ever and anon raised their voices in exclamation, as one trade or manufacture after another was touched upon and dealt with.

The excitement caused by the display of this grand picture of financial operations has rather altered in character than ceased by the lapse of time, as each class of interests has been enabled to more carefully weigh the importance of the suggested alterations.

To a society whose scope includes the consideration of everything affecting Arts, Manufactures, and Commerce, this measure cannot but be of great interest, proposing, as it does, such vast changes in the social, manufacturing, and commercial life and prospects of our country.

Some of these changes it might not be prudent or conducive to the welfare of the Society to discuss, but there is one subject treated of in the budget which we have ever taken an important and active part in promoting,—I refer to the repeal of the paper duty.

This subject has been frequently brought before the community by the Society, and in various forms; in discussions on papers read at the meetings, whether treating of some branch of the manufacture itself, or suggestions for the supply of materials; or more directly in the extensive series of circulars issued to paper manufacturers, stationers, publishers, newspaper proprietors, and authors, in 1853, a *resumé* of whose replies was given in the *Journal* of the 9th December of that year.

By these exertions much information has been from time to time obtained, the truth elicited, and the many bearings of the question placed before the public; and now that these labours seem approaching to a successful issue, it would appear an appropriate time to review the whole matter, ascertain our present position on the chart of progress, and estimate, as far as possible, the kind of influence the proposed repeal will have upon the future.

I propose therefore offering a few observations on the following branches of the subject:—Materials—home manufacture—foreign manufacture—English and foreign views of the question of differential duty, or free trade in materials—drawback—general results.

Materials.

The new forms into which the manufacture of paper may ultimately develop, it is impossible to foretel; but, judging from the past effect of the repeal of duties, we may safely assume that immense varieties of modelling, and combinations, will be attempted, and many doubtless with success.

As an illustration, I may refer to the novelty of bitumenised paper made into pipes, &c., which under the excise could not be done in the process of manufacture at the mill, without paying duty upon the bitumen, thus seriously increasing the cost and diminishing the hopes of success. But in future no objection will exist to the passing of the paper through bitumen at the end of the machine instead of through a solution of size, if such a plan should be found desirable. No restriction as to weight, size, or form, will in future operate to deter or impede the inventor.

Barry may grind up pieces of skin mixed with vegetable fibres or otherwise, without hindrance, and possibly for some purposes, as cartridges, the result might be extremely useful; at any rate the amount of duty will not interfere with the progress of the invention.

These developments may probably open out channels for the employment of many fibres, which cannot be successfully and profitably used in the present style of manufacture, requiring, as they do, too much cleansing to be made suitable for writing and printing paper purposes.

On the subject of materials generally, I have no reason to change the views expressed in my memorandum printed in the *Journal* of the 10th October, 1856.

If I might be allowed to offer a warning voice, it would be to caution against extravagant anticipations.

I have now lying before me evidence of the sad results of disappointed hopes—some in which the estimates were very far out in the item of cost of raw material, others in which the value of the manufactured article was equally wide of the truth.

And here this inquiry may properly be made of the very sanguine suggestors and inventors who are so fond of referring to the United States for examples of what may be accomplished by manufacturers untrammelled by Government regulations,—How does it happen that, having the world of fibres to operate upon, our American friends import rags extensively from England, and are the most severe competitors in the European market wherever the trade is open; and yet, according to these gentlemen, the crude fibres of nature abounding everywhere are equally available as rags. Thousands of bales of rags are imported yearly by America, and even low paper cuttings or waste have been very profitably shipped from London to the United States.

The result of the repeal of the duty will undoubtedly be a tendency to a rise in the price of the present ordinary rag materials.

In consequence of the very limited rainfall during the last two years, many of the mills dependent upon water-power have been producing far below their capacity, and the more abundant supply of water during the late winter having caused an increased power of production and consequent demand for material, a considerable rise had taken place prior to the announcement of the Chancellor of the Exchequer, and since that event the home and foreign markets are all reported to be firm and advancing.

Home Manufacture.

The first effect of the repeal of the duty on the home manufacture will be felt in the release of capital hitherto employed in advances to the Government; and the agita-

tion which prevails on the question of the drawback clearly indicates how much money is considered to be locked up in this manner. The release will be experienced most beneficially by those engaged in manufacturing the lower qualities of paper, on which the duty is a very large per centage of the selling price.

Another good effect will be experienced by the more necessitous manufacturers in the withdrawal of the constantly recurring inducement to sell goods below a remunerating price, in order to meet the inflexible, imperative, and unpostponable demands of the revenue.

At the same time it is probable that many persons will enter into the business who might not have contemplated doing so under the rigour of an Excise *regime*, and in this way the number of competitors may be increased; nevertheless, there seems no reason why the rich manufacturer, although deprived of the peculiar superiority of position conferred upon him by the duty, should not still retain the more legitimate advantage possessed by the capitalist over the man of small resources.

To the middlemen, who purchase the bulk of the paper from the manufacturers, and supply the public at a per centage advance on the cost, in which, of course, the duty is an element, it must result that their profits will be diminished by this per centage hitherto charged on the duty; they will require less capital, but must increase their busi- to realise their present profits.

Hence few of this class have been found amongst the advocates for a repeal of the duty.

This, moreover, shows that in all cases of indirect taxation the ultimate consumers pay large profits to the middlemen, who advance the duty on their behalf.

From the saving which many newspapers, &c., will effect, the proprietors will be enabled, without loss to themselves, to give an increased weight and better quality of paper to the public, and it may reasonably be expected that many new periodicals will also be attempted; hence a general briskness of trade may be expected, caused by an increased demand for paper, so many mills having to turn out a heavier weight of paper, although possibly in many cases not more sheets or superficies.

Therefore, it does not appear at all likely that the price will be lower by the full amount of the duty repealed, the probable immediate fall will be 1d. per lb.

Foreign Manufacture.

The primary effect on the foreign manufacture will most probably be to introduce extensive shipments of paper to England, in the hope of successfully competing, and sharing the market, with the English manufacturer.

Those who may have sagacious correspondents in this country to advise as to the quality and substance of the papers suitable to the market, may ultimately hope to prosecute a safe and profitable business, but if, as was the case soon after the former reduction in the duty, large quantities of unsuitable paper should be introduced, considerable loss will be sustained.

The consequences of making larger quantities of paper, and of thicker substance, must necessarily be to increase the demand for material, and as the ordinary rate of supply is fixed, a rise will follow in the price, thus causing the conditions of the foreign manufacture to approximate to those existing in England.

Our two great rivals, Belgium and France, are in this respect differently situated. Belgium is well supplied with coals, but its population is small, and the production of paper material is limited. France, on the other hand, has a larger population than our own, but stands at a disadvantage so far as fuel enters into the question.

These circumstances, combined with the cost of carriage, will tend to render the competition less formidable than many English manufacturers fear, for the prices of rags are not so widely different even now as is generally supposed; in fact, for canvas, rope, cotton-waste, and many articles, one would suppose that England must have the advantage.

Differential Duty of One Penny per Pound on Paper, or Free Trade in Rags.

Home Aspect of this Question.—The change contemplated by the Budget would allow paper to be imported free of any Customs duty. The home manufacturers object to this course, on the ground of the unfair competition to which they will be subject, so many foreign nations, as France, Holland, Belgium, Austria, prohibiting the exportation of rags, whereby a monopoly of material is secured to the paper manufacturers of those countries, whereas the home market is frequented by American buyers, who are also extensive purchasers in all foreign markets where the trade is open.

On the last occasion of a reduction in the duty on foreign paper, it was deemed fair to allow a differential duty in favour of the English manufacturer of about 1d. per lb.

It is now desired to retain this 1d. protection against those nations which refuse to allow free trade in rags, the point at issue being briefly—Rags free on your side, paper free on this side. Rags monopolised on your side, 1d. protection on ours.

The governmental arguments against acceding to this request are threefold. 1st. The utter hopelessness of inducing the continental governments to agree to allow free trade in rags (their reasons will be specified in the next paragraph), the views of the two parties as to what constitutes reciprocity, by which is understood equality in advantages, being so diverse. Hence, free trade in rags can be asked for with but little hope of success.

2nd. If the circumstances of greater cheapness of material and labour enable the foreign manufacturer to supply paper in the English market at lower prices than the home manufacturer, and we are to re-commence the vain endeavour to place all manufacturers, home and foreign, on a level, the great body of consumers would be injured, and all branches of trade and manufacture would find out real or fancied claims to protective enactments.

3rd. It being the obvious advantage to the community at large to buy in the cheapest market, it seems a somewhat startling proposition to demand for it a protection against cheapness, the great object of free trade, however much that cheapness may be caused by erroneous political economy on the part of our rivals.

Foreign Aspect of this Question.—An intelligent Frenchman, on reading the preceding remarks, would probably, and we take it, might fairly, reply to them in something like the following terms:—

The repeal of the English duty on paper is taking place in accordance with a vote of the British House of Commons, is the result of a home agitation, and for reasons of a purely English character, and is totally unconnected with the French paper trade; we are satisfied with the existing international arrangements.

From our comparatively small business and its peculiar character, our heavy postage, and our national tastes, we adopt a lighter kind of paper in our affairs than the English, hence our material is amply adequate to meet the requirements of our paper manufacture; if you would be satisfied with a similar article, your material would go twice as far, the average thickness of English paper being double of that used in France, and there would be less scarcity,—we have superficies, you require thickness in addition.

Competing as the French do with Austria and Belgium, in the Levant and South America, unless other nations could be induced to join in the arrangement, we might enlarge one channel by securing access to your market on the terms you propose, but should be placing ourselves at a disadvantage in other markets.

So far as your large colonial and Indian markets are concerned, we could not improve our position, being already on the best terms; it would only be in your home market that we could possibly be advantaged by declaring for free trade in rags and accepting free trade in paper.

If we supply you with rags, our purchasing power of your commodities may be represented by a certain definite

amount; but if those rags are exported in the form of paper, the price of our labour is included, and the purchasing power of our export more than doubled. Is it not the converse case of our importing your raw cotton and wool and the same articles manufactured.

Against our monopoly of paper materials we may enumerate,—cost of carriage, by land and sea, to your market, distance from the source of fuel, and extra cost of machinery which we import from you.

If we commence making heavy papers for your general market the enhanced demand for materials, and their consequent rise in price for all papers, whether intended for England or elsewhere, and the inevitable increased cost of fuel for grinding will still further diminish relatively our assumed advantages.

Lastly, if it should turn out that with our own views of Political Economy we can nevertheless supply you cheaper than you can make for yourselves—Why complain, my friend?

If there is any soundness in the arguments adduced in the two preceding paragraphs it is useless to expect either a continuance of the differential duty, or free trade in materials.

It would, we imagine, be more for the interest of the British manufacturers to brace themselves for the contest, and claim of the British Government to demand from France, the immediate removal of the terrible and monstrous duty of nearly £70 per ton now levied on English paper imported into France, and the free opening of the French markets to all papers we might be able to send thither.

This would be but bare justice to the home manufacturer, and, in the present asserted goodwill and rational humour of all parties, would probably be conceded.

It is difficult to conceive any reasonable objection which could be raised against this proposition.

Drawback.

It will be readily understood that parties who have paid duty to the Government, either as paper-makers, or dealers who have purchased with the intention of selling, thereby not only receiving back from the consumer the amount so advanced, but a profit thereon; are likely to be serious losers unless the Government arrange to return the duty on stocks of paper on hand.

In the understood financial circumstances of the country it was supposed that the paper duty, although condemned, would be reprieved until the revenue presented a different appearance, and thefore the boldness of the Chancellor of the Exchequer took the trade by surprise.

Feeling that it would be unfair to burden the present holders of stock with the loss consequent upon the repeal, he has proposed to meet the case by allowing drawback on such paper in stock on the 1st July next, as may have been charged between the passing of the resolution by the House of Commons and the said 1st July, thus allowing about three or four months for exhaustion of the old stock.

But it seems capable of being shown that this good intention will not work the desired object, for the following reasons:—

The immediate result of the announcement was to stop the execution of all orders on hand, except in cases of absolute necessity; and the circumstances of the trade may be thus summarised:—

The printing of books has almost entirely ceased.

The retail stationery trade state that the public are only buying from hand to mouth.

The wholesale houses report complete stagnation, owing to suspension of orders by retailers.

Papermakers are not charging except on paper required for immediate consumption.

The great manœuvre now is to try and remove any probable loss from the shoulders of A to B, and so on.

As soon as the resolution is passed, it is obvious that all purchasers will require paper to be either of a newly charged making, with a view to entitle themselves to the drawback, or accept old stock on condition of its being invoiced at a reduced rate, thus, the old stock, not entitled to drawback, will for the most part remain on hand, or be sold less the duty, thereby entailing great loss on the present holders.

Under this arrangement, the existing paralysis of the trade must continue for several months.

The wholesale stationers of London have boldly stated that the means of relief are within their own power, by exporting the paper and claiming the drawback—importing the goods after the repeal of the duty; and circulars have been issued by certain firms undertaking to accomplish this successfully, and return the paper into stock, at a commission charge of ½d. per lb.

But it seems to have been overlooked that, on entering paper for exportation, a bond is entered into, of double the amount of the drawback, that the goods "shall not be relanded or unpacked in any port or harbour of the United Kingdom," and, although the repeal of the duty would render bonds unnecessary for the future, the repeal would not cancel bonds entered into while the Act was in force.

Moreover, the Customs Import Act, 3 & 4 Wm. IV., c. 52, would be unaffected by the repeal, and it expressly stipulates that "paper on which drawback has been received on exportation shall not be re-imported for home use, without the special sanction of the Commissioners of Customs, *and repayment of the drawback*."

Parties, therefore acting in the manner proposed, would probably find themselves very much mistaken in the result.

The longer the delay the less comparative chance would many have of passing off their stock; although a few might be more fortunate, for it is evident that only new stock will henceforth be willingly accepted by purchasers.

It would therefore be more conducive to the welfare of the trade to meet the case at once, by taking the stocks on the 31st March of all paper charged within the previous six months, and allowing half the duty. This would be equitable to the trade, many having bought largely before Christmas, anticipating a rise, and others having deferred until the beginning of the year.

The trade would be immediately liberated, and transactions commenced on the new basis, otherwise several months of inaction must ensue.

Why collect the duty for the next three months to return the larger portion?

In granting the drawback it would be advisable to fix without delay the minimum limit of amount that would be allowed, for the retail stationers are now under the impression that every ream with a label affixed will be entitled to drawback, which we presume would give an extraordinary amount of trouble to the Government and can hardly be contemplated. If the lowest allowance is determined to be made to all persons possessing sufficient stock to entitle them to drawback on the half of £50 duty, notice might be required to be given to the nearest Excise Office, and after the weighing by the officer, and the claim being checked by the supervisor, the collector might be required to discharge half the amount on the first round then next ensuing, and half the following round.

Total loss would almost be better than long continued suspense.

Results to the Public.

Many vague and unwarrantable anticipations have been indulged in of the direct advantages which will accrue to the public from the repeal of the duty. These expectations have been raised, for the most part, by highly-coloured statements as to the bearings of the duty question on education.

Information from printed matter is derivable from books and periodical literature, and the foundation of all sound education is laid in the study of books devoted to the treatment of given subjects; but the advocates for the repeal of the duty have so explained the meaning of the term "Educational Works," as to almost exclusively refer it to ephemeral publications, and have most promi-

nently, if not unduly, put forward the doctrine that the future education of the country depended upon the publishing of cheap periodicals, and have argued, curiously enough, as though the duty prevented their issue, whereas, it is patent to all that, notwithstanding the burden of the duty, they are already printed to an enormous extent, though whether very profitably to the projectors may in some cases admit of question; however that may be, the chances of profit will be much increased by the removal of the tax, and hence has arisen a great deal of interested clamour.

But inasmuch as the duty does not amount to a farthing, either on an ordinary school book or any one copy of the large issue of periodicals and newspapers, &c. (with one or two exceptions), it is evident that the price of an individual copy is not capable of reduction, and therefore the public will not pecuniarily benefit.

So many of the public as may be purchasers of paper in quantity, whether for packing or writing purposes, will benefit, as the former description of paper should be procurable at an average of 25 per cent., and the latter at probably about 10 per cent. reduction on former prices.

Publishers will undoubtedly benefit, because, although the duty is too small to be appreciable on each copy of a work, yet in the aggregate it is a serious item; but exporters of printed books will lose the drawback on the paper, which, as the duty does not enter into the calculation in the cost price, has hitherto been so much special gain to them; therefore shippers of books were generally desirous of the continuance of the duty. Many other direct and indirect advantages might be enumerated, but the details would too far extend this already lengthy paper.

BOOK POST.

In 1858, 71,000,000 newspapers were delivered in the United Kingdom, and 7,250,000 book packets passed through the post. The average weight of book packets was 5½ oz. each, and of newspapers 2½ oz. each. The average postage on book packets was 2¼d. each. When the impressed newspaper stamp is abolished all newspapers will pass through the post as book packets.

THE LIME LIGHT.

The following is the substance of a letter from Mr. Denny Lane, of the Cork Gas Consumers' Company, to the editor of the *Journal of Gas Lighting*. Mr. S. Squire Baxter's paper, read before the Society last week, embodied some portions of Mr. Renton's report, alluded to below :—

Cork Gas Consumers' Company's Offices,
72, South Mall, Cork, Feb. 6, 1860.

It is a fallacy to compare gaslights, not exceeding twenty candles, with lime lights of from 758 to 1167 power. In reality, all illuminating power (except, perhaps, in the electric light) is conferred by solid bodies in a state of incandescence, which is more or less brilliant, as the temperature is higher or lower. A large flame, exposing to the cooling atmosphere around it a less surface, in proportion to its mass, than a small one, necessarily maintains a greater heat, and communicates to the glowing particles within it a higher degree of temperature, and, therefore, a greater illuminating power. The amount of light given by a gas flame, properly burned, increases in a ratio much larger than that of the consumption of gas. I have frequently illustrated this principle by the following very simple experiment :—If two batswings or fishtail burners are placed within an inch of each other, with both the flames perpendicular, a certain quantity of light will be given. If the two burners are then slightly inclined inwards, so that the two flames may impinge on each other, the amount of light will be so much greater, that the increase will be plainly discernible to the eye of the observer, without the use of any photometer or shadow test. The reason of this is quite obvious. The two flames, when separated, expose four flat surfaces to the cold air, while, after their union, little more than two surfaces are exposed to the same cooling influence. From many experiments, which all agree in proving this principle, I select the following one, of Mr. Alfred King's, on the consumption and light-giving power of "Wingfield's lucent" argand burner :—

	Feet of Wigan Cannel Gas.								
	1½	2	2½	3	3½	4	4½	5	5½
Consumption per hour — cubic feet.	1·5	2·	2·5	3·	3·5	4·	4·5	5·	5·5
1 foot = candles . .	0·318	0·73	1·09	1·57	2·09	2·59	3·07	3·82	4·5
1 foot = grains of sperm . . .	38·2	87·5	131·8	188·4	251·1	311·3	368·9	458·8	540·0
Total quantity of light given in wax candles	·477	1·460	2·725	4·710	7·315	10·360	13·815	19·100	24·750

The operation of the principle is represented by the diagram on the following page.

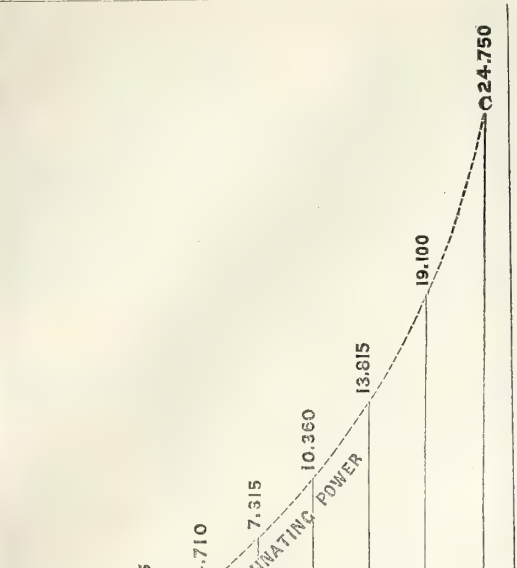
I have drawn the curve A C, the ordinates of which, measured to the horizontal line D E, represent the quantities of light given at the different rates of consumption, which rates are represented by the portions of the same ordinates intercepted between the two right lines, A B and D E. Thus, while the consumption of gas has increased in the proportion of the line B E to A D, the amount of light has been magnified in the ratio of C E to A D.*

It is unnecessary to say that, if the quantities of light increased in only the same ratio as the consumption of gas, the line A C would coincide with the line A B. This graphical delineation of the law represents its operation in a very striking manner. There is no doubt but that the lime light is subject to a law of similar character—indeed, the promoters themselves say that it "is found to vary in power in a much higher ratio than that of the consumption of the gases;" and I have reason to believe that the difference between the illuminating power and the consumption is much greater than in the case of coal gas.

This law leads to the conclusion that, if the gaslights were increased to the same power as the lime light, or the lime light diminished to the same standard as the gas, common coal gas, instead of being dearer, would be found five, and, under ordinary circumstances, twenty times as cheap as the lime light. This observation applies with still greater force to cannel gas.

Before I leave the subject, I cannot help remarking upon the very anomalous statements of Mr. E. V. Gardner's table, with respect to the light given by two fishtail burners, one of which, consuming less than 2½ feet per hour, gave a light of 7 candles, while another, burning 5 feet per hour, or more than twice as much, gave a light of only 6⅔rds candles. If Mr. Gardner chooses to burn good coal gas in such a way that 5 feet per hour shall give less light than 7 wax candles, he can easily prove anything he pleases with regard to the comparative economy of the lime light. If it were not an intrusion, I should be happy to communicate to him a mode in which he can burn the same quantity, so as to give less light than a single dip candle, and he can then make use of the experiment for his table of comparative cost with greater effect. I shall, therefore, dismiss the consideration of these statements, and confine myself altogether to the re-

* This law was found by Mr. King to be reversed, with respect to batswing and fishtail or union jet burners, when the quantity of gas consumed by each exceeded certain limits.—See his table at page 142, Vol. II., of the *Journal* from which the experiments quoted by our correspondent are extracted, and which may further explain the anomalies he points out in the Polytechnic experiments with fishtail burners, consuming 2½ and 5 cubic feet per hour respectively.—Ed. J. G. L.



ported experiment with an argand burner, in which the gas had an illuminating power of 15·52 wax candles per 5 cubic feet, being very nearly the quality of gas usually supplied to the public.

It is remarkable that, although Mr. Renton's report, with the greatest nicety, calculates the cost of the lime, being a matter involving the 33rd part of a penny per hour, there is no statement of the price at which either oxygen or hydrogen can be produced or supplied. This minute accuracy about an item which is only 1-396th of the whole cost, while the other 395 parts are allowed to take care of themselves, is even an exaggeration of the "penny-wise-and-pound-foolish" proverb, and is, at the least, suspicious. In justice to Mr. Renton, however, I must say that, at p. 13 of his report, he tells us that the cost of oxygen "will be merely nominal." I will give your readers some means of judging what Mr. Renton deems to be a "merely nominal" cost.

Now, sir, although the cost of each of these cases is not directly given in Mr. Renton's report, I have been able, from his table (part of which I here repeat) to show what the prices of these gases must be. Supposing the price of ordinary coal gas to be 4s. 6d. per 1000 cubic feet, and, in every other item, adopting the figures of the table itself, I now proceed to give the steps by which I have discovered these prices.

Description of Material.	Particulars of Burners, &c.	Value in Wax Candles, Six to the Pound.	Consumption of Material per Hour.	Units of Cost.	Cost per hour for Light of equal Intensity.
			Ft.		d.
Lime light, with coal gas	Jet, 1-16 in. diam.	758	7·2 oxy., 7·8 gas	9	1·00
Lime light, with hydrogen	Ditto, ditto	1167	6·53 oxy., 12·4 hyd.	10	1·11
Argand gaslight	Ditto, 15 holes	20 18	6·50 cubic feet	17	1·88
Fishtail ditto	Ditto, No. 1	7 00	2·41 ditto	18	2·00
Ditto ditto	Ditto, No. 4	6 66	5·00 ditto	40	4·44

Assuming the price of gas to be 4s. 6d. per 1,000 cubic feet, the cost of burner consuming 6·5 cubic feet = 0·351d.

(1.) 1000 : 6·5 :: 54d. : 0·351d.

This gives a light equal to 20·18 candles. Therefore, the cost per candle per hour is = 0·0174d.

(2.) 20·18 : 1 :: ·351d. : 0·0174d.

Now, the cost of the lime light, with oxygen and coal gas, is stated to be less than that of coal gas alone, in the ratio of 9 to 17. Therefore, the cost per candle per hour is 0·00921d.

(3.) 17 : 9 :: 0·0174d. : 0·00921d.

This gives a light equal to 758 candles, and, therefore, costs 6·98118d.

(4.) 1 : 758 :: 0·00921 : 6·98118d.

Now, this burned 7·8 feet of coal gas, which cost 0·4212d.

(5.) 1000 : 7·8 :: 54d. : 4212d.

In (4) we found the cost of lime light, with oxygen, to be 7·98118d. per hour. Therefore, deducting 0·03d., being the cost of the lime, and 0·4212d., being the cost of the coal gas, as we have found in (5), we get the cost of the oxygen consumed to be 6·52998d.

(6.) 698118—(0.03 + 0·4212) = 6·52998d.

There was burned here 7·2 feet oxygen, which thus cost 6·52998d. Therefore, the cost of oxygen per foot is 0·90674d., or £3 15s. 7d. per 1000 cubic feet!!!

(7.) 7·2 : 1 :: 6·52998 : 0.70674d.

Thus we find, from the promoters' own statement, the cost of oxygen gas to be £3 15s. 7d. per 1000 cubic feet—a price which Mr. Renton considers to be "*merely nominal.*"

I will now apply the same method to the statement regarding the light = 1167 candles produced by oxygen and hydrogen. The cost of the lime light produced by hydrogen and oxygen is in the proportion of 10 to 9 to the cost of lime light produced by oxygen and coal gas. I have already shown (3) that the cost with oxygen and coal gas = ·00921d. per candle per hour. Therefore, the cost of lime light produced by oxygen and hydrogen is 0·01023d. per candle per hour.

(8.) 9 : 10 :: 0·00921d. : 0·01023d.

This gave a light equal to 1167 candles. Therefore, the total cost is 11·93841d.

(9.) 1 : 1167 :: 0·01023d. : 11·93841d.

This burned 6·53 feet of oxygen; and I have already shown in (7) the price of oxygen to be 0·90674d. per cubic foot. Therefore, 6·53 feet cost 5·922318d.

(10.) 1 : 6·53 :: 0·90674d. : 5·922318d.

Total cost of light (9) is 11·93841d. Therefore, deducting ·03d. for lime, and 5·922318d. for oxygen, we get cost of hydrogen employed to be 5·9860918d.

(11.) 11·93841—(·03+5·922318d.) = 5·9860918d.

In this experiment there was burned 12·4 feet of hydrogen, which cost 5·9860918d. Therefore, cost of hydrogen per 1000 cubic feet is £2 0s. 2d.!!!

(12.) 12·4 : 1000 :: 5·9860918d. : 482·81d.

This is a price which Mr. Renton says, "will leave the cost of the gas in *favourable contrast* with other gases which may be employed for the purpose."

I must observe, that the oxygen and hydrogen gases should be distributed by separate mains, as, when mixed in the proportion necessary for the lime light (viz., 2 volumes of hydrogen to 1 of oxygen), they form one of the most dangerous compounds which the whole arsenal of explosive chemistry can boast of.

I will leave it to your practical readers to consider what would be the cost of distributing, under considerable pressure, two gases, the price of one of which is shown by the patentees themselves to be £3 15s. 7d., and that of the other to be £2 0s. 2d. per 1000 cubic feet, as contrasted with coal gas, which certainly should not cost the manufacturer 2s. for the same quantity. The comparative leakage of products, the value of one of which is twenty, and the other nearly forty times the cost of coal gas, would become a serious question with the practical engineer.

But, if we base our calculations upon the cost and illuminating power of cannel gas, it can be shown that the light from this source, even when burned at the low rate of 5 cubic feet per light per hour, is as cheap as the patentees themselves assert the lime-light to be. Cannel gas is now supplied in Liverpool (without competition, by a company which pays a dividend of 10 per cent.) at the low price of 3s. 9d. per 1000 cubic feet; 5 feet of this gas gives a light equal to 24 *sperm* candles, and costs 0·225d. The cost per candle per hour is, therefore, 0·0093d.; while the cost of the oxyhydrogen lime-light, as alleged by the promoters themselves, is (8) 0·0102d. per *wax* candle per hour. Making an allowance for the superiority of *sperm* to *wax*, we may put down the cost of cannel gas to be about 0·0080d. per *wax* candle per hour, which is thus much cheaper than the vaunted lime light, although the intensities of the lights, compared with each other, are in the ratio of 24 to 1167 candles, or 1 to 50.

Though the promoters of the company have thus set down the price of oxygen gas at £3 15s. 7d. per 1000 cubic feet, the following passage from Mr. Renton's report would seem to imply this is a gross under-estimate:—

"The chlorate of potassa is a substance which, though costly at first hand, is, nevertheless, a valuable material for the production of oxygen gas, from the facility which it affords to the operation. The comparatively low temperature required for its disengagement, and the rapidity with which it is produced, requires less attention and labour. Hence the cost of the gas is not so great as would, at first sight, appear, when contrasted with that from maganese. The residuum is chloride of potassium, or, familiarly, muriate of potash, and is used in the arts."

The plain inference from this passage is, that oxygen produced from chlorate of potash, cannot be very much dearer than from peroxide of manganese.

The present wholesale market price for chlorate of potash, bought in large quantities, is 1s. per lb. Berzelius has shown that one grain of chlorate of potash produces 0·3915 grains of oxygen, equal to 1·151 cubic inches; therefore, 1lb. of chlorate of potash produces (1·151 × 7000)=8057 cubic inches.

8057 : 1728 :: 12d. : 2·648d.

Here the mere cost of chlorate of potash, for 100 cubic feet of oxygen, without counting for fuel or labour, &c., is £11 0s. 8d. The residual product, chloride of potassium, being only employed in the manufacture of so cheap a salt as alum, and being abundantly supplied as a refuse of the soap manufacture, as "soap boilers' waste," is of little commercial value, and would become of still less if produced in larger quantities.

As far as Prosser's and Bastable's patents have yet been disclosed, they really amount to no more than an alleged improvement in what may be called the *wick-holder* of the lime-light. Whether the specification, not yet due, contains any more important improvement, I cannot of course, say.

QUALITY OF THE CITY GAS.

The following is the substance of a report on the Great Central Gas, with a summary of the experiments on the illuminating power and chemical quality of the gas supplied to the City of London during the last eight years, presented to the Commissioners of Sewers of the City of London, by Dr. Letheby, Medical Officer of Health:—

In the course of the last three months 246 experiments have been made on the gas, and the average illuminating power, when tested in accordance with the Act of Parliament instructions from an argand burner of fifteen holes with a seven-inch chimney, and burning at the rate of five cubic feet per hour, has been equal to that of 13·55 sperm candles, or 15·49 wax—each burning at the rate of 120 grains per hour. This is just twenty-nine per cent. above the requirements of the Act of Parliament.

The chemical quality of the gas has been equally satisfactory as regards the absence of the grosser impurities—ammonia, sulphuretted hydrogen, and fœtid tar matter.

At the present time, when the subject of the quality of the gas supplied to the metropolis is under the consideration of Parliament, it may not be out of place to refer to the general results of the testings of the Great Central Gas during the last eight years. In the course of that time I have submitted to you thirty-two quarterly reports, and they express the results of about 3,500 experiments, the main features of which are as follows:—

1. That the average power of the gas has been equal to that of 13·00 sperm candles, or 14·83 wax. This is nearly twenty-five per cent. above the standard of the Great Central Act (14 and 15 Vict., cap. 59.) The averages of the returns stand thus:—

Quarter ending.	Number of Experiments.	Illuminating Power.	
		Sperm 120.	Wax 120.
May	673	12·89	14·74
August	874	12·75	14·58
November ...	887	13·02	14·88
February	1084	13·21	15·10
Eight Years .	3518	13·00	14·83

In this case the gas was burnt from an Argand burner of fiften holes with a seven-inch chimney, and at the rate of five cubic feet per hour; but when it was burnt from bat's-wing and fish-tail jets of different sizes it had the following illuminating power:—

Consumption per hour cubic feet.	Illuminating Power.			
	Sperm of 120.		Wax of 120.	
	Fish-tail.	Bat's-wing.	Fish-tail.	Bat's-wing.
3·50	8·14	8·00	9·30	9·14
3·75	8·92	8·74	10·19	9·99
4·00	9·50	9·36	10·86	10·70
4·50	10·13	10·11	11·58	11·55
5·00	11·80	11·75	13·49	13·43
Average power per foot	2·34	2·31	2·67	2·64
	Argand 2·61		Argand 2·99	

In these several methods of burning the gas, there is an advantage of about 11 per cent. in favour of the argand.

2. The average rate at which a sperm candle burns per hour is 132 grains, and a wax is 172. The number 120, which is fixed as the standard for comparison in all the Acts of Parliament relating to this subject is, therefore, too low, for it is rarely if ever obtained in practice.

3. It has been ascertained, as the result of above 1,000 experiments, that the relation of the illuminating power of wax and sperm candles, when both are burning at the same rate, or are reduced to the same standard, namely 110 grains to the hour, is sixteen wax to fourteen sperm; and, as it is very difficult to secure the uniform or proper consumption of wax in testing the illuminating power of gas, it is most convenient to use sperm in the experiment, and then to calculate its value into wax according to the ascertained values.

4. In respect of the chemical quality of the gas it has been determined that, as a rule, the gas is entirely free from sulphuretted hydrogen; that it does not contain more than twenty grains of sulphur in any form in 100 cubic feet of gas; and that the proportion of ammonia does not exceed five grains per 100 feet. The absence of ammonia is a matter of some importance, because the

alkali acts corrosively on copper and brass fittings, and is the cause of the presence of offensive smelling tar in gas.

These results are sufficiently extensive to be made the basis of future inquiries into the subject.

Guildhall, February 14, 1860.

INSTITUTION OF NAVAL ARCHITECTS.

The following is the programme of the proceedings at the first ordinary meetings of this Institution, held during the present week at the house of the Society of Arts:—

Thursday, March 1.

Morning Meeting, at 11 a.m.

Sir John Pakington, Bart., G.C.B., Vice-President of the Institution, in the Chair.

Paper 1.—"On the Present State of the Mathematical Theory of Naval Architecture." By the Rev. J. Woolley, LL.D., F.R.A.S., V.-P. I.N.A.

,, 2.—"On the Wave Line Theory." Part I. By Mr. J. Scott Russell, F.R.S., V.-P. I.N.A.

,, 3.—"On the Strength of Iron Ships." By Mr. J. Grantham, M. Council I.N.A.

Evening Meeting, at 7 p.m.

The Earl of Hardwicke, D.C.L., Vice-President of the Institution in the Chair.

Paper 1.—"On the Connection between the Mode of Building Iron Ships, and the Ultimate Correction of their Compasses." By Mr. G. B. Airy, F.R.S., Astronomer Royal.

,, 2.—"On Chain Cables." By Mr. G. W. Lenox, F.G.S., Assoc. I.N.A.

Friday, March 2.

Morning Meeting, at 11 a.m.

Paper 1.—"On Experiments made upon some of H.M. Ships for Ascertaining the Positions of their Centres of Gravity in a Vertical Sense." By Mr. F. K. Barnes, M.I.N.A.

,, 2.—Three Short Papers "On the Tonnage Laws." By Mr. G. Moorsom, Surveyor-General of Tonnage; the Rev. Joseph Woolley, LL.D., F.R.A.S., V.-P. I.N.A.; and Mr. S. Read, M. Council I.N.A., respectively.

" 3.—"On Iron Ships." By Mr. W. Fairbairn, F.R.S.

Evening Meeting, at 7 p.m.

Paper 1.—"On an Improvement in the Form of Ships." By Mr. Joseph Maudslay, C.E., Assoc. M. Council I.N.A.

" 2.—"On a Method of Constructing Diagonal-Built Ships." By Mr. J. White, M. Council I.N.A.

,, 3.—"On Certain Improvements in Marine Engines." By Mr. Robert Murray, C.E., Assoc. I.N.A.

Saturday, March 3.

Morning Meeting, at 11 a.m.

Paper 1.—"On Mechanical Invention in Relation to Improvements in Naval Architecture." By Mr. N. Barnaby, M.I.N.A.

,, 2.—"On the Wave Line Theory." Part II. By Mr. J. Scott Russell, F.R.S., V.-P.I.N.A.

Home Correspondence.

THE NEW LIME LIGHT.

Sir,—On perusing, in your *Journal* of the 24th, an account of the discussion which followed the reading of my paper, when I was unavoidably absent, I was happy to find, from the closing remarks of your distinguished Chairman, that all who took part in it were of opinion that, for certain objects, it might be an extremely valuable application of light; that in cases were intensity of light was aimed at, it accomplished that object in a very successful manner; that, with regard to its purity, they had seen it to be complete and perfect; and that the difficulty which formerly existed in respect of its continuity had now been got over, in fact the light was there exhibited to speak for itself in testimony of these most important advantages, claimed for the improved lime light by me in my paper, on behalf of the inventor.

The principal difference of opinion which existed at the meeting appeared to have been as to the cost of the oxygen gas (the principal element of expense of the light), and to this point I will with your permission address myself, for the satisfaction of those who take an interest in the matter.

As one fact is worth many opinions, I beg to acquaint your readers that an offer has been made, by responsible parties, to the directors of the Universal Lime Light Company, to contract with them for the supply of oxygen gas at three farthings per cubic foot, or £3 2s. 6d. per 1,000 cubic feet, which offer they have not as yet accepted, as they expect to receive other tenders on more favourable terms. It is obvious that the company could produce the gas at less than three farthings, as that price carries with it transport and profit. Indeed, more recently, an offer has been made to them for supplying this gas at a price not exceeding that of coal gas.

I am in possession of much valuable information and experience relative to the generation of oxygen gas, and selection has been made of the best means suited to the purpose of the Company, which it is, however, inconsistent with sound commercial principles to make public.

These facts are sufficient to show how careful professional men (especially) should be in putting forth statements as facts, which after all are but opinions based on very questionable data, and insufficient knowledge of the subject, often tending greatly to mislead the public. These facts also show that the realization of the expectations formed with regard to economy was something more than a probability, and they were in a measure confirmed by the statement made to the meeting, of which I was long ago cognizant, that Mr. Michiels, a gas-engineer and German chemist, of great practical knowledge and skill, had produced (on the large scale) oxygen gas, by passing atmosperic air over hydrate of baryta, a process so economical as to enable him to produce oxygen gas at about the same price as common gas, say 5s. per 1000 cubic feet.

To show still more palpably the truth of my statement, (in showing that the lime light might be supplied at one-half the price of ordinary coal gas) the economy of the light may be rendered in a simple form, by taking the cost of the oxygen gas at £3 2s. 6d. per 1,000 cubic feet, (the maximum price offered) and coal gas at 4s. 6d. per 1000 cubic feet, from which the cost of the combined gases (equal in quantity) supplied to the lime light may be obtained, viz., £1 13s. 6d. per 1000 cubic feet, or in proportion to the price of coal gas, as 402 : 54, or as 7·44 : 1 in favour of coal gas. But as the relative consumption of the gases in the lime light and gas light, for equal effects, is, from the superior intensities of the former, in the ratio of 8 : 400, or as 1 : 50 in favour of the lime light, it is obvious that the economy of the two lights is in the ratio of 50 : 7·44, or 6·7 : 1 in favour of the lime light, neglecting the cost of the lime, which is trifling; that is, the cost of the lime light is a trifle less than one-seventh of its equivalent in gas.

This is so simple a calculation that it can be appreciated by anyone even slightly versed in the subject; and it is most unaccountable that men whose professional knowledge should enable them to anticipate these results, should commit themselves to such serious errors as those enunciated at the meeting of the 22nd.

With regard to the specimen lamp, which was placed in the Society's room on that evening, with a view to illustrate its applicability to the lighting of large rooms and the illumination of paintings, without either the oppressive heat or the contamination or deterioration of the atmosphere usually attending the use of gas lights, a very

striking instance of these facts was afforded to the meeting as soon as the ordinary chandelier was re-lighted. The economy, as stated by Mr. Hawes, was substantially correct. The cost of the gas chandelier, which contains (as I was informed) about 275 jets, each consuming about 4 cubic feet of gas per hour, or 1,100 cubic feet of gas in the aggregate, at a cost of 4s. 6d. per 1,000 cubic feet, was 4s. 11½d. per hour. The lime light (as there exhibited) consumed, at a maximum, 40 cubic feet per hour (though I believe it did not exceed 35 cubic feet) of the combined gases, which, at £1 13s. 6d. per 1000 cubic feet, as before stated, is 1s. 4d. per hour; but this light was equivalent to at least 400 gas jets, each consuming 5 cubic feet per hour, or, in the aggregate, 2,000 cubic feet, which, at 4s. 6d. per 1,000 cubic feet, is 9s. per hour. Hence, the relative cost of the two lights is as 9s. : 1s. 4d., or in the ratio of 6·7 : 1, as before stated, in favour of the lime light, which I submit is sufficient to show the erroneous character of the calculations placed before the meeting.

It was remarked that the extreme intensity of the light was painful to the retina of the eye, but it should have been added that glass shades were as available for the lime light as for gas, for similar reasons and with similar results. In like manner, when a gas or other light suited to large spaces is too powerful for a smaller space, it is very naturally reduced to the required volume; and so with the lime light, which admits of its "rushlight" as well as its maximum brilliancy.

With regard to a remark made as to the safety from explosion, I beg to say that the well-known precautions, viz., wire gauze discs, which have successfully prevented such accidents during the last 40 years' use of the lime light, have been adopted by the company as a safeguard against such occurrences, which, indeed, are less likely to happen than with gas backed by the gas-holder of a gas works, except when protected by proper appliances and attention.

I may conclude my remarks by stating that in presenting the improved lime light to the public, the directors of the Universal Lime Light Company do so neither unadvisedly nor precipitately; they know the value of the improvements possessed by them, which have so successfully contributed to the perfecting of this light.

Since the reading of my paper on the 22nd inst., intelligence has been received that during the storm of the evening of the 21st, at Liverpool, the lanterns which enclosed the lime lights on the south landing stage were completely denuded of their glass casing; the lights, exposed to snow, sleet, rain and wind, remaining perfectly steady and undiminished in brilliancy—a fact which deserves recording.—I am, &c.,

S. SQUIRE BAXTER.

Feb. 28th, 1860.

Sir,—I am afraid I did not express myself very clearly on Wednesday evening, when, in the discussion on Mr. Baxter's paper, I spoke of the calculated value of the Lime-light; for although my estimate of its cost, as compared with the price of coal gas, was as nearly as possible in accordance with the practical valuations of Dr. Bachoffner, yet many of the speakers so far misunderstood me as to fall into the error of supposing that our results were very dissimilar. Mr. Hawes, for example, in commenting on them, said "they (Drs. Bachoffner and Letheby) were as far from each other in their calculation of the cost [of the light] as either of them was from the author of the paper;" and the learned Chairman, in his concluding address, observed "that they had had an illustration that evening of a topic which was presented to them a few weeks ago, as to the difference of opinion which existed amongst scientific men." When, however, it is stated that the actual difference in our valuations amount to but a small fraction (less than 0·5 on 2·6) it will be manifest that our modes of comparison, as well as our general conclusions, were not at all understood. I am anxious, therefore, to set the matter right, and, if possible, to make it intelligible.

Dr. Bachoffner found that when the lime-light was obtained from oxygen and coal gas, and had an illuminating power of 25·9 Argand burners, each consuming 6 cubic feet of gas per hour, its cost was 1s. 10½d. per hour, whilst coal gas of the same power would cost but 8½d. These numbers are in the proportion of 2·6 to 1·, and mine, as will be presently seen, are from 2·5 to 2·1 to 1.

It is hardly necessary to discuss that which is so fully reported at page 229 of the *Journal*, viz., that 220·6 lbs. of chlorate of potash are required to produce 1,000 cubic feet of oxygen, for this is not a matter of speculation, but is a rigid fact, founded upon the laws of chemical combination; and it matters not whether the gas is produced in a small glass retort for experimental objects, or generated in larger quantities for commercial purposes, the ratio of proportions will always be the same, for it is the ratio of the chemical equivalents.

At the present time, the wholesale price of chlorate of potash is one shilling per pound, and therefore 1,000 cubic feet of oxygen would cost £11 for merely the raw material; but, supposing that an increased demand would reduce the price of the chlorate to 10d. per lb.—even then the oxygen would cost £9 3s. 10d. per 1,000 feet. Coal-gas, however is produced at something less than 1s. 6d. per 1,000; and if the lime light is to compete with coal-gas as an illuminating agent, its power should be as much greater than that of gas as the prime cost of the one is from the other—that is, as £11 or £9 3s. is to 1s. 6d. Supposing, therefore, that both are burnt at the rate of 6·5 cubic feet per hour, the lime light should have a power of from 147 to 122 times that of coal gas—these being the ratios of 1s. 6d. to £11 and £9 3s.; but, according to Mr. Baxter's table (p. 229) the lime light, even under the best circumstances, as when the oxygen is burnt with hydrogen, has only 58 times the power of coal gas (the numbers are, lime light, 1,167 candles, coal gas 20·18). It is clear, therefore, that upon these data the relative cost of the lime light and gas light is as 2·5 to 1 in the first case (£11 per 1,000), and 2·1 to 1 in the second (£9 3s. per 1,000), numbers which are not very far from those given by Dr. Bachoffner, namely 2·6 to 1, and they would have been still nearer if the cost of the other materials had been considered; but it is unnecessary to complicate the subject with questions concerning the cost of the hydrogen which is required to burn the oxygen, or the lime and its cage for producing the light, or the fire and the apparatus for making the gas, all of which have been disregarded in the preceding estimates; for, if it is shown that one of the materials will cost more than double its equivalent of power in coal gas, there is no need for further investigation.

I am, &c.,

HENRY LETHEBY.

College Laboratory, London Hospital,
Feb. 25, 1860.

Sir,—Having had an opportunity of hearing the paper read before the Society on Wednesday evening, it appeared to me that the only difference between the present "lime light," as described by Mr. Baxter, and the one with which we are all acquainted, is, that he encloses the lime in a sort of case, to keep it from falling to pieces. This, however, is a step in the right direction.

The commercial difficulties which stand in the way of the general use of the "lime light" are many and great, and may be divided into two classes, viz., physical and chemical. By the physical difficulties I mean those which refer to the supply of the gases from the works to the places of consumption, regulating the proper supply of each gas at the burners, which is absolutely necessary if the best effect is required. As far as the manufacture of the gases by private individuals, in their own houses, is concerned, I think it would be attended with great danger and expense, as it would be necessary to have a person who understood it to attend to it. Let these examples of the physical difficulties suffice, which with others are far greater than any chemical difficulties, and are, to all ap-

pearance, insurmountable, and in its present state invincible; but, seeing what science has done of late years, and is still likely to do, I must not say that it was impossible that the "lime light" should ever come into general use. Nothing was told us by Mr. Baxter how these physical difficulties were to be overcome, and how it was intended to supply the gases, &c.; and this I think should have been done, as, in my opinion, in these would exist the improvements upon the old lime light. I will now endeavour to point out what I consider the principal chemical difficulties.

In the case of ordinary gas companies, they have only to take account of and supply one gas, the oxygen being supplied by the atmosphere, but in the case of the lime light it is otherwise,—they have to supply both the combustible (coal gas or hydrogen) and the supporter of combustion (oxygen); and it so happens that this latter is not only the most expensive to obtain, but is that which will be required in the largest quantity if coal gas be used, and it be good. I will endeavour to show this:—If the coal gas be good, it will contain much heavy carburetted hydrogen, which requires three times its volume of oxygen for perfect combustion; but seeing that it will also contain light carburetted hydrogen, which requires twice its volume of oxygen, and some hydrogen, which requires only half its volume of oxygen for perfect combustion, I will fix the quantity of oxygen required at twice that of the coal gas.

For the "lime light" the gases are required to yield the greatest possible heat, and not light, and since the more complete the combustion of the gases the greater will be the heat given off, it is plain that it is necessary to have perfect combustion, which can only be effected by a perfect supply of oxygen; the lime, when thus intensely ignited, becomes incandescent, and yields the light.

Now the principal chemical difficulty will be to provide a process for supplying oxygen at a sufficiently low price, and I think it will be with this, as with most other things, —as the demand so will be the supply; and I doubt not, if the demand arose, there would quickly be several processes discovered for supplying it at a mere nominal cost. I will just give an instance of a similar kind, the metal "Sodium," the price of which, now it is employed so largely in the manufacture of aluminium, is a mere nominal one compared with what it was before that demand, and I think chemistry will not be behindhand in the case of oxygen either.

As far as regards obtaining oxygen from binoxide of manganese, if the residues could be revivified as easily as stated in Mr. Baxter's paper, viz., by throwing it into water, or by exposure to the air, there would not be such large quantities wasted every year as there are in different parts of the country at the present time. I am not aware that any process, commercially successful, has been discovered for bringing the manganese residues back again to the state of binoxide, and I know there are many who would be very glad of such a process.

The process for obtaining oxygen by the aid of "hydrate of baryta" may form a good continuous process. The hydrate of baryta, heated to low redness in a current of atmospheric air, absorbs the oxygen from it, and becomes binoxide, and when this change is complete the oxygen may be driven off again by raising the heat a little and exchanging a current of steam for that of air; in this way the oxygen may be alternately absorbed and given off in the pure state; and if the process be carried on with due precaution, to prevent the presence of carbonic acid in the air, it may be continued for a considerable time. A patent has, in fact, been taken out for obtaining oxygen by this process.

In conclusion, I would state that I think the lime light was seen on Wednesday under very disadvantageous circumstances, for if it had been softened by a ground glass shade, it would have produced a much more pleasant effect.

I am, &c.,
HENRY K. BAMBER,
Analytical Chemist.

9, Walpole street, Chelsea, S.W., Feb. 27, 1860.

LOCAL BOARDS.

Sir,—I have so often been asked how a "Local Board" for Examinations, in connexion with the Society of Arts, is to be formed, that I think a few lines of the *Journal* may, with advantage, be occupied by a reply to this question.

The Committee of any Institution in union with the Society of Arts, the managers of any school, any schoolmaster, or other person or persons interested in the instruction of adults in any locality, may conveniently originate the formation of a "Local Board." It must consist of not fewer than three persons, and may well be much more numerous, provided that all its members are persons of respectability and of influence in the locality. Wherever there is an Institution for the instruction of adults there must be the materials from which a "Local Board" may be formed. The chief officer of the Institution, with its secretary; the mayor, if there be one; the Members of Parliament, if any; the clergyman, who is probably a Master of Arts; the surgeon of the town or village, who must have some knowledge of science; the master of the Grammar School, if there be one; the certificated schoolmaster, the most influential of the dissenting ministers, one or two of the local magistrates, the judge of the county court, any person eminent in any branch of literature, science, or art, and a few of the principal gentry and tradesmen having influence as friends of education or as employers of labour, may be invited to combine in the formation of a "Local Board," which shall represent all the educational interests of the neighbourhood, and command its respect and support.

If any of these persons be wanting, or refuse their co-operation, the others, or any three or four of them, may form a sufficient board.

It is commonly, but erroneously supposed, that where there is no Institution, nor any class for the systematic instruction of adults, the Examinations of the Society of Arts are inapplicable. Wherever there is a village evening school, of the humblest pretensions; wherever there is a single person, of either sex, not under 16 years of age, who desires that the knowledge which he or she may possess, however and wherever acquired, shall be tested, attested, and rewarded by the Society of Arts, then that person may be examined, on the spot, if not fewer than three qualified and responsible persons will act together as a "Local Board."—I am, &c., HARRY CHESTER.

63, Rutland-gate, London, S.W., 27 Feb., 1860.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Entomological, 8.
British Architects, 8. Mr. Robert Kerr, "On the Historical Notices of Building and Art in the Earlier Writings of the Old Testament."
Medical, 8½. Mr. De Méric, "On Injections of tris-Nitrate of Bismuth in Gonorrhœa."
United Service Inst., 8½. Mr. Julius Jeffries, "Proposed Improvements in the Clothing, Tents, Housing, &c., of British Troops in the Tropics."

Tues. .....Civil Engineers, 8. Continued discussion upon Mr. Longridge's Paper, "On the Construction of Artillery and other Vessels to resist great internal pressure."
Pathological, 8.
Photographic, 8.

Wed. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. Alderman Mechi, "On the Application of Town Sewage to a Large Agricultural Area, comparing its Strength and Dilution with the Ordinary Farm Manurial Resources, with Considerations of its Effects on Farm Profit."
Pharmaceutical, 8.
Royal Soc. Literature, 8½.

Thurs. ...Royal Soc. Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.

Fri. .....Literary Fund, 2. Anniversary.
United Service Inst., 3. Captain Fowke, R.E., "Pontoons."
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Astronomical, 8.
Royal Inst., 8.

Sat. .....Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February 24th*, 1860.]

Dated 4th January, 1860.

26. P. J. Worsley, Rotherhithe, Surrey—Imp. in the separation of silver and lead.

Dated 11th January, 1860.

72. J. Jameson, 10, Catherine-terrace, Gateshead—Imp. in compressing and expanding aeriform fluids.

Dated 12th January, 1860.

86. G. Carter, Water-street, Blackburn—Imp. in the means and apparatus for boiling and mixing size, colour, or any other matters or substances requiring such treatment.

Dated 17th January, 1860.

114. N. Grew, 47, Parliament-street, Westminster—Improved pressure and vacuum guages for steam, water, gas, or other fluids.

Dated 25th January, 1860.

190. F. G. Grice, West Bromwich, Staffordshire—Imp. in the manufacture of nuts for screws, and in machinery employed in the said manufacture.

Dated 27th January, 1860.

206. C. F. Varley, 4, Fortess-terrace, Kentish-town, St. Pancras—Imp. in electric telegraphs, part of the invention being applicable to other purposes.

212. J. Duncan, A. Scott, and J. Dawson, Greenock—Imp. in reburning animal charcoal, and in the application of the products arising therefrom, and in the apparatus employed therein.

Dated 31st January, 1860.

252. T. Culpin, 24, Dowgate-hill, London—Imp. in waterclosets, and all sanitary vessels that require frequent flushing.

Dated 2nd February, 1860.

272. G. Redrup, Loughborough, Leicestershire—Imp. in the means of, and apparatus for, obtaining and applying motive power, whereby perpetual motion may be obtained.

276. A. Denny and E. M. Denny, Waterford—An improved method of and apparatus for singeing pigs.

Dated 3rd February, 1860.

286. R. Fielden, jun., and T. Fielden, Walsden, Lancashire—An imp. or imps. in machinery for cutting hides or skins into fillets, strips, or sheds, and also in the manufacture of pickers, to be used in looms for weaving, and apparatus connected therewith.

Dated 4th February, 1860.

294. J. Taylor, Birkenhead—Imp. in locomotive engines and wheel carriages.

Dated 7th February, 1860.

321. A. Prou-Gaillard, 29, Boulevard St. Martin, Paris—Imp. in vessels for containing solid or fluid matters of all sorts.

323. H. C. Jennings, 8, Great Tower-street, London—Imp. in the manufacture of pulp.

325. W. E. Newton, 66, Chancery lane—Rendering waste "vulcanized," "hermized," and "changed" or "converted" india rubber and india rubber compounds, useful and capable of being reworked for the manufacture of a great variety of articles of trade and commerce. (A com.)

327. C. Hall, Navestock, Essex—Imp. in steam tilling machinery and apparatuses.

329. E. Lea, Hill Top, West Bromwich, Staffordshire—An imp. or imps. in the manufacture of iron and steel tubes.

Dated 9th February, 1860.

347. G. F. Wilson and W. C. Wilson, South Kirkby, near Pontefract, Yorkshire—Imp. in the manufacture of ridge-stones and scythe-stones, and in the machinery or apparatus employed for that purpose, which machinery is also applicable for other similar purposes.

351. W. A. Gilbee, 4, South-street, Finsbury—Imp. in treating saccharine fluids. (A com.)

353. J. J. Smith and C. Bolland, Sheffield—Imp. in fenders and fire-guards.

355. W. Oxley, Manchester—Imp. in apparatus for extinguishing fires in manufactories and other buildings.

Dated 10th February, 1860.

357. P. Adie, Strand—Imp. in the means and apparatus for measuring angular and actual distances.

359. D. Auld, Glasgow—Imp. in machinery or apparatus for supplying steam boilers with water.

361. A. Earnshaw, E. Graystone, J. Shackleton, and W. Stell, Keighley, Yorkshire—An imp. in the spinning of wool, cotton, flax, alpaca, mohair, and other fibrous substances.

363. H. Parrish, Balsall-heath, Worcestershire—An imp. in pressure guages, the which is also applicable to vacuum guages.

365. G. A. Huddart, Brynkir, Caernarvon—Imp. in obtaining and applying motive power.

Dated 14th February, 1860.

369. F. Romeu, Paris—Improved hair pins.

371. W. Nevill and C. Bark, Godalming, Surrey—Imp. in the manufacture of fleecy web.

373. T. Shedden, Ardgartan-house, Argyle, N.B.—Imp. in firearms.

375. A. Henry, Edinburgh—Imp. in apparatus for cleaning firearms.

377. A. V. Newton, 66, Chancery-lane—An improved construction of joints for railway bars or rails. (A com.)

379. W. Mitton and J. Penney, Lincoln—Imp in apparatuses employed for cleaning, dressing, winnowing, separating, and sifting grain and seeds and such like matters.

381. R. J. Cole, 21, Chepstow-villas, Bayswater—Imp. in the manufacture of lead and other materials for pencils.

Dated 13th February, 1860.

383. R. Telford, Birmingham—Imp. in castors.

385. W. Readman, Leighton Buzzard, Bedfordshire—An improved apparatus for communicating motion to roller blinds, maps and other articles.

387. E. Landsberg, sen., Paris—Imp. in button, studs, and other similar fastenings for wearing apparel or other purposes.

391. J. Marsh, London-road, Nottingham—Imp. in sewing machines.

393. K. T. Bowley, Charing-cross—An improved knee-cap for military, sporting, or other purposes.

395. L. J. T. Howard and L. Howard, West-street, Green-street Bethnal-green, Middlesex—Imp. in the fabric or materia used for bolting or sifting flour and other matters.

Dated 14th February, 1860.

397. D. Nickols, Manchester—Imp. in machinery or apparatus for separating the fur from the skins of certain animals.

399. W. Leatham, Leeds—Imp. in the means or apparatus for governing steam engines.

401. W. Hunter, 30, Sussex-place, Kensington, Middlesex—Imp. in apparatus for measuring and regulating the flow of gas as applied to compensating gas meters.

403. P. L. R. Mouillard, Bell-yard, Doctor's-commons—An imp. in the manufacture of metal chains and chain cables.

405. W. Davis, 48, Bankside, Surrey—Imp. in the manufacture of bread, and in apparatus applicable for the same.

407. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in apparatus for separating impurities from grain. (A com.)

Dated 15th February, 1860.

411. R. Morrison, Newcastle-upon-Tyne—Imp. in marine steam engines and boilers.

413. G. Wright, Ipswich, Suffolk—Imp. in winnowing and dressing machines. (A com.)

415. T. Allen, Little Smith-street, Westminster—Imp. in window sashes.

417. G. Bonelli, Milan, Lombardy—Imp. in machinery for weaving figured fabrics.

419. J. G. Jennings, Holland-street, Blackfriars—Imp. in waterclosets, urinals, and lavatories.

PATENTS SEALED.

[*From Gazette, February 24th*, 1860.]

February 24th.

1946. J. M. Hetherington.
1951. F. Wrigley.
1954. T. Craven.
1955. G. Bell.
1959. J. Whitworth.
1977. R. F. Drury and E. Drury.
1983. S. Middleton.
1993. J. A. Simpson.
2184. C. Cowper.
2257. J. J. Eagleton.
2358. N. Montanari.
952. J. J. House and H. A. Martin.

[*From Gazette, February 28th*, 1860.]

February 28th.

1911. E. Hardon.
1966. B. Baugh.
1969. J. B. Barnes and J. Loach.
1973. T. Eastman.
1974. J. Field.
1976. H. Hutton.
1980. W. A. V. Kanig.
1985. A. Smith.
1986. J. Samuel.
1988. L. Berge.
1999. J. Bernard.
2003. W. Fearn.
2006. W. A. Turner and H. L Lilley.
2016. G. Davies.
2017. J. C. Nixon.
2919. C. Schiele.
2024. J. B. H. H. R. Barre and J. B. M. E. Barre.
2055. T. W. Allsopp.
2610. J. McKenzie and S. T Wentworth.
2891. J. Smith.
2907. P. G. Gardiner.
2947. J. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, February 24th*, 1860.]

February 21st.

530. C. H. Murray.
535. J. Milnes and W. Thompson.
552. W. E. Newton.

February 22nd.

524. J. Brown.

[*From Gazette, February 28th*, 1860.]

February 23rd.

541. A. Parkes.
568. W. Mills.

February 24th.

571. W. Macfarlane.
730. J. P. Oates.

February 25th.

607. F. W. Mowbray.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, February 24th*, 1860.]

February 21st.

525. R. Waddell.
594. S. Blackwell.
595. S. Blackwell.

[*From Gazette, February 21st*, 1860.]

February 23rd.

712. C. W. Siemens and J. Adamson.

February 24th.

491. Hon. J. Sinclair.

Journal of the Society of Arts.

FRIDAY, MARCH 9, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of RECENT Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

The days for receiving articles (which must be forwarded to the Society's House *carriage paid*), are Thursday, Friday, and Saturday, the 22nd, 23rd, and 24th March, but no article can be received unless space has been previously allotted, for which application should be made to the Secretary without delay.

Illustrated Catalogues of the Society's Annual Exhibitions are published; a short but clear description of all Inventions exhibited will therefore be required for the Catalogue, with an engraved wood block (when it is possible) for illustration.

These descriptions must be written in a clear hand, on one side only of each half-sheet of foolscap paper, with an inch margin on the left side of the page.

All Drawings exhibited must be framed.

Articles which have been included in previous Exhibitions of the Society of Arts *cannot be readmitted.*

No charge is made for space.

EXHIBITION OF FURNITURE OF ITALIAN DESIGN.

The following circular has been issued :—

Sir,—The Council of the Society of Arts have resolved to open, in the first week in June next, an "Exhibition of Modern Furniture in the Italian Style," by means of which they hope to extend the acquaintance of the public with Ornamental Art, and the appliances of modern workmanship and material.

With this view, the Council have appointed a Committee to superintend the necessary arrangements, and to facilitate the exhibition of all good works of art-workmanship, which in their treatment can be included under the term Italian or Renaissance.

The Exhibition will include all kinds of decorated cabinet-work; works of art in metal, pottery, and glass; textile fabrics, such as curtains, table-covers, and carpets; composition ornaments, such as picture-frames, brackets, and paperhangings.

The Committee solicit your assistance, and will be happy to hear that you are disposed to contribute to the collection.

Should you desire any further information, I shall be happy to afford it.

I am, Sir,
Your obedient servant,
P. LE NEVE FOSTER,
Secretary.

FOURTEENTH ORDINARY MEETING.

Wednesday, March 7, 1860.

The Fourteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 4th instant, J. Bennet Lawes, Esq., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bagnall, Thomas, jun. | Griffiths, George.
Forbes, Charles W., B.A. | Joynson, Edmund H.
Spill, George.

The Paper read was—

ON THE APPLICATION OF TOWN SEWAGE TO A LARGE AGRICULTURAL AREA, COMPARING ITS STRENGTH AND DILUTION WITH THE ORDINARY FARM MANURIAL RESOURCES; WITH CONSIDERATIONS OF ITS EFFECTS ON FARM PROFIT.

By Mr. Alderman Mechi.

The question of town sewage is so important in a national point of view that I venture again to call your attention to the subject. My principal object in doing so is to rebut certain objections raised, and to dispel erroneous opinions that exist on this question. I have been made more fully acquainted with these objections and opinions in consequence of a paper recently read by me before the London Farmers' Club, copies of which I have presented to several hundred Institutes in union with your Society.

It is first objected that sewage is too much diluted to be beneficial to agriculture, except in enormous quantities. Let us test this objection by comparative facts.

The farmer's principal source of manure is from his live stock. The total area of land farmed in the United Kingdom (pasture and arable) may be taken at 50,000,000 acres, half in pasture. I omit poor mountains, &c. These 50 millions of acres may be taken as equal in natural quality to my own. The following statistics

Latest Agricultural Statistics.

	England. Estimated by Poor Law Commissioners.	Scotland. Collected by Highland Society.	Ireland. Collected by Constabulary.	Total.
	1854.	1857.	1859.	
Horses ...	1,309,010	185,409	625,916	2,223,335
Cattle ...	3,422,165	974,437	3,810,136	8,206,738
Pigs	2,363,724	146,168	1,262,873	3,772,957
Sheep ...	18,691,688	5,683,168	3,588,356	27,962,612

show that, reducing all the animals to sheep, the farmer has, on an average, something less than the manure of two sheep or lambs per acre as a source of animal manure. Two sheep (young and old) per acre would be equal, in weight and manurial results, to two inhabitants of a town—weight for weight; indeed, less than this, if you take into account the animal ordure and various other manurial elements that accompany the excretion of two individuals into the sewers. Now let us see whether this manure of two sheep per acre gets more or less dilution than the excrements of two human beings residing in towns. The manure of the two sheep,—which is nearly all fluid (the dry matter being only 1-13th),—is spread over one acre of land. Taking the average of the kingdom the rainfall on this acre will be about 26 inches per annum :—

Average Amount of Rain, Chiefly from a Table by Harvey. *Encyc. Metropolitana.*

	Inches.
Diss	18·7
Upminster	19·5
Carlisle	20·2
Glasgow	21·3
Edinburgh	22.0
Chiswick	23·5
Lyndon (Rutland)	24·3
Youngsbury (Hertfordshire)	25·0
Kimbolton	25·0
Norwich	25·5
Fyfield (Hampshire)	25·9
Ferriby (Yorkshire)	26·6
Chichester	26·8
Epping	27·0
Chatsworth	27·7
Bridgewater	29·3
Gordon Castle	29·3
England, Dalton's Mean	31·3
Exeter	33.2
Liverpool	34·1
Manchester	36·1
Dumfries	36·9
Penzance	44·7
Keswick	67·5

or, 2,626 tons. Thus the manure of each sheep is diluted with 1,363 tons of water; but the excrement of each resident in towns only receives as follows:—

Annually, as water supply	30 tons
Annually, as rain fall (taking the area of the metropolis, its rain fall and population)	50 tons
	80

thus proving, unmistakeably, that the much abused town sewage is, in reality, sixteen times less diluted, and consequently sixteen times stronger than that on which the farmers of England depend for the production of their crops; so that, in fact, an annual application of 160 tons of town sewage per acre would equal the annual manuring which the farms of England now receive.

I have no doubt that this statement will create some astonishment, but I have taken particular pains to obtain from various sources correct approximate statistics, and I have reason to believe that I have allowed more than the farmer really has on an average, I mean animals equal to two sheep to the acre. 'Tis true he adds guano and artificial manures, but the quantity, when spread over 50 millions of acres, is insignificant, and affects but slightly the comparative dilution. He also adds, as a vegetable manure, the unconsumed straw.

Well, then, having disposed of the question of dilution, we may come to a safe conclusion as to the effects of a given quantity of town sewage on a certain agricultural area.

I am a good deal amused when I compare various opinions on this point. Our excellent chairman, Mr. Lawes, told us, when the question was last discussed here, that we must apply 10,000 tons per acre of town sewage, or, in other words, that we must apply to the soil, annually, from £40 to £50 worth of manure. Mr. Halkett values London sewage at 2d. per ton, which I think a fair estimate; if so, 10,000 tons would be £83 per acre. Now, if I recommend farmers to feed more stock per acre, or to put on an extra 20s. worth of manure, to pay 6s. an acre to their landlords for efficient drainage, and another 7s. an acre for superior covered yards, and another 7s. for irrigation, and, in fact, when I tell them generally that it would be much more profitable for them to pay a double rental, provided the increase represented a fair interest for necessary improvements, I am asked where the money is to come from, am called a visionary enthusiast, and am told that I want to open the landlord's eyes. What will they say then to Mr. Lawes and the £40 per acre manure alone?

The London sewage, 240,000,000 of tons, would be worth, at 2d. per ton, £2,000,000.

Farmers and the public generally have no idea of the power which clay soils have to lay up in reserve a stock of manure for the present and future use of plants. Chemists have enlightened us very much on this point; but we have a very recent illustration of it, which bears directly on this sewage question, and I cannot do better than quote the words of that very intelligent and safe calculator, Mr. Halkett, who, in the *Mark Lane Express*, and in a recently published pamphlet, writes as follows with reference to Dr. Voelcker's experiments on soil and sewage, in a recent number of the *Royal Agricultural Society's Journal*:—

"Dr. Voelcker says: 'It will be noticed that none of the four soils used in the experiments had the power of absorbing completely the whole of the ammonia, potash, or phosphoric acid contained in the liquid.' I may, however, here draw attention to the fact that a little less than half the ammonia—about 3-7ths—has been taken up by the clay soils of Cirencester, and with Mr. Mechi's clay soil with a solution very much weaker; so that there is only 1-10th of the ammonia in a gallon which there is contained in the other mixture, one-half, or rather a little more than one-half, namely 1·81 grain out of 3·36 grains, has been retained in the soil, the rest passing off in the liquid.'

"It would I think be an interesting question to solve what, in the use of large amounts of liquids in contact with soils, can be expected to be retained of the manure in those liquids; what is the proportion of ammonia, &c., which is retained in the soil in the case of Edinburgh or Milan, by analysis of the liquid passed off as well as passed on to the land. Or would the vegetation on the ground produce a different effect to that produced by the plain soils unmixed with herbs in Dr. Voelcker's experiments? It is singular, too, that the money values of the crops taken off fields largely irrigated, to which I first alluded, were also half of the money-value of the ammonia, &c., in the liquids passed through the land.

"From these experiments I think it will be seen, if the land is so underdrained that the liquid readily percolates, that from good soils we shall get more than from poor sandy soils; and receive what we gain upon a more concentrated area.

"It has been said that there is little value in sewage; that it is not much better than an equal amount of water. Now, this is true in respect to market-gardening and arable land crops; but is it true in respect to grass land? It is said that in these large dosings of sewage for grass we should gain our advantage from the water; that water alone is known to produce upon some grass-lands very great effects, but that it depends upon the land suiting the water, or the water suiting the land. How do we know that land can take up in an available form such large quantities of ammonia, phosphates, &c., as to equal the value of £35 per acre, in one year, from a bulk of water containing £83's worth? I answer, that certainly very good effects have been produced by water; but that it has been proved that those waters had matters in suspension, or solution, of great value to the lands over which they passed. But I never heard of such great results from water-meadows as from those at Edinburgh. But to discover whether soil can take up fully the amazing amounts stated, let us examine a little further the experiments of Dr. Voelcker. His mixture contained in a gallon 35·58 grains of ammonia, besides potash, phosphoric acid, &c., and an amount of soil in the proportion of only one part in weight of soil to 3½ parts weight of liquid: namely, 2,000 grains of the soil to 7,000 grains of the liquid mixed together, and the soil retained 14·75 out of the 35·58 grains. To see how this fact stood in the matter of bulk as well as weight, and how much would have been retained in an acre of land, I had some ground carefully cut out from grass-land, to the depth of a foot, taken up and weighed. Excluding a quarter of an inch at the top (where the grass was), it weighed at the rate of 112 lbs.

per cubic foot. I had it dried for two days, at a heat above boiling water, till it lost no more in weight, and I found that it had been reduced in weight to 86·2 lbs. Multiply 86·2 lbs. by 3½, and the result will be the weight of liquid manure to put to it to equal Dr. Voelcker's experiment, the result will be 301 lbs. of liquid to 86·2 lbs. of soil, or to every foot of surface of land if the land is to be drenched to one foot deep. But I shall only consider that the top soil is the amount of soil that takes up the fertilizers from the liquid manure; and if I consider this to be ten inches deep (if I take it deeper the argument is stronger in my favour), it will be seen that in round numbers one ton of liquid would be the quantity to each yard of surface; or, as there are 4,840 square yards to an acre, 4,840 tons of liquid would impart to an acre of land as large a proportion of ammonia, &c., as the 7,000 grains of liquid did to 2,000 grains of soil.

"Without further detailing the calculation, it will be found that this amount of liquid would contain a value (at 35·6 grains to a gallon, and at 6d. per lb. for the ammonia, putting nothing down for the value of the phosphates, &c.) of £130; and the acre of land would retain (according to Dr. Voelcker's experiment, where 14·77 grains was extracted from the gallon) £55's worth of ammonia, besides other fertilisers. And this £55's worth of manure per acre is extracted in the one dosing from £130's worth in the liquid, in the space of time (whatever that is) that this quantity would have taken to pass through the soil. "Is this the utmost amount that the soil can hold at one time?"—Dr. Voelcker asks this question; but says that, at present, it cannot be answered. Would vegetation assimilate these fertilisers? Could another, or several more doses equal to this one, be given periodically, so that the acre of land should take up a yet larger quantity in the course of the year? Very likely the plants could not bear such large quantities of a liquid-manure of this strength; for the manure contains 6½d. worth of ammonia, besides other matters, in the ton, while the Edinburgh sewage has an amount of manuring matter in it of which ammonia, together with all other matters, is worth only 2d. per ton. That is not the question at present. The question is, whether land can take up the large quantities of ammonia, and other matters, out of the quantities I have at the commencement mentioned, namely, out of 10,000 tons, containing £83's worth, to retain and give out £32 or £35's worth; the land evidently can do so, and a very much larger quantity. Whether the crops obtain the chief advantage from the manure, when there is such a large amount of it, or from the water only, the marvellous amount of the crop is, I think, the best answer."

Having then proved, both by Mr. Lawes and Mr. Halkett, that you may profitably invest an enormous money value in manure per acre for green crops, we must naturally consider whether it is advisable to do so on a large scale, when there is so much land in this kingdom that only receives the manure of two sheep per acre, and requires an additional supply.

At all events we may safely come to one conclusion, that as the land only abstracts 50 per cent. of the treasures contained in the sewage or manure, that which escapes through the soil or drains should be used over and over again on other less fertile lands, in order to extract from it as much as possible of its valuable elements. What would be said of millers who did not avail themselves, over and over again, of the power which water affords by means of the sloping inclination and differing levels?

How interesting to see a succession of farming engines dispensing the fluid over distant districts, straining from it through impoverished soils, the last drop of fertilising element.

I am not quite sure that some day there may not be as much jealousy and coveting this liquid, as we now see about the waters which work the mills on our streams; besides it has not been proved yet whether or not it would not answer to pump the sewage a second time over the same soil; whether it would not have, especially where covered with vegetation, second powers of abstraction from the unexhausted sewage. We should thus have the satisfaction of sending the water to our rivers pure and deprived of those elements which are only noxious when out of their proper place.

I now proceed to consider how we may best fertilize our soil with town sewage. It may be done as on my farm, with common iron water pipes; but it appears to me that as a single heavy dressing with sewage will fertilise a field sufficiently to carry it through a four or six course rotation of crops, it might be desirable, in many cases, not to have subterranean pipes but moveable conduits, that could be carried from field to field, or from farm to farm. We should then, probably, have travelling irrigators, who would do all that was needful at a moderate but remunerative charge, much as is now done by those who purchase and let out steam threshing machines. This mode of temporary irrigation has been suggested to my mind by observing the bitumenized paper pipes made by Messrs. Jaloureau and Co., of Paris, of which I now exhibit specimens. I am glad to find that Messrs. Paul Joske and and Alexander Young, of 67, Mark-lane, have purchased the patent for England.

So far as I can judge, this invention is likely to have a most important influence on the success of sewage companies, for it would reduce by more than one-half the capital required for piping. I am told that by chemical analysis the composition of the pipes corresponds exactly with the material used by the Egyptians for preserving their mummies. The mode of joining the pipes saves the expense of lead. These pipes are easily removable, being only one-fourth the weight of iron.

A reference to my last paper on sewage, read before the London Farmers' Club, shews that these paper pipes for gas, water, or sewage, have an extraordinary power of endurance, and of resisting great pressure; whilst for moveable irrigation they have the great advantage of extreme lightness, freedom from oxidation, and, unlike the gutta percha tubes, are unaffected by sun heat.

It might probably answer best to have a few acres for Italian rye grass laid down with subterranean paper pipes, so much of the rest as required it being irrigated by the moveable pipes. On my own farm the fixed iron pipes are only used in alternate years, as the rotation varies, which locks up capital uselessly.

Assuming that we shall some day see lines of main pipes charged with sewage intersecting our country, how easy would it be, where levels were suitable, to avail ourselves of the services of these itinerant migratory irrigators, who, carrying with them these paper pipes, would fertilise field after field, by connecting them with the main sewer pipes always charged. Probably agriculturists, in particular districts, will combine their means, and thus effect the object in the most economical and effective manner, much as the great fen drainages have been carried out.

Very exaggerated notions prevail as to the cost of putting on town sewage or water for irrigation. If landlords or tenants would take as much trouble to prepare their lands by open conduits at proper levels, as is now done in many districts to make use of river irrigation, the sewage might be cheaply pumped to the necessary level where the rise was not great.

A Cornish engine, or Mr. Appold's pump, would raise 43,000 tons, or more than 15 years rain fall, one foot high, with 1 cwt. of coals, or a cost of one shilling's worth of coal, to which must be added interest for wear and tear and other expenses.

On level land, near a river, or near the sewer, has this ever been duly considered?

Let us see what is doing at Whittlesea Mere. If this body of water can be taken off at so small a cost per acre, can it not be put on at about the same cost, provided the levels were suitable?

Drainage and Irrigation effected by Steam.

The great fen district of the Bedford Level, once a swamp of 200,000 acres, owes its value and fertility to a steam-power of some 1,200 horses, which, distributed at intervals towards the coast, works enormous pumps or wheels, which, creating an artificial fall, by raising the water, cause an outfall for the drainage. Some of these engines throw up 120 tons per minute.

Again, the great Whittlesea Mere, a sort of inland sea, is now a garden of cultivation, having been pumped dry by Appold's steam-pumps, such as we saw at the Exhibition of 1851. These lands, like the great Bedford Level, are preserved from inundation by steam-power always acting or ready to act.

I have to thank Mr. Laurance for the following communication:—

"Elton, Oundle, 19th April, 1859.

"Sir,—I beg to acknowledge the receipt of your letter of the 15th.

"The Appold pump, at Whittlesea Mere, drains upwards of five thousand acres of low land, exclusive of the water shed from the high lands, which will include four or five hundred acres.

"The engine, pump, and buildings, including extensive piling for foundations, cost £2,500. (The drains and ditches are not included in this sum).

"The cost of the first three years' working and repairs—1851 to 1854—averaged one shilling per acre. In 1852, the newly-formed banks broke, and one thousand acres of land were inundated. This had to be pumped out, and the average of the cost was raised by this circumstance.

1855	6d. per acre.
1856	8d. ,,
1857	10d. ,,
1858	8d. ,,

This includes coals, repairs of engine, engine-man's wages, oil, &c., &c.

"The quantity of water raised six feet high is 16,000 gallons per minute. The lowest lift is four feet six inches, the highest ten feet. The engine works now about three days a week, and runs four or five hours per diem, not consecutively, but at intervals, the supply of water not being sufficiently rapid for the discharge by the centrifugal pump.

"There is no publication containing these facts. You are welcome to them.—I am, Sir, your obedient servant,

"JOHN LAURANCE."

Probably there is no surer source of profitless farming, than poor grass land on undrained heavy clays. There are many millions of acres of such land.

The following letter will give a tolerable idea of the position of the holders of such rough grass farms:—

"Dear Sir,—From a lecture on sewage recently delivered by you, the following extract is most extensively circulated:—'For the last six years my gain, as landlord and tenant, on my little farm of 170 acres has been nearly £700 per annum. Even this year, with wheat 42s., I have gained £600, after paying every expense. Of course, much of this benefit has arisen from steam-power, drainage, and deep cultivation, and other improvements, but the liquified manure system has greatly contributed to this result.'

"This declaration has been variously received, but most generally amongst the strong land farmers of the West Riding of Yorkshire as rather apocryphal. There is no disposition to call in question your veracity, thinking the rather that a grave error in some of the items of profit may have occurred. Should this not really be the case, certain inferences must follow:—That a great extent of land is at present badly cultivated, and the difficult and embarrassed circumstances of many occupants ought not and need not continue. You have, by your spirited attention to farming, set a most praiseworthy example to landed proprietors; and, taking the results to be as you have given, tenant capitalists—being practical men—may find a good investment for their money.

"Numerous advantages would follow if the internal facts of your success were generally known. The result, as given in one concentrated amount, is very pleasing. Would you take the trouble to give the process in detail, or, in other words, the accounts in full? Such a request may be considered by you (and not improperly so) as trenching on your kindness and valuable time. My only apology is, from an earnest desire to follow your practices and adopt your plans, as far as a tenant farmer can do so. I hope, therefore, that if you decline a grant to my request, you will pardon the liberty I have now taken.

"I farm 165 acres of principally strong clay land, under ———. Two-thirds of the farm is in pasture grass—old sward overrun with rough grasses. The land is in a ring fence, it is mostly drained, but not deep, but the homestead is three-fourths of a mile from the land, and no land joins the said homestead. I proposed to build a homestead in the middle of this 165 acres, with some little allowance, and thirty years' lease, which was refused. The total receipts on this farm, during the very highest period of the last nine years, are £834 19s., and the payment £885 13s. 11½d. I have not charged the farm with interest of capital invested in it, neither with my own time and skill employed, and yet I am minus above £50, so that you will readily grant that something is directly necessary as a remedy for such a state of things. I have lost £52 per annum for the last nine years. Such has been the profits in grazing on the present system.

"I am, &c.,

———

"Feb. 16, 1860.

"Any information as to the cost of a new homestead, where brick can be made on the spot,—and deep drainage per statute acre,—and how much you keep in grass,—and how you fence your land, and apply your liquified manure, will be thankfully received.

The following balance-sheet has been furnished me by the same gentleman:—

1859.—Account of (principally a clay soil) farm in the West Riding of Yorkshire, 163a. 2r. 36p., of which 107a. 0r. 0p. is in old sward.

Income.	£	s.	d.	£	s.	d.
18 Ac. Wheat, 27 bushels per a. at 6s.	140	16	0			
12 ,, Barley, 36 do. do. 4s. 9d.	102	0	0			
7 ,, Pasture seeds do. do. 63s.	22	1	0			
3½ ,, Red clover do. do. 80s.	14	0	0			
3½ ,, Beans or peas, 30 bushels	26	5	0			
10 ,, Swedes and Turnips, valued on land, 70s.	35	0	0			
3 ,, Summer Fallow						
57				340	2	0
Sheep.						
54 Lambs at 26s. per head	70	4	0			
22 st. 12 lb. Wool at 17s.	19	6	0			
37 Ewes, fattened on grass and turnips, 43s. 6d.	80	9	6			
3 Do, fallen carcases, 6s.	0	18	0			
				170	17	6
Grass.						
20 Ac. Meadow, valued at 60s.	60	0	0			
10 ,, Horse pasture	15	0	0			
10 ,, Sheep and lamb do.	15	0	0			
36 ,, Rising stock	72	0	0			
31 ,, Twenty head of feeding stock	65	0	0			
107				227	0	0
Pigs.						
Sold and consumed, as per account		...		33	12	0
Dairy.						
Produce of three cows		...		24	0	0
Loss (exclusive of interest on £1,090)		...		43	12	3
				£838	3	9

Expenditure.	£	s.	d.	£	s.	d.
Rent and Tithe	186	10	0			
Rates	38	6	0			
Manual Labour	171	13	9			
Two Servants in House and Wages	45	0	0			
Horse keep (4 and 1 nag)	109	0	0			
Trades Bills	23	18	0			
Purchased Manures	38	0	0			
Seed	28	14	6			
Decadence and Wear of Implements (average)	8	14	0			
Fencing materials, Pastures and Sheep	4	4	0			
Casualties	2	10	0			
				656	10	3
Sheep.						
40 Ewes, at 45s. per head	90	0	0			
1 year's keep, Grass and Turnips	43	6	8			
Salving, Shearing, Washing, &c.	1	7	4			
Loss by Deaths (3 average)	6	15	0			
54 Lambs dipping	0	8	6			
				141	17	6
Losses by Deaths in Cattle (average)		...		13	0	0
Pigs.						
Purchase and Feeding, as per account				26	16	0
				£838	3	9

Now, if this tenant were permitted to deeply cultivate and carbonize this soil, not exhausting it by consecutive corn crops, but applying to it the best system of alternate husbandry, he would be in a more hopeful condition, but there is also another way of improving poor grass lands without breaking them. This is most successfully practised by a money-making farming friend of mine, who takes poor parks, and other poor grass lands, and very quickly improves them. Sheep are folded upon them during autumn and winter, having an unlimited supply of cut hay, with cut turnips, and half a pound of oil cake or rape cake per day, or, in lieu of that, half a pint of beans or peas per diem each.

Thus, the sheep are placed upon the grass, not for the purpose of feeding on it, but to manure and improve it, by restoring those elements of fertility which exhaustive farming had previously abstracted. The results are obvious and unmistakable. The grass field thus becomes a fold yard. The next hay crop gives unmistakable evidence of the prosperity of this system.

No one would recommend spring or summer grazing with sheep; but there is a much cheaper and quicker way than either of those I have mentioned of making poor grass lands pay—I mean by the application of town sewage, or simple water. If the contents of our town sewers were poured over those millions of poor and profitless pastures which occupy more than one-half the area of this kingdom, they would, as it were, spontaneously clothe themselves with rich and meat-making herbage. Of course, the undrained clays must be previously drained, or the sewage or water would not filtrate through them. On the whole, I am decidedly of opinion that the occasional breaking up of poor grass lands is a decided gain individually and nationally. I know an instance (See Mr. Woodward's statement in the Royal Agricultural Society's *Journal*, Vol. IX., page 54,) where grass land rented at 25s. per acre, was drained and deeply dug and levelled at a cost of £15 per acre. The very first wheat crop produced £15 15s., and it produced successively several such crops. The late Mr. Woodward who did this realized a large fortune by farming, and, having had the pleasure of his acquaintance, I know that his system was to invest much capital to produce a more profitable result. I can confirm his practice by my own.

How I Make My Farm Pay.

I have received many letters from practical farmers desiring to know how I can pay myself a high rent, and make, besides, a satisfactory tenant's profit, at the present low prices of corn? I find, on inquiry, that many of those farmers are placed in an unfavourable and profitless condition, as compared with myself, for want of those improvements and advantages which I possess, and for which my increased rental is charged. In order that farmers may compare their own position with mine, I have propounded the following questions, which I have answered, and which each farmer can reply to, and thus compare his practice and position with mine. I will call it

Alderman Mechi's Agricultural Catechism, especially addressed to Heavy Land Farmers.

1. *Q.* How much do you suppose the landlord's investment is per acre in the purchase and improvement of the land which you occupy?—*A.* About £60 per acre.

2. *Q.* What rent do you pay per acre?—*A.* 42s.

3. *Q.* How much is your working capital per acre?—*A.* £14.

4. *Q.* How much is your gross produce per acre. I mean the total amount received for produce sold without any deduction of expenses?—*A.* £11 15s.

5. *Q.* What are your total expenses per acre, including purchased food and manures, but irrespective of horse-keep, which I assume is furnished by the farm?—*A.* £9 11s. 8d.

Gross Expenses per Acre on the Whole Farm.

	£	s.	d.
Rent ..... 36s. / Irrigation ..... 6s.	2	2	0
Tithes (great and small)	0	5	0
Church rate	0	0	2
Road rate	0	0	3
Poor rate, including police and county rate	0	2	3
Manual labour, including engine-driver and bailiff	2	0	0
Horse labour (fed from the farm), 20s.			
Seed	0	8	6
Depreciation, or wear and tear of implements	0	2	0
Steam power	0	5	0
Blacksmith, wheelwright, cooper, founder, saddler, basket-maker, bricklayer, carpenter, and veterinary	0	5	6
Thatcher	0	1	0
Depreciation of horses	0	2	0
Artificial manures (guano)	0	10	0
Wear, tear, and loss of sacks	0	0	3
Bean tiers	0	0	3
Loss of stock and casualties	0	1	0
Loss of land by roads, buildings, fences, and waste	0	2	0
Road mending, ditch cleaning, fence trimming, &c.	0	1	0
Miscellaneous petty expenses	0	1	6
Malt and hops used in brewing beer for men	0	2	0
Purchased food for stock	3	0	0
	£9	11	8

6. *Q.* How much permanent grass have you per 100 acres?—*A.* 4 acres.

7. *Q.* Has your landlord drained the land?—*A.* Yes.

8. *Q.* Has he put up farm buildings in a central part of the farm, affording ample covered shelter for live stock and manure, with tanks for economising liquid manure?—*A.* Yes.

9. *Q.* Is there a good farmer's residence?—*A.* Yes.

10. *Q.* Are there good roads on the farm?—*A.* Yes.

11. *Q.* Is any portion irrigated by water and gravitation?—*A.* No.

12. *Q.* Is any portion laid down with subterraneous iron pipes for irrigation with water and with farm sewage, by hose, jet, and steam-power?—*A.* Yes, the whole farm.

13. *Q.* Is there a fixed or portable steam-engine?—*A.* A fixed engine.

14. *Q.* Does the steam-engine work a thrashing and dressing machine?—*A.* Yes.

15. *Q.* A chaff-cutter?—*A.* Yes.

16. *Q.* An oil cake breaker?—*A.* Yes.

17. *Q.* A pair of mill stones?—*A.* Yes.

18. *Q.* Irrigating pumps?—*A.* Yes.

19. *Q.* Sack-raising tackle?—*A.* Yes.

20. *Q.* A root pulper?—*A.* Yes.

21. *Q.* Are the buildings troughed?—*A.* Yes.

22. *Q.* Is the liquid manure allowed to run away?—*A.* No.

23. *Q.* Is your corn drilled?—*A.* Yes.

24. *Q.* Do you use Garrett's horse-hoe for your corn and root crops?—*A.* Yes.

25. *Q.* How much seed do you drill per acre?—*A.* Wheat, 4 to 5 pecks; barley, 6 pecks; oats, 6 to 8 pecks; beans, 10 to 12 pecks.

26. *Q.* Do you subsoil and trench plough your land?—*A.* Yes.

27. *Q.* What is your depth of cultivation (measured on the solid side of the ploughed land)?—*A.* 12 inches, but it ought to be deeper.

28. *Q.* Do you use a reaping machine?—*A.* Yes.

29. *Q.* How much has been your annual loss in horses

and live stock per acre (in money value) the last seven years?—*A.* One shilling per acre per annum.

30. *Q.* How many acres (landlord's measure) does each farm horse consume annually of the produce?—*A.* 2½.

31. *Q.* How many working horses do you keep to each 100 acres?—*A.* Six for 170 acres.

32. *Q.* How much is your labour per acre per annum, including bailiff (if any) and engine driver?—*A.* 40s.

33. *Q.* How much purchased manure do you use per acre over the whole farm?—*A.* 10s. worth.

34. *Q.* How much purchased food per acre over the whole farm?—*A.* £3 worth.

35. *Q.* How many pounds of meat (net dead weight) do you make per acre over the whole farm? I mean actual dead weight, added to the animals which you purchase?—*A.* 200lbs. per acre, or 34,000lbs. on 170 acres.

36. *Q.* How many quarters of corn do you sell off the farm annually per acre?—*A.* Average—Wheat, 280 quarters; beans, 100 quarters; oats and barley, 150 quarters from 170 acres, or 24 bushels per acre.

37. *Q.* How much clover and grass-hay do you sell off annually?—*A.* £100 worth.

38. *Q.* How much dairy produce ditto?—*A.* £70 worth.

39. *Q.* How much clover seed, or other seeds, ditto?—*A.* This year about £70 worth.

40. *Q.* How much of any other produce ditto?—*A.* About £30 worth.

41. *Q.* Are your fences closely trimmed?—*A.* Yes.

42. *Q.* Or are they allowed to grow untrimmed for several years?—*A.* No.

43. *Q.* How many acres per 100 of the farm are occupied by buildings, fences, roads, water courses, and waste?—*A.* Five acres, or 5 per cent. of the land.

44. *Q.* Are your drains and water courses free and open?—*A.* Yes.

45. *Q.* How many loads of burned clay ashes have been applied per acre?—*A.* 25 cart loads.

46. *Q.* How much lime?—*A.* About 80 bushels, or 240 bushels of chalk.

47. *Q.* How many trees have you per acre?—*A.* None.

48. *Q.* Is much of your labour done as piece work?—*A.* Yes.

49. *Q.* Do you enter every money receipt and payment in the cash book, and take stock at the beginning and end of each year?—*A.* Yes.

50. *Q.* What profit do you make upon your farming capital?—*A.* From 15 to 18 per cent.

51. *Q.* Do you apply your house sewage to the soil?—*A.* Yes.

52. *Q.* Do you grind corn for your neighbours?—*A.* Yes, and it pays well at 3s. per quarter.

53. *Q.* Are your stock comfortably housed during the winter?—*A.* Yes.

54. *Q.* Are your green and root crops passed through the chaff cutters for your animals?—Yes.

55. *Q.* Are your animals permitted to walk, lie down, and dung upon their food?—*A.* No.

56. *Q.* Do you hold your land on lease or by annual tenure?—*A.* I farm my own land, except a portion held on a 21 years lease.

57. *Q.* Do you use wagons or carts.—*A.* Carts.

58. *Q.* Are your corn stacks on iron rick frames.—*A.* Yes.

59. *Q.* Do you feed much of your straw.—*A.* Yes.

60. *Q.* Does your landlord allow you to break up poor, old, profitless, grass land?—*A.* Yes.

61. *Q.* Are you tied to the four-course rotation?—*A.* No, I consider it unprofitabl with very high farming.

I think it right to state, that I consider the items of £3 per acre for purchased food, and 10s. per acre for guano, have a most important influence on my profit. Without these items, I should expect a very different balance sheet. I also derive much benefit from applying the manure mixed with large quantities of water. In fact, every one of the questions I have propounded have, in a greater or less degree, an influence on the profits of farming, and it would be easy to come to a conclusion as to the success or failure of a farmer, from the manner in which these questions would be answered.

What margin for improvement is there in British agriculture? I have tested this by comparative results, and find that if all the land of this kingdom, 50,000,000 acres, which is equal in quality with my own, produced as much as mine does per acre, our agricultural produce would be increased by the enormous amount of £421,000,000 annually, the present produce, according to my calculation, being only £3 7s. per acre, or 169 millions. According to my annual produce of £11 15s. per acre, it would be 587 millions.

This is no exaggeration, but a stern and humiliating fact. I have taken great pains, in the absence of agricultural statistics, to test the correctness of my opinions by an infallible check. I mean the annual average consumption of agricultural produce by each individual of the population which, taking all classes, sexes, and ages, amounts to about 2s. 5d. per head per week, or £6 7s. per anuum, as explained in the following tables.

From this amount must be deducted the profit, &c., intervening between the farmer and the consumer, the amount of foreign food imported, the taxation on malt and hops, and home-made spirits. On the other side, we must add the productions of wool, hides, fat, flax, &c., and also the value of food consumed by horses non-agricultural, by dogs, cats, birds, donkeys, &c.

In dealing with the items, there may be a difference of a million or two on either side, but this will not affect materially the grand total.

I have not taken any account of the keep of farm horses, as they are kept on the farm's produce. The gross acreable produce of £3 7s. per acre, is, of course, without any deductions for rent, labour, and other farm expenses. My return of £11 15s. per acre is estimated in the same way.

There are 50 millions of acres in the United Kingdom paying probably from 45 to 50 millions of rental annually, and, on an average, of equal quality with mine.

If my return of rent and produce be correct, their gross return only represents 3¼ rents; my return is equal to 5¼ rents.

Small as our produce is, Monsieur Lavergne estimates the gross acreable return of French agriculture at only one-half the amount of ours, although their soil and climate are quite equal to ours. Still, this is poor consolation for our own deficiencies and short comings.

Our population, 27 millions, consume annually of agricultural produce—bread, meat, vegetables, eggs, poultry, and beer, £6 5s. 8d., or 2s. 5d. per head per week, (taking all classes, ages, and sexes).....	£169,000,000
Deduct: Foreign food imports, and carriage, profit, &c., between the producer and consumer of English produce.....	39,000,000
	£130,000,000
Add: Wool, tallow, hides, flax, &c., and horses, not used in farming, and hay, corn, &c., for these horses	36,000,000
	£166,000,000
Or, £3 7s. per acre, on 50 millions of acres, which I think I have valued too high by 2s. per acre—the farmer's capital employed per acre I estimate at £4.	
At my rate of produce per acre (£11 15s.), our 50 millions would produce	£587,000,000
Or, an increase produce equal to.....	£421,000,000

The results of improved farming are cheering, and convince me that we can safely compete with the whole world in the production of corn, but that can only be done by a concurrent large production of meat and of manure, the latter not purchased but produced by the feeding of stock.

My crop of wheat this year is immense. I threshed this week a seven-acre field of wheat, which produced a large crop of wheat in 1857, a great crop of beans in 1858, and now, in 1859, the crop of wheat is nearly seven quarters per acre. This field was manured for beans in 1858, but had no manure of any kind for the wheat crop of 1859.

Those who have not experienced the advantage of drainage, very deep cultivation, and abundant manuring, have yet a great lesson to learn. I have good reason to believe that my 56 acres of wheat will produce more than 308 quarters, or 5½ quarters per acre, although 20 acres were taken without manure after a heavy crop of beans; 12 acres after mangel; 6 acres after wheat; 12 acres after Italian rye grass; 6 after clover.

My crops were seen, as usual, during their growth by many agriculturists from various parts of Britain, and from foreign countries.

If this statement does not overwhelm British agriculture with shame at its shortcomings, I shall indeed be much surprised. My consolation is that there is a grand future in store for our multiplying millions; that there will be a doubled or tripled rental for our landlords, if they will but deserve it by an improved investment, and that our multiplied artizans, mechanics, and manufacturers may receive from the future tillers of an improved soil cheap and ample food in return for their own handy work. My heart warms with delight at such a prospect.

The perspective of an intelligent availment of science by a future race of landlords and tenants cheers my spirits, and encourages me to go on in the rugged paths of agricultural stimulation. If stagnation and retrogression weaken and humiliate a nation, it is but a logical conclusion that advancement and improvement shall bless it with peace, plenty, and dignity. That my efforts may tend to this happy result I most sincerely pray.

A review of agricultural amelioration judiciously conducted is full of the most pleasing deductions and considerations. My case has proved that it may double rental, triple the farmers' capital, multiply employment, greatly increase and cheapen food, and enlarge the demand for it, with increased profit. Improvement, by creating a new demand for labour and material, enhances their value, encourages population, and thus establishes an additional and improved market for that very food which it has more abundantly produced, whilst it enables us to compete successfully with the most favoured corn and meat-producing countries.

I conclude in the eloquent words of Mr. James Caird, at page 528 of his admirable book on English Agriculture: "I rise from my task conscious of its imperfect execution, but with a firm persuasion that, though there are many exceptions, the great body of the landlords and tenants of England have, by mutual co-operation, energy, and capacity, sufficient to meet, and by degrees, to adapt themselves to a change which, in its extraordinary effect on the welfare of all other classes of the community, will sooner or later bear good fruits also to them."

DISCUSSION.

The Chairman said it was now his duty to invite discussion upon the very important subject introduced by Mr. Alderman Mechi in his paper. It had been discussed more than once in that room. At one time they had to combat the views of those who told them that the sewage should always be manufactured into a solid form, and they were called prejudiced and ignorant. There could be no doubt, however, that Mr. Alderman Mechi had adopted the right view, viz., that if sewage was employed upon the land, it must be used in a liquid rather than in a solid form. He somewhat demurred to what Mr. Alderman Mechi had said respecting himself (the chairman). It was true that he had recommended that 10,000 tons of sewage should be used per acre, but at the time he did that, it was contemplated that the sewage would be distributed over enormous tracts of land—some 2,000,000 of acres—in the proportion of only 30 or 40 tons per acre. Having to combat that idea, he advocated the application of the large quantity per acre which had been stated, and to be used profitably, he considered it must be used in large quantities over a limited area. They had been frightened into the idea that the land of this country was becoming rapidly exhausted, and even Baron Liebig had lately written letters to that effect in the *Times*. If he (the chairman) thought such a result was happening, he should say that this must not remain a question of pounds, shillings, and pence, but that if the land had deteriorated in the way suggested, it must be immediately restored at any cost. But he did not think there were any grounds for saying that the land was deteriorated. It showed weakness in the argument when they were sent to Virginia, and other places, for examples of exhausted soil, inasmmch as the cultivation of land had been carried on in this country from the earliest ages, and yet no one could point out any portion of the soil in Great Britain which had become exhausted. Twenty years ago he had himself entertained the idea that the soil could be exhausted; but at that time he began to do that which was considered by farmers to be most exhausting, viz., to grow a succession of wheat crops without manuring, For 20 years he had done this, and the land now yielded as good crops as it did when he commenced that plan, and this went to show the great latent capabilities of the soil. He therefore hoped that this paper would be discussed as a commercial question rather than as one of exhaustion of the soil, as to which he felt sure there were no grounds for apprehension.

Mr. George Shepherd said he had paid a great deal of attention to the use of the sewage of our towns for agricultural purposes, and as the subject had been so long before the world, he had imagined that all scientific men and practical farmers were agreed as to its manurial value; but two opponents had sprung up at the eleventh hour, and raised their voices against its application to the land. Mr. Bidder, President of the Institute of Civil Engineers, in his address from the chair on the 10th January, stated, "One great inducement hitherto held out has been the prospect entertained of employing the sewage of our towns for fertilising our lands, and it is mainly due to our member, Mr. Hawkesly, that this delusion, to a great extent, has been dispelled. Recent investigations have shown that in towns amply supplied with water, the sewage contains very little, if any, fertilising quality, certainly none of any commercial value." In reference to this statement, he had written both to Mr. Bidder and Mr. Hawkesley, but had received no reply. With regard to the strength of the London sewage, from the returns just published by order of the House of Commons on the supply of water to London, they were informed, that the various water-works supplied London daily with, in round numbers, about 80,000,000 gallons of water, about equal to the water pumped daily out of half-a-dozen mines in Cornwall. Assuming these figures to be correct, from a series of experiments, extending over nearly three years, he had found that the water supplied was consumed as follows:—About 25 per cent., or 20 million gallons of the daily supply, was consumed in various household uses, drunk by animals, evaporated, used for watering roads and for manufacturing purposes; this amount disappeared entirely. About 60 per cent., or 48 million gallons, went into the sewers, after it had been used for the various household and other purposes. In addition to this, there was the wash from the slaughter-houses, gas works, manufactories, and various other places. These 48 million gallons of water, consequently, contained all the soap, soda, potash, fatty matter, &c., besides valuable slush of every character, all of which contained ingredients of animal and vegetable matter of the highest fertilising character, some of it too rich for grass-land, and requiring further dilution with water before it could be applied. From numerous experiments, he was convinced that this mass of sewage was equal in value to the water

closet sewage itself. About 15 per cent., or 12 million gallons of water, went through the water-closets, carrying with it into the sewage all the excrements from nearly three millions of human beings, the inhabitants of London. Taking the excrements (fæces and urine) at 3¼ lbs. daily from each person, this 12 million gallons contained about 9,750,000 lbs., or 4,352 tons, of excreta daily, in the best state for assimilation with the soil. Therefore, scarcely a gallon of water went into the sewers which did not contain valuable manure more or less. For the last few years, during the hot months in summer, the intolerable stench from the Thames, caused by the sewage of London, was found to extend over a distance of upwards of 40 miles. Now, taking the average width of the Thames at 1,500 feet, and 20 feet deep=30,000 square feet sectional area, multiplied by 40 miles in length, would give a mass of water equal to 6,336,000,000 cubic feet. Now during the hot months in summer, the quantity of sewage discharged into the Thames did not exceed from 7 to 8 million cubic feet per day. He would ask how it was that this small quantity of sewage, if it contained no manurial or fertilising matter, possessed the power of putting this enormous mass of water into such a state of fermentation. Such was the strength of the London sewage; now for its commercial value. Mr. Bidder had stated that in "towns amply supplied with water, the sewage contains little or no fertilising quality, certainly none of any commercial value." Now for practical facts. The following statement, with regard to the town of Ashburton, Devonshire, was interesting:—

"As an illustration of the extraordinary effects of sewage water, even in a highly diluted state, I will mention that beautiful valley in Devonshire immediately below the little town of Ashburton. The stream of water which runs through the place receives all its sewage and the wash of two or three manufactories, and is afterwards, by a well-arranged system, made to irrigate the valley below for nearly three miles in extent, until it falls into the river Dart. The produce of this valley is perfectly astounding, and no stranger ever can pass along the high road from Ashburton to Buckfastleigh without being at once struck with the luxuriance and abundance of the pasture around him. The average rental is about £6 per acre; but it sometimes lets at fabulous prices, especially in a late, cold spring; the last meadow is as good as the first. The water rises on the high moorlands; it is of no use for irrigation, but absolutely injurious to the soil before it receives the sewage or wash of the town. The population of Ashburton does not exceed 2500 inhabitants. The land not irrigated lets for 20s. per acre."

The effect of the sewage of the town of Malvern on land in that neighbourhood was described as follows by Mr. Lawrence, farm bailiff:—

"Since we have had the sewage on this field we have had five times the quantity of hay we ever had before. We used to mow our clover three weeks before we mowed our hay. Since we have had the sewage we have mowed our hay three weeks before we cut our clover, and the grass ought to have been cut much earlier than it was; it was rotten at the bottom for want of being cut earlier. We now cut our grass for hay three times in the year instead of once, and have a good pasture for our cattle until very late in the winter."

The sewage of the town of Mansfield had been applied to the land in the neighbourhood of that town, and it had increased the value of that land from 3s. per acre, the price paid before the sewage was applied, to £12 per acre. The 400 acres of land irrigated by the sewage of Edinburgh, were let for from £15 to £20 per acre per annum. The Earl of Essex had written as follows with regard to his land:—

"During the winter, from October to January, or longer, I apply the sewage to meadows for hay, two dressings per acre, each about 50,000 gallons—*i.e.*, 225 tons. I have done this now two winters, and the increase of hay, both in quantity and quality, is most extraordinary. It seems especially to thicken the bottom wonderfully, bringing up abundance of clover. I think my produce of cut grass this year, when the cuttings are over and accounts made up, will not be less than 45 tons per acre. The year before last I kept 34 bullocks all the summer, with as much as they could eat, from seven acres. They had some cake also, and were well fattened. This year I have fourteen bullocks and eight horses consuming it. The former are fattening beautifully without any other food."

With regard to the value of sewage for wheat crops, Baron Liebig had said, in a letter dated 8th January, 1860—

"The contents of the reservoirs of the fortress of Rastadt, in the Grand Duchy of Baden, which received the deposits of a garrison of 8,000 men, were sold in 1858 for 8,155 florins. The commune of Olligheim, near Rastadt, consumed the greater proportion of this sewage, and in the course of a few years they converted the most sandy unproductive soil into flourishing corn fields."

On the same subject the Earl of Essex had stated:—

"Last year, having heard it stated that sewage was not good for wheat, I marked out two adjoining acres in the centre of a field. No. 1 received 60,000 gallons—270 tons. No. 2 received nothing.

				£	s.	d.
No. 1 produced 53 bushels, worth at 6s.				15	18	0
And straw, 5 loads, at 30s.				7	10	0
				23	8	0
No. 2, 44 at 6s.	13	4	0			
Straw, 4¾ loads	7	2	6			
				20	6	6
Profit per acre				3	1	6

The Earl had applied the sewage also to rye-grass crops, with the following results:—

"I am now entering on my fifth cutting. No other manure has been applied, except 1½ cwt. of guano washed in after having four enormous cuttings, from sewage only. Doubts have been raised as to the fattening properties of sewaged Italian rye-grass. I have had thirteen bullocks 2¼ years old, feeding entirely and solely on cut rye-grass in the yard all the summer, never having had an ounce of cake or corn since they were born, and have sold some of them for nearly £20 a piece. Better or fatter beasts, full of inside fat, could not be wished for, which is proved by the eagerness of the butchers to have six which I have left."

With reference to mangold wurzel, the same authority said:—

"In 1857 I had nearly seven acres of wurzel almost entirely taken by the fly, and during intensely hot and dry weather. I transplanted five acres with the assistance of the sewage, and, although a transplanted crop, it was the largest I ever had—over 43 tons per acre."

The average yield of wheat per acre from the average farmed lands in England did not exceed 32 bushels; and even the lands adjoining the farm of the Earl of Essex did not produce more. But his lordship's farm, from its high state of cultivation, produced 44 bushels of wheat per acre; and even on this cultivated soil, where the sewage was applied to the wheat crops, it increased the produce of wheat 20 per cent. If the sewage of London, including the washing of the streets, was taken at 400,000,000 tons per annum as it flowed into the Thames, and with the Earl of Essex's experience as a guide, the sewage of London, at 270 tons per acre, if applied for wheat alone, would manure 1,481,481 acres, and would produce an increase at the rate of 10 bushels per acre; 1,851,851 additional quarters of wheat at 50s. per quarter, worth £4,629,629. It was quite clear that if our farmers had the sewage at command, the worst land in England might be made to produce on an average 50 bushels of wheat per acre, or 18 bushels more than the land now produced. Now, if the sewage was applied to produce wheat on our poor lands, and distributed at the rate of 270 tons per acre over the before-mentioned area, it would increase the produce of wheat 3,333,333 quarters at 50s., worth £8,333,333, which wealth-producing mass was thrown into the Thames annually. Now, the yield of mangold wurzel on the average farmed lands did not exceed 20 tons per acre. The experience of the Earl of Essex had shown that with

the aid of the sewage, at the rate of 270 tons per acre, the produce of wurzel was over 43 tons per acre, or 103 per cent. more than the produce of wurzel from the average farmed lands. Now, suppose the sewage had been applied for the growth of wurzel, and at the same rate as for the wheat, the land would have produced 33,074,219 additional tons of wurzel, at 6s. per ton, consumers' price, worth £9,922,219, and we might well ask how many fat cattle this produce would send to our markets per annum. The same nobleman had stated the produce from his grass land to be 46 tons of grass to the acre, while the yield of grass from unsewaged meadow-land was not more than from seven to eight tons to the acre. There was a difference of 35 tons of grass per acre in favour of the sewage in one year, at £1 per load, worth £35. Now, if the 400,000,000 tons of London sewage had been applied, at the rate of 400 tons per acre, to our meadow land, it would have produced 36,000,000 additional tons of grass, at £1 per ton, worth £36,000,000. With these facts before them, they could understand how Mr. Mechi could boldly state that, as farmer and tenant, his farm of 170 acres paid him from £600 to £700 per annum net profit. He thought with such evidence before them, they would have little difficulty in arriving at the conclusion, that if the whole of the sewage of the towns in England, taking it at 4,000,000,000 tons per annum, which now ran to waste, was applied in a proper manner to the land, it would produce us something like 20,000,000 quarters of grain, besides an abundance of agricultural produce of every kind, and enable us to dispense with importing foreign grain and guano, at a cost of about £30,000,000 per annum. The next question was, at what rate can our landed interests have this wealth at their disposal. At less than £4 per acre, and a constant supply on every field on their estates. To our towns this was a question of health; to our landed interests it was a question of wealth, and the well-being of the whole community.

Mr. S. Sidney said, the liquid manure having been brought before them by Mr. Alderman Mechi, in one of his agricultural papers in 1853, and again in 1854, in 1855 the Chairman, Mr. Lawes, had also read a paper on the value of the sewage, and in 1856 Mr. Fothergill Cooke had re-opened the subject. In all these discussions he (Mr. Sidney) had taken part, and had expressed views which subsequent extended observation of liquid manure farms had thoroughly confirmed. In the months of June, July, and August, 1857, a discussion had been carried on in the *Journal* of the Society, between himself, Mr. Alderman Mechi, and Mr. Edwin Chadwick, and his statements of the 21st August, 1857, had not yet been answered. But a more recent discussion had taken place between himself and Mr. Alderman Mechi, at the Central Farmers' Club, in February last, and on that occasion the two illustrations of the success of the liquid-manure theory in Ayreshire, which Mr. Mechi had put forward, were shown by him (Mr. Sidney) to be, and to have been, for at least two years, absolute failures. To these failures Mr. Mechi, on the present occasion, had not alluded; indeed, he had carefully avoided quoting any facts, except his own extraordinary profits, in support of his sewage theory. That statement of profits of £700 a year from a 170-acre farm certainly had created a sensation. No doubt Mr. Mechi believed it, but he (Mr. Sidney) felt bound to tell the Society that, at a very numerous meeting of the Central Farmers' Club, on the previous Monday, including the first and most advanced farmers in the kingdom, the statement was received with perfect incredulity, and an offer to investigate the accounts, by three eminent farmers, one being Mr. Little, the land agent, of Chippenham, had been refused by Mr. Mechi. But that part of the subject he would leave to the investigation of the great farmers present, from whom Mr. Mechi had learnt the value of agricultural steam engines, and deep ploughing, trim hedges, artificial manure, everything, in fact, except his liquid manure theory. The main object of the paper was to support, if not recommend, the projects for spending two millions and paying sixty thousand a year for pumping the sewage of London into agricultural districts, where at present no one was prepared to pay for it. Mr. Mechi supported his estimate of the value of sewage by purely empirical calculations. He averaged the number of live stock as sheep, and distributed them over the acres, including grass, of the kingdom, and then having averaged the rain, he argued that the manure applied by sheep-folding, or ploughed in, was as weak, as much washed, as a ton of London sewage. That was an amusing theory on paper, but, practically, manure was rarely, if ever, washed away by rain. Then, to make out his profit, he valued London sewage at twopence per ton, on the authority of Mr. Halkett, who must be very much surprised to find his name coupled with Mr. Lawes, and erected into an agricultural authority. There was about one ton of solid sewage in 600 tons of London liquid sewage. A ton of solid night soil could be delivered in Kent for 10s. In six hundred tons of water, according to Mr. Halkett, it would cost, at twopence per ton, just £5, and he was at a loss to understand how Mr. Halkett and Mr. Mechi made 10s. worth £5 by adding water. But after all the value of a thing was what it would fetch. Professor Liebig valued his patent manure at £8 a ton, but it turned out to be not worth twopence. He (Mr. Sidney) did not come there to say that water was not an excellent thing—although in England farmers generally got too much rain and too little sun—or to say that night soil was not a powerful manure, or that liquid manure, of due strength, might not be a most valuable assistance to a farm. But he wished to maintain that there was no evidence to justify our farmers in adopting an extensive system of pipe and pump irrigation, or to justify shareholders, or the Government, in expending a vast sum in addition to the inevitable expenses of the great drainage scheme, in distributing a liquid which no practical farmer was inclined to buy at a remunerative price. When the liquid manure theory was first introduced to the public by the Board of Health, it was asserted that it was so valuable that it might economically supersede all solid manures and be applied to all crops. He was glad to find that Mr. Mechi had tacitly given up that part of the theory, and had given up corn and roots to the solid manure cultivation, which he himself practised. But it was impossible to be content with mere theory. Mr. Mechi, in the address which he had recently published, referred his readers, for proof of the success of the liquid manure theory, to two farms, Myremill and Cunning-park, in Ayrshire, where he asserted great profit, as well as good crops, had been derived from the system. Now he (Mr. Sidney), in reply, had told the club what he repeated now, that, at any rate, these farms were not evidences of success; they were not witnesses on Mr. Mechi's side, for Mr. Telfer, a merchant, the owner of Cunning Park, had failed (according to the universal belief of the Ayrshire farmers, in consequence of his high farming liquid manure operations), and Mr. Kennedy, a banker, after sinking £30,000 on his farm in six years, £18,000 of which was lost on farming, had got rid of his manager and let his farm on lease. But there were other liquid manure farmers once much quoted; there was Mr. Chamberlain, who having made a fortune in trade, wisely settled in the country, and unwisely followed Mr. Mechi's advice, pumped and piped his farm, and discontinued operations after a great loss. There was the French farm of Vaujours, assisted by the French Government, and carried out by a company under Mr. Chadwick's advice and instructions; there the published balance sheet showed a great loss, and a loss on every crop except a little grass. There was Rugby, where the tenant, Mr. Congreve, one of the most respectable farmers in the county, said he had lost hundreds by having to pump the sewage from the town tank. In Scotland, Mr. Railston, of Lagg, wisely confined his irrigation to ten acres, and ten acres would be profitable on many farms, if supplied, as at Lagg, by gravi-

tation. He could not take much account of the Earl of Essex's experiments; the experiments of a wealthy peer only just commenced. In fact, the only instance of assumed success was Mr. Alderman Mechi at Tiptree, who, as he (Mr. Sidney) had proved, by the Alderman's own words, did not cultivate his farm on liquid manure principles, but with plenty of good solid manure. The country would never have any confidence in this costly liquid manure theory until they could see instances of its being successfully carried out by practical farmers. Professor Liebig and other professors might out-talk them with theories of a universal mineral manure, and prophecies of the exhaustion of the soil, but if the English farmer, who was the model farmer of the world, found the Liebig manure valueless, and the native soil constant in its fertility, he would treat with equal disregard the prophecies and the analyses of amateur farmers and continental professors.

Mr. Robert Rawlinson said statements had been made by the last speaker which ought not to go forth to the world as truth. They had been led to believe that Mr. Telfer had been ruined by the use of liquid manure. He had been over Mr. Telfer's farm two or three times, and would say that there was not the slightest foundation for this assertion. Mr. Telfer had been unfortunate in other matters of business, but to assert that he had been ruined by the use of liquid manure upon his farm was incorrect. A great question like this would not be forwarded by mere assertion, but must be settled by stern reality and practical investigation. It had been part of his duty to make an inspection of every place in this country where the sewage of towns had been applied to the purposes of agriculture; and he could tell them that great mistakes had been made, and great errors committed in over expenditure at the commencement; but he would say that in all cases where the sewage had been applied in a proper manner, the result was favourable, and the crops spoke for themselves. As to town sewage, it was a subject which, in some cases, must not be treated in a purely commercial spirit. Towns must be drained, though there were still some who talked of returning to the old system of cesspools, but he would like to see the man who was bold enough to stand forward and openly advocate that, and he should be most ready to meet him upon that point, because it had become a question not of profit and loss, but of the health of the population—a question of life and death. With regard to the value of the sewage of towns, there were many things to be taken into consideration. They must look at position and the varying conditions of different localities, for no two places were alike. In places where he had carried out town sewage, the subsoil water was in many cases in excess of the water supply to the town; therefore, in dealing with this question, they had the subsoil water *plus* the sewage water and *plus* the rainfall. Again arose the difficulty that they could not construct tanks for the storeage of all that water, as the outflux of sewage was continuous and constant, and they must deal with it in some way. It was unquestionably a nuisance to discharge it into the rivers and streams. It poisoned them and made them obnoxious both to sight and smell. But let them remember that it must be got rid of. If it did not blacken the streams it would be festering in the cesspools below our dwelling houses, and destroying life. They had, therefore, two evils to escape from, and there were two ways of getting rid of the sewage. They could render it innocuous by the use of disinfecting agents, or they could disinfect it by passing it through the land. It might therefore be a question whether the inhabitants of towns should not contribute a portion of their local rates to assist in carrying the sewage upon the land instead of expending large sums of money to disinfect it by other means, or to discharge it into streams where it could be of no use; and he thought it would be better for a town to pay some thousands of pounds to utilise the sewage rather than, perhaps, a larger sum to render it useless.

Mr. Sidney wished to be allowed to read an extract from a letter received from a Scotch gentleman well acquainted with the facts of the case, in justification of his statement with regard to Mr. Telfer. The letter said:—

"At Cunning Park the pecuniary results have not been more agreeable than at Myremill. Cunning park was occupied by the proprietor, Mr. A. B. Telfer, and the system was carried out under his supervision. Besides the possession of this property, Mr. Telfer had a good business as a merchant in Ayr His means have been dissipated, his farm has been sold, and he is left to begin a new career. During the two last years the pipes were not so much used at Cunning Park as formerly. A considerable extent of early potatoes was grown on the farm for the Glasgow market. A few years ago, M. Lavergne characterised Cunning Park as 'the real wonder of the United Kingdom.' It has now little to attract or astonish the visitor. The new proprietor took the engine, pumps, hose, &c., at a valuation, but they are not likely to be much used, although they are in skilful as well as wealthy hands."

Mr. P. H. Holland remarked that, in addition to Mr. Sidney's statement with regard to the results of the application of liquid manure upon Mr. Telfer's farm, he had stated that Mr. Kennedy had also been ruined by his irrigation works. Mr. Sidney had told them that Mr. Kennedy had lost £30,000 upon those small farms, but would any one say that that was due to the irrigation? Of this there was no proof. Mr. Sidney had asserted that arguments he had used upon this subject six or seven years ago had never been confuted, but that gentleman had gone to the extent of reading an extract from a paper delivered by the chairman before this society some years since, in which the chairman was made to say (which he did not say) that he did not consider sewage manure was applicable to corn crops. What Mr. Lawes then stated was, that he thought it was applicable to, and was attended with better results upon, green crops than corn crops. Mr. Sidney had also said, that there was no evidence to justify large investments of capital for carrying out the application of sewage to the land. Mr. Rawlinson had shown that the large outlays must be incurred in getting rid of the sewage from the towns, rather than in applying it to the land. The expense of putting the sewage upon the land would vary very much according to local circumstances and conditions; but it must be got rid of. The most ready and economical mode of doing this would be, in the majority of cases, by passing it through the land. In such cases the expenses would be repaid by the sanitary advantages gained by such a system. In all cases some amount of expense must be incurred; therefore it was absurd to talk of expending £200,000 a-year in works of irrigation, when a large portion of that sum must, in any case, be expended in getting rid of an intolerable nuisance. But even if that amount were expended, would it not prove a very good investment? If they spread it over 20,000 acres it would increase the value of land £20 or £30 an acre; but say it only increased the value of the land £20 per acre, that 20,000 acres would become of the increased value of £400,000, and would they not be justified in expending £200,000 to get a return of £400,000? But supposing, instead of spreading the expenditure over so large an area as 20,000 acres, they confined it to one-fourth of that extent, so as to provide a spot of excessive fertility upon each farm, was it not evident that they could not only manure the portion of the farm which was irrigated, but they could manure a large portion of the rest of the farm with the manure which they produced from the feeding of the cattle upon this fertile spot. It had been mentioned, as an argument against this system, that at Edinburgh the plan had never been extended beyond the 400 acres originally submitted to that treatment. The fallacy of that argument was transparent. The Edinburgh irrigation meadows were not extended, simply because the sewage from the "foul burn" was a monopoly, and the owner of the property naturally wished to keep the advantages to himself. He irrigated all the land he had, and the sewage which he did not want for his purposes he allowed to run into the sea. With regard to the value of

this system to grass crops, it was unnecessary to point out the great advantage of getting an early and a late crop. They all knew the value of a good grass crop in March and November. At the time when nature in the other parts of the country was dead, the Edinburgh meadows were not only verdant but even luxurious. Enormous crops of grass were cut as early as May, and a good grass crop might even be cut in March. What was the great food want of our large towns in the present day? It was a good supply of milk. No dietetic want was felt so much among the children of the poor, and if they had in Essex 50,000 acres of such grass land as they had in Edinburgh, they might calculate what the effect would be as to the supply of that most nutritious article. He would in conclusion only allude to the fallacy which Mr. Sidney had put forth upon the authority of Mr. Hawksley. That gentleman, an engineer, had put forward a notion which must be astounding to every chemist. It was this, that if sewage ran away for a distance of about 10 miles, it was no longer sewage, but almost plain water. That was one of the most astounding assertions he had ever heard made.

Mr. Hudson (of Castleacre) could not say that he had himself carried out the practice of irrigation with sewage water, but a neighbour of his had applied to him to introduce him to Mr. Mechi, with a view to gain a knowledge of his system. His friend visited Mr. Mechi, and was charmed with all he saw and heard, and went home and adopted the system. Mr. Sidney had mentioned the name of this friend, Mr. Chamberlain, who made a handsome fortune in business, and then turned farmer, and tried this liquid manure; but it became such a nuisance that an action was brought against him on account of the stench from his tank, and he was compelled to break up the works. Mr. Mechi had told them the astounding fact, which very much astonished farmers—that out of his little farm of 170 acres he made the enormous profit of £700 a year. He was sure Mr. Mechi had done much for the benefit of this country by showing them what could be done—what ought to be done—and what ought not to be done. He had pointed out quicksands upon which the farmer might be wrecked, but he (Mr. Hudson) questioned whether irrigation ought to be included amongst the number. He (Mr. Hudson) did not call it irrigation; they did not put enough upon the land to come up to his idea of irrigation. He had fifty acres of land which he irrigated from an adjacent stream, and the result had been very productive crops. He did not see how the "squirt" system could be made to answer. All that he could say was, that at the present price of wheat—42s. per quarter—if tenant-farmers paid their rent and taxes they had nothing left for profit; but Mr. Mechi had the advantage of being his own landlord. It was said that live stock produced a good deal of money, but they cost a great deal to feed. He had recently sent 250 sheep to the market when meat was quoted at a high price, but he had only been able to get sixpence a pound net for his mutton. He should be only too glad if Mr. Mechi's plan of dealing with the sewage of London could be brought to bear, and made profitable, for it would be followed generally throughout the country.

Mr. P. A. Halkett said his opinions coincided with those who thought that for town sewage a large quantity upon a limited area of grass land was the proper way of arriving at a good result, and that gravitation instead of the hose and jet should be the system for applying it. With respect to London, he would very briefly state his plan, the cost, and the profits anticipated, leaving out details. It was as follows:—He proposed that at various places along the line of the large intercepting or main sewer, which was to proceed nearly parallel with the banks of the Thames, the sewage should be taken out from the main sewer by small steam engines, of power proportioned to the breadth of land proposed to be irrigated; the sewage to be forced up a large pipe to the level of the highest portion of the land, and from thence to be distributed over the rest of the land by gravitation; with the aid of under draining it would then percolate through the soil without the possibility of stagnating on the surface; the water thus filtrated being led back by drains in the direction of the steam engines, to be again pumped back into the main sewer, or to pour in by its own gravity, and so out to sea. The above referred to those lands rising from the main sewer; whilst in those lying below, or falling from it, the sewage would be gravitated from the main, and, after percolating through the soil into the drains in the direction from the main, would be led back and forced into it by the pump. Such lands as were nearly level would be treated in either of these two directions; but in all cases the plan should be to pump direct from the main sewer, at once distributing it over the portion of the land which was then to be irrigated, allowing it to percolate through the soil and the drains, divesting it of all its fertilising matters, and so far purifying the sewage in its course towards the Thames. This system would require no means for precipitating the solid parts, or deodorising the sewage. The liquid would be always either upon grass or within pipes, and no effluvia would take place. The difficulty brought forward, that the low lying lands of the Thames could not be drained for irrigation, was met by the drained liquid being pumped back into the sewers. The system would also require no costly and objectionable reservoirs to contain the sewage, involving a large accumulation when the works were at rest, neither would extra pipe room nor space to contain the sewage on occasions of heavy rainfalls be necessary, for it would then pass away in the main sewer. The cost of the system for one block of land of 300 acres would be as follows:—Thorough draining per acre, £6; large pipe, to convey water to highest point of land, laying down ditto, &c., £600; engine, pump, and building, £600. The system for distributing the water would be according to circumstances, and differing in cost; but the whole might be taken, on an average, at £15 per acre. Annual interest for capital:—Rent of land, say £5; and interest on drainage, per acre, 8s.; interest at 7½ per cent. on works, and 15 per cent. on engines, £1 4s. —total, £6 12s. Thus £1 4s. represented the increased annual outlay upon land contiguous to the main sewer. With regard to the profits, if the Edinburgh returns were taken as a guide, £30 or £40 might be expected for the crops of grass per annum. And at this price an immense sale might be anticipated in food for cows so near the metropolis, with a population fifteen times larger than that of Edinburgh whilst at meat-feeding prices, £20 per acre would be realised. The average might be taken at £30, and the amount stood as follows:—

Value of grass				£30	0	0
Deduct annual rent and interest for capital laid out	£6	12	0			
Fuel, labour, &c.	2	0	0	9	12	0
Superintendence & contingencies.	1	0	0			
Clear				£20	8	0

With reference to the land required, he maintained that much harm had been done to the question by proposals for very great quantities of land. If at present only one-half of the 125,000,000 tons of sewage disposable per annum had to be absorbed, 6,000 acres would be sufficient for the purpose. Now this was a very attainable quantity of land, four thousand acres to the north of the Thames, and two thousand to the south, might easily be obtained; and the amount of pipes and cost on account of the distance of any part of this surface would not be increased much beyond the original estimate which he had given, certainly not increased £2 per acre per annum. According to the amount (320 acres) now laid down in Edinburgh, in proportion to its population, 4,500 acres bore the same proportion to London, and a high value doubtless would be obtained for the produce. If the six thousand acres were considered at the average returns over cost of production, which had been given,

namely £20 per acre, there was a return of £120,000 per annum for an outlay of £90,000 upon the land, and it would not be difficult to extend the pipes lower down to take in the other 6,000 acres of land, and exhaust the whole sewage of London. If the proposed plan should succeed, a money return by the metropolis could be obtained for the sewage for a stated measure, according to the amount used, in the same manner as was now obtained for it at Milan. A large saving would also accrue on account of a much smaller amount of sewage requiring to be pumped into the river, and pumping, it was estimated, would make a very heavy addition to the tax for the sewage works. No money risk to the town was necessary to make the trial, but he thought that some encouragement of a prospective kind would have to be held out on account of the length of time necessary to the experiment, for land required generally to be irrigated several years before full results were obtained. There might also at first be a considerable difficulty in obtaining land. His (Mr. Halkett's) conclusions, irrespective of the question of farm liquid manure, but with reference to town sewage in general, were, that when steam power was found necessary, 1st, the pipes for lifting the liquid to the highest point of land should be large; 2nd, the sewage should be distributed by gravitation only; and 3rd, the area of land for its distribution should be small.

Mr. Wilkins considered there had been a mistake in the mode of applying the sewage to the land. The practice had been to put it upon the surface. He had established a method by which he applied it directly to the roots of the crop through the subsoil, by means of which air was supplied with the liquid. It was applied at about 21 inches below the surface, in the subsoil. He had cut four crops a year with ease. He had applied it at a depth of 2 feet 6 inches for carrots, and had grown roots to the same length.

Mr. Parkinson said, as a statement of his made at the Farmers' Club had been impugned, he begged to say a word in reply with respect to the Mansfield meadows. He had stated that the irrigation was by water alone, and not with sewage water. He stated also that no doubt the sewage had done good, and he gave it all the credit it deserved; but mention had been made of the land to which the water was applied afterwards. He referred to the supply to the lands of Earl Manvers, after the Duke of Portland had done with it. Those lands were nearly equal in extent to the Duke of Portland's, and the immense extent over which the water had to flow upon the Duke of Portland's land would, he thought, take the greater part of the benefit of the sewage of Mansfield, which was seven miles from the point of departure from the Clipstone meadows. After it had done duty upon one flat it was carried down two other flats, thus doing duty three times before it reached the stream which supplied Earl Manvers' meadows. He left them to judge whether, under those circumstances, the Duke of Portland did not get all the goodness out of that sewage. Hence had arisen the joke that Earl Manvers got the Duke of Portland's small beer; such, indeed, it must be. Mr. Mechi appeared to consider his case proved; if so, why had he not complied with the demand made upon him to bring forth his figures? When that was done greater faith might be put in his statements. Mr. Mechi had spoken of £3 7s. per acre per annum as the average produce of the land in England, whilst in his own case he had placed it as high as £11 per acre. He confessed he was at a loss to know how those results were arrived at. He had yet to learn that Mr. Mechi was a very large stock farmer. His experience of farming was this, that it was stock farming that paid; and when Mr. Mechi put down £3 7s. per acre as the average of the kingdom, he underrated it, whilst in his own case the £11 15s. was, in his (Mr. Parkinson's) opinion, too large.

Mr. James Thomas observed that it was most remarkable that in discussing the value of this manure, they had not heard of a single instance (Mr. Mechi's alone excepted) in which it had been beneficially applied to the cultivation of the soil, whilst other artificial fertilizers, in smaller compass, had been extensively used with good results. The state of circumstances now was very different from what was the case at the time that cesspools were in general use. It was then a great object with the farmers to obtain as much of the matter from those cesspools as possible to mix with the manure made upon the farm; but under the now generally prevalent system of sewers, the case was very different, the fertilising matter being so largely mixed with water. He entertained a strong hope that the cesspool system would never be again reverted to. Notwithstanding the repeated failures mentioned, they were asked to adopt this expensive plan of manuring. They had been told that the misfortunes which had befallen the individuals alluded to had no connection with the use of sewage, or laying down a costly system of piping upon a farm. It was very rare that the bankruptcy of a man was admitted to have been occasioned by any fault on his own part, but the investigation of the accounts showed where the mischief lay. He contended that there had been no proof that this system had ever answered, or resulted in profit to those who had tried it; and he believed, do what they would, it would never do so. They had heard from Mr. Mechi that his farm, of 170 acres yielded him an annual profit of £700. He gave Mr. Mechi the fullest credit for completely believing all that he stated, but he thought there was scarcely another individual to be found who would do so.

Mr. Antony Hamond wished to ask Mr. Parkinson, with reference to the Clipstone meadows, what he considered a fair produce per acre for those meadows.

Mr. Parkinson did not consider the question relevant to the present discussion. He had already stated that he considered the meadows were nearly as good before the sewage was applied as they were afterwards.

Mr. R. A. Slaney, M.P., thought this Society, and the country at large, owed a deep obligation to Mr. Mechi for bringing this subject forward, for elucidating it with great care, and for having for many years endeavoured to bring it in a practical shape before the farmers of the country. Whatever might be the opinions with regard to its success in an agricultural point of view, there could not be a doubt that Mr. Mechi had, at great cost, with great perseverance and with great ability, endeavoured to work out a problem of great value and importance, not merely to the farmers, but also to those who looked to the sanitary condition of our great towns. He ventured to say he thought they went a little too far on both sides. He thought Mr. Mechi, and some of those who agreed with him, were a little too sanguine in their views, but he believed they would ultimately be able to work out great advantage to the farmers of England, through the utilisation of the refuse matters of our towns. As an owner of land, he had tried something of this kind, but had never found it to answer except it was effected by gravitation. Where that could be done, the expense was very much diminished and the advantages very much increased. One gentleman had spoken with great effect of the advantages to be derived, in some cases, from the sewage matter being carried below the surface of the ground into the subsoil. That opened up a question of great importance, which had been long neglected, viz., that of subsoil ploughing—bringing the subsoil to the surface, and enabling the fertilising matter to go to a much greater depth.

Mr. Mechi would express his thanks to the meeting for the patient manner in which his long story had been listened to. He could assure them his only object in mooting this question was the public good. He should be pleased to see the agriculture of this country progress as rapidly as its manufactures. There certainly must be something in what he had brought forward, or it would not have excited so much feeling. He separated matters of feeling from a question of this kind. It was purely a matter of busi-

ness. If any person had lost his money by carrying out this system he was very sorry for it; but those who made this assertion ought carefully to investigate all the circumstances before doing so. He thought his friend Mr. Hudson took rather a one-sided view of the case. He had alluded to Mr. Chamberlain; and he (Mr. Mechi) would ask whether the death of that gentleman was not the reason why the pipe system had been given up. With regard to the action brought against him for a nuisance, he believed the verdict had been against the individual who attempted to stop the works. That, however, did not affect the question as to whether the sewage was valuable or not. His opinion was that farmers would not properly appreciate the value of the system until they learned to take more care of the fluid which ran away from their homesteads in wet weather. He thought it desirable that this subject should be agitated from time to time. He believed an important key to his own success had been the putting on the land the manure of the farm with immense quantities of water. It enabled him to grow green crops at a time when they were very valuable, and when they would not otherwise have grown. It had been remarked by Mr. Halkett, that even if they put £20 worth of manure upon an acre of land, the grass would only be made worth 7s. per ton. As practical farmers they knew that mangold wurzel was worth 14s. to 15s. per ton, and grass was very much more valuable than wurzel. He believed it to be worth 20s. per ton. But there was another point. Would any man tell him that, having put £12 worth of manure upon an acre of land, it was not felt for years after? Would any one tell him that if they put on 48 loads of manure per acre, at 5s. per load, that would not show itself in stiff clays for seven years after? He was prepared to prove that the land would produce more for seven years than if it had not been applied. It was a one-sided view of the case that, because they did not get all the good from the manure the first year, the system did not answer. With regard to his balance-sheet of profit and loss, he had been asked so many questions that he had thought it right to put those interrogations to himself which would be found in the paper. Those questions turned the farm inside out. He had answered these question honestly and fairly, and by those questions they might judge of every penny of expenditure and every penny of return upon the farm. He asked those who doubted those facts to answer those questions for themselves, and if they sent the replies to him, he would tell them why they did not make that farming profit which he had done for many years.

The Chairman said it now only remained for him to propose a vote of thanks to Mr. Alderman Mechi for his valuable paper.

The vote of thanks was then passed.

The Secretary announced that on Wednesday evening next, a Paper "On the Art Treatment of Granitic Surfaces," by Mr. John Bell, sculptor, would be read.

The Paper will include remarks on the application of encised decoration, in the Ancient Egyptian method, to the surfaces of Modern Granite Structures; also on floral and symbolic sculptural treatment generally, as applied to the surfaces of hard stones, illustrated by drawings and models of Art so treated, as columns, capitals, obelisks, and drinking fountains; and of floral types, as the Lotus, Papyrus, Water-lily, and Victoria Regia; also by specimens of Granite and Granite Tools from Quarries.

Home Correspondence.

THE EXAMINATIONS AND LOCAL UNIONS.

Sir,—Your number for the 17th February contained a report of a meeting held at Dudley, to promote the success of the Examinations instituted by the Society of Arts. Permit me to call attention to some important portions of that report.

The meeting wisely resolved not merely to form a "Local Board" for the examinations, but also to create a "Union of the Institutions" promoting the instruction of adults in South Staffordshire; to connect the "South Staffordshire Union" with the Society of Arts; and to employ organising masters to traverse the district comprised in the Union, organising therein the means of instructing adults, taking part in their instruction, and explaining and preparing for the examinations.

In these resolutions, the excellent precedent set by the East Lancashire Union appears to have been kept in view. The district, densely populated, is not too large for a vigorous supervision and direction by the central authority of the union; and the appointment of itinerating masters may provide a nucleus for an efficient body of teachers, and a systematic scheme of teaching. These are everywhere the fundamental wants of our Institutions viewed as places of instruction. The Society of Arts has never lost an opportunity of recommending them to form smaller local unions within the great circle of the Society's union; and to provide, through those local unions and through the Local Boards, for each separate locality, a suitable scheme of systematic instruction, local and itinerating teachers, and independent local examinations, with local certificates and prizes.

In the East Lancashire Union there are three degrees of teachers; 1st—An itinerating master, who, having the charge of a portion of the district, teaches in succession at each institution therein, and superintends the teaching of the local teachers. 2nd—The local teacher, who teaches probably five nights a-week at his own institution; and 3rd—The assistant teacher, generally a youth, who not only assists in teaching, but also carries on his own studies under the direction of the local teacher and itinerating master.

In East Lancashire both those masters who are certificated by the Committee of Council on Education, and the local teachers, who may or may not be engaged by day in teaching, are subsidised by that committee. In South Staffordshire I presume that the Union, the Institutions, and the students, will together provide the requisite funds.

Two examinations annually are better than three; and it is therefore well for the local unions to hold their own examinations at such a time, and on such subjects, as to meet the Society's rules in respect of the "Previous Examinations by the Local Boards." That is to say, the Examination of the local unions and the previous Examination of the local board should be one—the local examiners should examine all, whether children or adults, that are willing to be examined by them; and those adults who satisfy the examiners, in accordance with the rules of the Society, should be "passed" to the final Examination of the Society's Central Board. However eminent may be the local examiners in any locality, and however careful their examination, it seems to be necessary to their possession of the confidence of the public, that their decisions should be submitted to some independent test; and this test can be supplied at present only by the Central Board of Examiners provided by the Society of Arts. One would like to know how many of those youths who were plucked by the examiners for the A.A. of Oxford, in the first year that the experiment was tried, had previously carried home testimonials and prizes from their own schools and teachers. A merely local standard must vary in the various localities, and is everywhere likely to

degenerate, from obvious causes; while local standards, however numerous, if constantly corrected by reference to an unswerving central standard, have no such evil tendency.

I am, &c., HARRY CHESTER.

63, Rutland-gate, London, S.W.

THE NEW LIME LIGHT.

Sir,—In the recent discussion on the lime light, I notice that several speakers allude to Mr. G. Michiel's process of obtaining oxygen gas by passing air over hydrate of baryta, at a low temperature, which, absorbing the oxygen, again evolves it by subjecting the baryta to a higher one.

It may not be generally known that Mr. Michiels patented this process on the 12th of March, 1853.

Perhaps I misunderstand Mr. Baxter's meaning in his letter of last week, in which he says "that accidents are less likely to happen with the lime light than with gas backed by the gas-holder of a gas works, except when protected by proper appliances and attention," but if not, I am surprised that a gentleman who has so much to do with gases, should be unaware of the fact that coal gas of itself, as stored in a gas-holder, is not explosive.

I am &c., GEORGE BOWER.

St. Neots, 7th March, 1860.

Sir,—I copy the following from the *Illustrated London News* of to-day:—"Phosphorescence in the Eye.—A memoir on this subject was read lately before the French Imperial Academy of Medicine, by M. Jules Regnauld, and an abstract appears in the *Journal de Pharmacie*. The results of his experiment show that in man and some other of the mammalia, the cornea and the crystalline humour are endowed with a manifest phosphorescence, and that the retina possesses it also, but in a less degree. M. Regnauld attributes this phosphorescence to the prolonged action of intense light, particularly of the violet rays, and thinks that the electric light, if generally introduced, will become injurious, unless a way can be devised for cutting off the extreme violet rays. As the general introduction of the electric light is now much advocated in England and France, M. Regnauld thinks the subject demands investigation." Are not the foregoing remarks equally applicable to the lime light?—I am &c.,

GEORGE H. COUNTZE.

103, Long Acre, W.C., 3rd March, 1860.

BUILDING STONES.

Sir,—I was unwilling to lengthen still further the protracted discussion on Mr. Burnell's paper, but I will now crave permission to say a few words concerning that part of it relating to "salt efflorescences." In the first place the terms "saltpetering" and "nitrification," are apt to suggest to a casual hearer that the substance in question is mainly composed of nitre, or more correctly nitrate of potassium, whereas such is very seldom the case, in fact it is quite the exception instead of being the rule. I have now before me some notes of 37 specimens of "salt" collected from the surfaces of various building materials. Of these 31 contained only sulphate of sodium (with inconsiderable traces of other salts); 3 were mainly composed of the same salt, but also contained sulphates of magnesium and aluminium; 2 samples consisted of sulphate of sodium, together with various phosphates and nitrates, the latter (generally nitrates of sodium and calcium) never exceeding 18 per cent. of the whole. The last specimen was made up of the sulphates of sodium and potassium, with a small amount of nitrates, and a notable quantity of common salt, &c.; this latter ingredient being derived, I imagine, from sea-spring, as the sample was found in a vault at the old Castle of Mont Orgueil, Jersey. For all practical purposes I think that sulphate of sodium may be taken as the chief component of those "salt" formations, so destructive to the architecture of this country; and in all building materials, therefore, whether of natural or artificial origin, the absence of this substance should be satisfactorily proved before they are employed for any important work. If due precautions had been taken by the Crystal Palace Company in the selection of their materials, and if surface-water had never been used there for mixing mortars, cements, &c., I feel assured that the salt "efflorescences" apparent in the Pompeian, Byzantine, and other courts, to the disfigurement alike of classical decoration and visitors' coat sleeves, would have been far less injurious, if, indeed, they had not been altogether avoided.

With regard to the preventive means, I can add but little to the mass of information already laid before the Society, but I cannot help denouncing the too free use of resinous, oleaginous, or tarry matters, as my own experiments have shown me that, in the event of fire, the walls of a building treated with such substances would inflame the moment their temperature was raised to about 200°. Still, where a building is to be erected upon a soil known to be impregnated with various salts, the writer's plan of "insulation,"* in which the upward percolation of moisture, if the expression is allowable, is prevented, by a seam of asphalte laid on every wall, when at a height of from two to four feet from the ground, may be employed with safety and advantage. To the general efficiency of silicate of calcium, or, still better, of aluminium, I can also bear testimony.

In reply to an observation of Professor Ansted's, I may here remark that I have observed silicate of calcium in a partly crystalline condition, when its formation has been very slow, but in this state it is certainly very rare. In relation to curative processes, I am decidedly of opinion that no universal system can be recommended. The plan adopted should always be that most suited to the requirements of each particular case. Where, as generally happens, the efflorescence consists chiefly of the sulphate of sodium or magnesium, a weak solution of chloride of barium may be applied with great advantage, as the original "salt" is then destroyed, sulphate of barium and chloride of sodium (or magnesium) being formed. The first is perfectly insoluble, and the latter, which appears to have little or no action upon building materials, soon gets washed away. This solution, and also one of shell-lac in ordinary borax, was kindly tried for me at the Crystal Palace, by gentlemen connected with the fine arts department, more than three years ago, as far as I can now learn, with entire success. Sulphate of ammonium has, according to my experiments, no injurious effect on buildings until it meets with substances capable of converting it into the corresponding sodium salt; and I consider that its action may be disregarded practically, as its presence in the atmosphere is quite exceptional. Sulphurous acid, also, either free or in combination with ammonia, I believe to have rather a preservative influence than otherwise, as it is never present in sufficient quantity to cause an efflorescence of sulphites; and its compounds with lime, alumina, &c., are very insoluble. It is very probable that the theory of osmosis has been endowed by many with far more important functions in relation to building materials than it really possesses, for, granting that stone has a large amount of air condensed within it when first quarried, the process of diffusion, resulting from occasional and minute differences in the external atmosphere, must proceed but very slowly under the retarding influences of damp and a low temperature. In common with many others, I differ entirely from Mr. Burnell when he designates as "obscure" that branch of chemical science relating to the phenomenon of "salification," as I prefer to call it. I am, &c.,

WENTWORTH L. SCOTT.

March 1, 1860.

Sir,—The paper read on this subject on Wednesday evening, the 29th of February, would seem to lead to the simple result that architects and surveyors should not only be careful in the selection of the best and most durable stone for all buildings of any architectural importance, especially when situated within the range of the

* Adopted at St. James's Hall and other buildings.

metropolitan atmosphere, but, in addition, should also carefully test each individual stone brought to the works, and personally see where and in what position each stone may be placed. As such a system must necessarily entail a vast increase in the cost of public works, would it not be wiser and more economical to adopt the stone of such quarries only as can be proved to have been exposed to all weathers and in all situations unharmed for more than ten centuries, and which may be obtained in abundance in many parts of these dominions?

Mr. Burnell, the author of the paper, would appear to recommend the best quality of Portland stone, since, according to that gentleman's statement, St. Paul's stands so well. Now, I would undertake to gather a hatful of stone powder in a few minutes, with my hands only, from some of the shattered portions about the portico of that cathedral; and I take this opportunity of stating that any stone that will not endure between wind and water is rubbish, unfit to be used in any part of the building. The Cathedral of Exeter plainly shows what elaborate carving in self-perishable stone must inevitably come to, and that not between wind and water, but where exposed to weathering only.

It is very probable that, being in the habit of rearing large structures with bricks that require to be sheltered from the rain when in the stack, to prevent them melting away, and that will crust to powder under the heel of a tolerably heavy man, we are reconciled, when building with stone, to the use of such as is scarcely superior to those wretched substitutes miscalled bricks.

The author of the paper is also of opinion that the colour of the stone, as well as all architectural beauty, are quickly effaced by the rapid accumulation of smoke and carbonaceous matter upon our great public buildings; why, therefore, should costly architectural beauty ever be attempted, excepting as far as regards general form, outline, mass, and position of parts? more especially as there is no space in London where any public building can be seen with due regard to effect, the front of Goldsmiths' Hall, for example, behind the Post-office. The Alhambra, in Leicester-square, is blocked out by the Great Globe, but it is a circumstance of no importance, as the beauty of that building, if it ever had any, is already gone.

In regard to prevention of decay, the only process at all likely to ensure permanent endurance to bad perishable stone, under all circumstances, is that so much ridiculed by Mr. C. H. Smith, namely that of boiling, baking, stewing, and burning in "vacuo," and various mixtures, though, of course, the latter process of burning could not be applied with safety to any of the varieties of limestone.

The Roman brick, or tile, as it is sometimes called, is familiar to all. It is as good now, after two or three thousand years of exposure, as the day when it was turned out of the kiln. We could obtain any number of millions of bricks, of precisely the same quality, from the Italian brickmakers of the present day. They are made now, as they always have been—from the deposits of the rivers which take their rise in the Appenines, where they are all torrents, and bring down immense masses of rock of every description, and which, together with the soil, are ground down into an impalpable paste, ready, when partially dried, for the hands of the moulder. The bricks made from this material are uniform in texture, will cut in any direction, and are not at all porous. Indeed, they will absorb a few grains only of moisture by twenty-four hours' boiling in water. What would be the result if we were to submit the stone of the two houses of Parliament, or of Buckingham Palace, to the test of twenty-four hours of boiling water?

Why, with our colossal wealth and colossal appliances, should we not make good bricks by grinding down the heterogeneous mass of rubbish of which they are now made into a similar impalpable paste?

The fact is, that our builders, contractors, and architects reckon to have acquired a vested or prescripted right to amass enormous fortunes by rearing costly buildings of mere rubbish, while philosophy, science, and common-sense are to be distorted and prostituted in order to bolster up this, one of the very minor modes in which the public purse is most ruthlessly sacked and plundered for private gain.

The New Houses of Parliament might have been built on a more splendid scale, and far more healthy and convenient, for one-fourth of the fabulous—and as yet unknown—sum that they will ultimately cost to the nation.

I beg to refer those of your readers that may be interested in such subjects to my paper on the "Stones of London," inserted in your *Journal* for September 16th, 1859, a letter that remains to this day unchallenged and unanswered. I am, &c.,

THOMAS REVELEY.

March 6th, 1860.

Sir,—I have read with much pleasure, in the last number of your *Journal*, the interesting paper of Mr. George Burnell, on "Building Stones," and the discussion which followed. Although I admit, with Professor Ansted and some of the other speakers, that in our large cities the action of the atmosphere must be greatly modified by the presence in it of sulphurous and sulphuric acids and other compounds, still I am of opinion that the more or less porous condition of building-stones is in itself the chief source of decay, owing to the circumstance that the water which penetrates into their pores during wet weather expands as it is solidified by cold, and thus disintegrates the stone. This well-known cause of the decay of stones has led the architects on the Continent to classify building-stones under the name of "pierres gélives" (stones which easily decay) and "pierres non-gélives" (those which resist the action of the atmosphere); and to enable them to distinguish these two classes of building-stones, they have adopted the following valuable process, discovered by M. Brard, an eminent mineralogist, for testing the power of stones to resist decay:—This process consists in placing samples of stone in a cold saturated solution of sulphate of soda, and raising the whole to the boiling point for half an hour. The samples are then taken out and suspended by pieces of string above the vessels containing the solution. After twenty-four hours their surface is found covered with little white needles. These are removed by dipping the stones into the solution and suspending them again, alternately dipping and suspending for four or five days. If the stones are "non-gélives" no fragments are found at the bottom of the vessel into which they have been dipped, whilst, if otherwise, they have lost their angles, and fragments of them are found at the bottom of the vessel. By examining the angles and collecting the deposits, a correct opinion can be formed of their compactness and power of resisting atmospheric influences or decay.

This process was first applied to determine a point in litigation concerning the stone to be employed in building the Madeleine, and the investigation clearly proved that stones procured from the same quarry varied greatly in quality. Therefore I agree with Mr. C. H. Smith, that in using a known building-stone it is not sufficient to specify the locality, or even the quarry, from which it is derived, but I would suggest that a peculiar layer or stratum should also be named in the specification.

I am, &c.

F. CRACE CALVERT.

Royal Institution Laboratory, Manchester,
March 6th, 1860.

Proceedings of Institutions.

Ipswich Mechanics' Institution.—The annual meeting of this Institution took place in the Lecture Hall on

Monday evening, the 30th January. J. B. Alexander' Esq., one of the vice-presidents of the Institution, was called to the chair, and among the gentlemen present were T. S. Gowing, Esq., George Bayley, Esq., of London, George Christopherson, Esq., Mr. C. M. Burton, Rev. F. H. Maude, Dr. Drummond, &c. The report was read by the Secretary (Mr. Richard Gowing). The financial statement shows that the receipts during the year (which include a donation of £15 5s. from the managers of the Weekly Penny Readings) have been £455 14s. 10d., and the expenditure (including an item of £63 7s. 8d. for repairs and alterations) £446 17s. 2d., leaving a balance in hand of £8 17s. 8d. The number of members upon the books is 575, being a slight decrease upon late years. The educational branch of the Institution continues to afford instruction to about 50 young men. Arrangements are being made to co-operate with the Society of Arts in their examinations for 1860. At the solicitation of a large number of the younger members of the Institution, the committee have granted the use of the Lecture Hall for the formation of elocution and vocal music classes; and they have given every assistance in their power to the establishment and conduct of those classes. Various books have been added to the library during the year. The Report states in conclusion, that while the state of the funds renders necessary a temporary effort of economy, the committee wish to convey the confidence which they feel that the Institution is in a thoroughly healthy and hopeful condition. For while extensive improvements and new privileges have been and are being effected, the institution is rapidly working out for itself a most satisfactory state of financial prosperity. After the adoption of the report, the Chairman said that considering the extra outlay, the financial statement was satisfactory. He hoped the Institution would never again become involved in the financial difficulties of a few years ago; he felt assured the worthy chairman of the committee (Mr. T. S. Gowing) would carefully guard the funds against falling into such a state. He wished to allude to one other point in the report—the donation from the penny readings. He was sure he should be only expressing the sentiments of the meeting when he said that they were all exceedingly obliged to the conductors of those readings for that handsome donation. Mr. T. S. Gowing, Mr. George Bayley, Dr. Drummond, and other gentlemen then addressed the meeting, and the officers for the ensuing year were elected. The meeting concluded with a vote of thanks to the chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Geographical, 8½. 1. Mr J. Macdougall Stuart, "South Australia; Exploring Expedition into the interior of the Continent." 2. Sir G. F. Bowen, "Discovery of a New Harbour on the N.E. Coast of Australia."
Medical, 8½ Mr Henry Lee, "On the Radical Cure of Varicocele by Subcutaneous Section."

Tues. .....Royal Inst., 3. Professor Owen, "On Fossil Reptiles."
Syro-Egyptian, 7½ Mr. R. C. Marsden, "Hieroglyphic names of the Kings of Egypt, from Menes to Amasis."
Civil Engineers, 8. Continued discussion upon Mr. Longridge's Paper, "On the Construction of Artillery and other Vessels to resist great internal pressure."
Medical and Chirurg., 8½.
Zoological, 9.

Wed. .....London Inst., 7 Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. John Bell, "On the Art-Treatment of Granitic Surfaces."
Geological, 8 1. Mr. J. W. Kirkby, "On the Occurrence of *Lingula Credneri* in the Coal Measures of Durham." 2. Mr. C. H. G. Thost, "On the Rocks and Minerals on the Property of the Marquis of Breadalbane in Perthshire and Argyllshire."
Graphic, 8.
Microscopical, 8.
Archæological Assoc., 8½.

Thurs. ...Statistical, 3. Anniversary.
Royal Inst., 3. Professor Tyndall, "On Light."
Royal Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8.
Royal, 8½.

Fri. .....United Service Inst., 3. Captain Blakely, "The Advance in Military Science, as exhibited by the late War in Italy."
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Mr. Maxwell T. Masters, "On the Relations between the Abnormal and Normal Formations in Plants."

Sat. .....Asiatic, 2.
Royal Inst., 3. Dr. Lankester, "On the Relation of the Animal Kingdom to the Industry of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on February 21st, 1860.

80. Light Dues—Returns.
81. East India (Baptisms at Umritsur)—Return.
83. Taxing Masters (Court of Chancery)—Return.
92. Landed Estates Court (Ireland)—Return.
93. Military Savings Banks—Account.
44. Bill—Settled Estates Act (1856) Amendment.
15. Railway and Canal Bills (70. Inverness and Aberdeen—71. Limerick and Ennis—72. London and Blackwall—73. London and North Western (No. 1)—74. London and North Western (No. 3)—75. London and North Western, Great Northern, and Manchester, &c.—76. London and South Western and Bristol and Exeter—77. London and South Western (Kingston Extension, &c.)—78. London, Brighton, and South Coast and Victoria Station, &c.—79. London, Chatham, and Dover (Capital)—80. Marlborough Branch—81. Midland (Burton-upon Trent Branches and Deviation)—82. Midland (Hinckley Extension—Rowsley and Buxton Lines)—83. Mid Sussex and Midhurst Junction—84. Morayshire—85. Newcastle-upon-Tyne and Carlisle, &c., Railways and Docks—86. Newcastle-upon-Tyne and Derwent Valley—87. Newry, Warrenpoint, and Rostrevor—88. North British and Peebles and Jedburgh—North British (Stations, &c.)—89. North Eastern (Blaydon and Conside Branches—Extension of Time, &c.)—90. Northleach and Witney—91. Oxford, Worcester, and Wolverhampton and Severn Valley—92. Oxford, &c., Newport, Abergavenny, and Hereford, &c.—93. Portadown, Dungannon, and Omagh Junction—94) Silverdale and Newcastle—Stockport and Woodley Junction—95. Sudbury, Melford and Clare, and Bury St. Edmund's.—Board of Trade Reports.
85. Harbour, &c., Bills (3. Truro Port and Navigation)—Board of Trade Report.

Delivered on February 22nd, 1860.

53. East India (Incorporation of Banks of Bengal, &c.)—Return.
54. East India (Godavery River)—Return.
46. Bills—Dwellings for Labouring Classes (Ireland).
47. Bills—Coroners.
15. Railway and Canal Bills (96. Atheny and Ennis; 97. Bourton-on-the-Water; 98. Burnham Tidal Harbour and Railways; 99. Carrickfergus and Larne; 100. Cork and Limerick Direct; 101. Dublin and Kingstown, and Dublin and Wicklow)—Board of Trade Reports.
76. Local Acts (12. York Improvement (Lendal Bridge and Approaches); 13. South Devon Railway; 14. South London Railway (No. 1); 15. Buckley and Connah's Quay (Flintshire) Railway; 16. Dublin and Wicklow Railway; 17. West Somerset Railway; 18. Commercial Docks Acts Amendment (Rotherhithe); 19. Galway Harbour; 20. Galway Pier Junction Railway; 21. Waterford and Limerick Railway; 22. London, Chatham, and Dover Railway (Metropolitan Extensions); 23. Stockton and Darlington Railway)—Admiralty Reports.

Delivered on February 23rd, 1860.

86. Bullion—Return.
96. Metropolitan Improvements—Statemext.
97. Chinese Expedition—Estimate.
71. Anchors—Return.
43. Bills—Piers and Harbours.
45. Bills—Medical Acts Amendment.
15. Railway and Canal Bills (102. Dumfries, Lochmaben, and Lockerby Junction; 103. Letterkenny, Londonderry, and Lough Swilly; 104. Llanelly Railway and Dock; 105. Llyfni Vale Railway and Harbour; 106. London and North Western (No. 2); 107. London-bridge Railway Terminus Hotel; 108. Marple New Mills and Hayfield Junction; 109. Milford Haven Railway and Docks; 110. Montrose and Bervie; 111. North Staffordshire; 112. Oswestry and Newton (Branch, &c.); 113. Shrewsbury and Welchpool; 114. Stourbridge; 115. Tenbury and Bewdley; 116. West-end of London and Crystal Palace)—Board of Trade Reports.

Delivered on February 24th, 1860.

87. British Museum—Return.

88. Cavalry, &c.—Return.
94. China—Correspondence.
95. Calais Night Mail—Return.
48. Bill—Administering of Poison.
85. Harbour, &c. Bills (4. Grand Surrey Docks and Canal; 5. Galway Harbour; 6. Greenock Harbour)—Board of Trade Reports.

Delivered on February 25th and 27th, 1860.

8. Proprietors, &c. (Scotland)—Return (a corrected copy).
30. Police (Counties and Boroughs)—Reports of Inspectors.
61. Delta of the Nile, &c.—Abstract Return.
84 (1). Trade and Navigation Accounts (31st January, 1860).
100. Sale of Gas—Copy of the Report of the Astronomer Royal, &c.
102. Committee of Selection—3rd Report.
France—Further Correspondence respecting the Negotiation of a Treaty of Commerce.
Japan—Correspondence respecting the Stoppage of Trade.

Delivered on February 28th, 1860.

31. East India (Hindoo Shrines, &c.)—Return.
72. Woods, Forests, and Land Revenues—Abstract of Accounts.
99. Mint—Account.
111. Wine—Copies of Treasury Minutes, &c.
China—Correspondence.
Treaties of Peace and Alliance, signed at Paris, 30th May, 1814, and 20th November, 1815.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 2nd*, 1860.]

Dated 26th October, 1859.

2449. J. R. Prichard, Dowlais, Glamorganshire—A new method of relieving pain in the human body.

Dated 20th December, 1859.

2892. J. Fairclough, Liverpool—Imp. in bed-bottoms and other similar structures.

Dated 17th January, 1860.

121. B. Burrows, Leicester—Imp. in looms for weaving narrow fabrics.

Dated 27th January, 1860.

207. B. Ponçon-Jeandelize, Bonsecours, près Rouen, Seine Inférieure, France—An improved eye flap designed to stop horses which have taken fright, by depriving them of sight, and which he calls "blinding eye flap," for which he has obtained in France a Patent for invention and improvement for 15 years, bearing the date of the 19th August, 1859, No. 41,909.

Dated 30th January, 1860.

230. M. Wigzell, Friars'-green, Exeter, and E. Wigzell, 15, Marden-terrace, Lewisham-road, Greenwich—An improved form of land battery for coast and other fortifications.

Dated 2nd February, 1860.

275. S. Chatwood, 65, Cornwallis-street, Liverpool—Imp. in sewing or stitching machines.

Dated 4th February, 1860.

299. G. A. Biddell, Ipswich—Imp. in projectiles.
304. W. Spurrier, Birmingham—Imp. in shaping metals and in machinery employed for that purpose.

Dated 6th February, 1860.

310. J. E. Boyd, Hither-green, Lewisham—Imp. in carriages and other conveyances used for the conveyance of children, adults, and invalids.
311. J. Skertchly, Ashby-de-la-Zouch, Leicestershire—Imp. in apparatus for evaporating the moisture from slip for potters' use.

Dated 7th February, 1860.

318. M. J. Roberts, Crickhowell, Brecon—Imp. in breech-loading fire-arms.
319. W. N. Wilson, 144, High Holborn—Imp. in sewing machines and apparatus connected therewith. (The first part a com.)
320. J. Whitehead, Preston—Imp. in moulding or shaping clay and other plastic materials, and in the apparatus employed therein.
324. A. L. E. Breittmayer, 14, Rue de Bruxelles, Paris—Imp. in machinery for, and in engraving, the metallic surfaces of printing rollers or cylinders.
326. W. E. Newton, 66, Chancery-lane—Imp. in the fittings of sun-shades or roller blinds. (A com.)
328. J. R. Cooper, Birmingham—Imp. in breech-loading fire-arms and ordnance.

Dated 8th February, 1860.

330. A. Dalgety, Shard's terrace, High-street, Peckham, Surrey—Imp. of watches, clocks, and chronometers.
332. J. M. Rowan, Glasgow, and T. R. Horton, Birmingham—Imp. in steam engines and boilers.
334. C. P. Moody, Corton Denham, Somersetshire—Imp. in carrying, supporting, and shifting engines used in ploughing and other agricultural operations, and in apparatuses employed therein.
336. J. Miller, Ayr, N.B.—Imp. in propelling vessels, ships, and boats.
338. G. Whight, Ipswich—Imp. in sewing machines. (A com.)
344. J. Cocker, Liverpool—Improved apparatus for indicating the number of passengers carried by public vehicles.
346. J. Carver, Nottingham—Imp. in the manufacture of combs used in pusher machines, for the making of lace or other articles, and in the manufacture of counters used when casting the same.

Dated 9th February, 1860.

348. C. Stuart, Halifax—Imp. in machinery or apparatus for the manufacture of soles for clogs, shoes, and pattens.
349. J. C. Lupton and J. Bleasdale, Church, near Accrington, Lancashire—Imp. in machines for preparing and spinning cotton and other fibrous materials.
350. E. T. Hughes, 123, Chancery-lane—Imp. in scouring wool, and in machinery or apparatus employed therein. (A com.)
352. H. Deacon, Widnes, and T. Robinson, St. Helen's, Lancashire—Imp. in the manufacture of soda.
354. G. White, 34, Dowgate-hill, Cannon-street, London—An improved machine for moulding candles. (A com.)

Dated 10th February, 1860.

356. T. W. Rammell, 1, Saint Alban's-place, Saint James's, Middlesex—Imp. in pneumatic railways and tubes.
358. J. S. Dawes, Smethwick-house, near Birmingham—An imp. or imps. in breech loading fire-arms and ordnance.
360. T. R. Yarrow, Arbroath, Forfar, and W. M. Neilson, Glasgow—Imp. in steam engines and boilers.
362. B. Bonnet, Salford—Certain imp. in Jacquard apparatus to be employed in looms for weaving.
364. G. W. Bostock, George-street, Blackfriars-road, Surrey—Imp. apparatus for taking the measure of the human body.
366. D. Wesson, 7, Granby-street, Hampstead-road, Middlesex—Imp. in the manufacture of pianofortes.

Dated 10th February, 1860.

368. D. Dietz, 60, Boulevart de Strasbourg, Paris—An improved oil-box for lubricating the axle-trees of railway carriages or waggons, applicable also to the shafts of all kinds of machines.
370. W. Aldred and J. Maynes, Manchester—Imp. in apparatus applicable to steam boilers for liberating steam therefrom, either in the event of excessive pressure or of deficiency of water, for giving audible signals in like cases, and for regulating the supply of water thereto.
372. J. Wright, 42, Bridge-street, Blackfriars—Imp. in the construction of water-closets. (A com.)
374. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in sewing machines. (A com.)
376. B. Purnell, Birmingham—Imp. in hot water apparatus applicable to the heating of buildings, supplying baths and laundries, and other similar uses.
378. E. Humphrys, Deptford, Kent—Imp. in marine steam boilers.
380. W. Harwood, Stowmarket, Suffolk—Imp. in machinery for reaping and mowing.

Dated 13th February, 1860.

382. H. Hewetson, Blackheath, Kent—Imp. in rockets.
384. J. C. Haddan, Bessborough-gardens, Pimlico—Imp. in the manufacture of guns and projectiles to be used therewith.
386. J. Green, Newtown, Worcestershire—Imp. in machinery or apparatus for drilling and distributing or sowing broadcast lime, salt, soot, guano, and other manures.
388. J. A. H. Ballande, Paris—An improved paper and ink for writing and printing purposes.
390. R. J. Cole, 21, Chepstow-villas West, Bayswater—Imp. in the construction of brushes.
392. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of certain kinds of soap.

Dated 14th February, 1860.

400. J. K. Worts, Colchester—Imp. in means or apparatus for obtaining motive power.
402. W. E. Newton, 66, Chancery-lane—Improved apparatus for producing an artificial draft in chimnies, and for purposes of ventilation. (A com.)
406. M. J. Haines, Stroud—Imp. in the manufacture of driving straps.
408. S. Rowbotham, Putney, Surrey, and H. Bolton, Penketh, near Warrington, Lancashire—A composite soap.
409. J. Weeks, Marylebone—Imp. in umbrellas and parasols.

Dated 15th February, 1860.

412. J. Ronald, Liverpool—Imp. in machinery for "topping up," "forming," or "laying twine," lines, cables, and other cordage.
414. Major W. F. Nuthall, North Lodge, Kilburn—An improved portable machine for correcting and boring rifle bullets, also for turning-in shot cartridge cases.
416. R. A. Brooman, No. 166, Fleet-street—Imp. in the manufacture of fabrics suitable for carpets, hangings, furniture stuffs, and the like. (A com.)
418. J. Hamilton, Glasgow, and T. Silver, Philadelphia—Imp. in marine steam-engines.

Dated 16th February, 1860.

420. E. Caplen, Islington—An imp. in the construction of soles and heels for boots, shoes, and other coverings of the feet.
421. C. Spryc, Saint Leonard's-on-Sea, Sussex—An improved self-feeding apparatus for printing machines.

422. T. Green, 2, Nicholas-lane, London—An improved machine for the manufacture of paper and other bags. (A com.)
423. G. Parsons, Martock, Somersetshire—Imp. in steam engines.
424. W. H. Elkin, 27, Belvidere-road, Lambeth—Imp. in window frames and sashes.
425. G. Cowdery, Strood, Kent — An improved brick-making machine.
426. W. Clark, 53, Chancery-lane—Imp. in the manufacture of gas and in apparatus for the same. (A com.)
427. W. Clark, 53, Chancery-lane — Imp. in sword and other sheaths or scabbards. (A com.)
428. H. Widnell, Lasswade, Edinburgh—Imp. in the manufacture of embossed pile fabrics.
429. J. Hopkinson, 14, New North-street, Finsbury—Imp. in machinery for cutting paper.

Dated 17th February, 1860.

430. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in fire arms. (A com.)
431. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in furnaces for the prevention of smoke. (A com.)
432. W. Hudson, Burnley, Lancashire, and C. Catlow—Certain imp. in power-looms for weaving.
433. J. George, Birmingham—A new or improved method of suspending gas and other chandeliers.
434. E. Westwood, Brierley-hill, Staffordshire—An improved mode of securing or holding corks in the necks of bottles, jars, or other similar vessels.
435. A. Belpaire, Brussels—Imp. in fire-boxes and other parts of locomotive and moveable steam engines.
436. S. Bury, Manchester—Imp. in machinery or apparatus for embossing and finishing textile fabrics or other like surfaces.
437. T. H. Morrell, Leyland, Lancashire—Imp. in apparatus used in moulding and pressing bricks, and in drying bricks, tiles, and other articles made from plastic earths.
438. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for twisting, doubling, and winding thread. (A com.)
439. Q. Filopanti, 36, University street, London—An apparatus for storing up the motive power of cheap or costless forces and carrying their useful effects where no such cheap or costless moving powers could be applied.
440. H. D. P. Cunningham, Bury, Hants—Imp. in reefing sails.
441. W. Woodcock, 5, Bessborough-gardens, Pimlico—Imp. in stoves.
442. D. Irons, 31, Hamilton-street, Deptford, Kent—Imp. in ship's compasses.
443. J. Henry, Mitchell-street, Glasgow—Imp. in the manufacture of flounced dresses.
444. J. Maude and L. Tindall, Sherwood Iron Works, Mansfield, Nottingham—A combined garden roller and seat.
445. P. Lavenas, Lyons—Imp. in obtaining motive power by compressed air and by its successive and ascending pressures, and in apparatus employed therein. (A com.)

Dated 18th February, 1860.

446. P. A. Gillis, Braine-le-Comte, Belgium—An improved regulator for prime mover engines.
447. P. E. S. Dulos, 60, Boulevard de Strasbourg, Paris—An improved process for engraving metallic surfaces either in relief or sunk lines, applicable to copper plates, presses, and to ordinary printing presses.
448. J. Luis, 1B, Welbeck-street, Cavendish-square, Middlesex—An improved jointed blind. (A com.)
449. R. Bewley, jun., Brook House Foundry, Uttoxeter, Staffordshire—Imp. in the mode of heating the drying rooms, sheds, or stories used by potters and manufacturers of bricks and tiles.
450. J. Sanders, West Bar, Sheffield—Certain imp. in watches.
451. M. Henry, 84, Fleet-street—Imp. in the production of gas for lighting and heating, and in apparatus employed therein. (A com.)
452. W. E. Newton, 66, Chancery-lane—Certain imp. in knitting machines. (A com.)
453. E. Winter, New Oxford-street—Certain imp. in library and office tables.

Dated 20th February, 1860.

454. T. Osborne, Derby—Imp. in coupling and uncoupling railway and other vehicles.
455. J. Earnshaw and W. Green, Preston—Imp. in machinery for forming blocks of wood into shape to be used as soles for boots, shoes, or clogs, or for other purposes.
456. J. Moffat, Ardrossan, Ayr, N.B.—Imp. in steam-boiler furnaces.
457. A. Teissere, 29, Boulevard St. Martin, Paris—An improved blank stamping press.
458. W. E. Newton, 66, Chancery-lane—A new and useful imp. in the smelting and refining of iron. (A com.)
459. T. Hoyle, Marsden, Almonbury, Yorkshire—Imp. in the construction of screens employed for cleaning wheat and other grain.
460. A. C. Hill, and W. Morgan, Witton Park Iron Works, near Darlington—Imp. in protecting the sides and ends of puddling furnaces.
461. F. W. Mart, 11, Gresham-street West—Imp. in the manufacture of mops or 'sponges' for cleansing cannon.
462. J. Sowerby and S. Neville, Gateshead, Durham—An imp. in moulds for making pressed glass.
463. R. A. Brooman, 166, Fleet-street—Imp. in stamping presses.
464. G. W. Townsend, Calcutta—An imp. in projectiles.
465. Sir Charles Tilston Bright, Harrow Weald, Middlesex—Imp. in working and testing telegraphic conductors, and in apparatus connected therewith.

Dated 21st February, 1860.

467. P. J. Weerts, 4, South-street, Finsbury—Imp. in the preparation of stuffs in general.
469. L. Sautter, 37, Avenue Montaigne, Paris—Imp. in the treatment of mica and its application to the manufacture of reflectors, and to other uses.

Dated 22nd February, 1860.

473. W. H. Crispin, Marsh Gate-lane, Stratford, Essex—Imp. in fastenings for doors.
475. C. Schiele, Lower Bebbington, Cheshire—Imp. in machinery for hammering, crushing, reducing, cutting, and mixing.
477. V. E. Lecoupeur, Rouen—A new or improved system of filter.
479. W. Symons, Dunster, Somerset—An imp. in self registering thermometers.
481. T. Lovelidge, Philadelphia, U.S.—Imp. in looms for weaving.
483. E. D Reynolds, Southville, Bedminster, Bristol—An improved rifle ball.

Dated 23rd February, 1860.

585. P. A. J. Dujardin, Lille, France—Imp. in printing telegraphs.
487. T. Barlow, Hill Top, West Bromwich, Staffordshire—A new or improved rail for railways.
489. W. Charlesworth, Union street, Southwark, and H. Charlesworth, 36, Barbican, and T. H. Dunbar, Clerkenwell—Imp. in cigarettes.
491. Major W. F. Nuthall, North Lodge, Kilburn, and C. Humfrey, Southwark, Surrey—An improved lubricant for small arms and ordnance ammunition.
495. J. Redfern, Cumberland-road, Southsea, Portsmouth—Imp. in the construction of steam boilers for increasing the durability thereof and also for economising fuel.

Invention with Complete Specification Filed.

548. H. Higgins, Orleans, Massachusetts—Supporting the fluke of an anchor and discharging the same from the bulwark rail of a vessel.—28th February, 1860.

Patents Sealed.

[*From Gazette, March 2nd*, 1860.]

March 2nd.
2021. B. Lauth.
2033. F. J. Manceaux.
2035. J. Stewart.
2036. E. Blake.
2041. W. J. J. Varillat.
2048. W. Rothwell.
2078. W. A. Morrison.
2098. A. Applegath.
2101. J. Brière.
2169. T. Robinson.
2222. M. and A. Samuelson.
2294. P. Robertson.
2341. F. Levick.
2842. A. Leslie.
2908. J. H. Johnson.
2980. Sir P. Fairbairn and R. Newton.

[*From Gazette, March 6th*, 1860.]

March 6th.
2042. J. L. Jullion and G. Pirie.
2043. J. P. Joule.
2044. A. V. Newton.
2045. A. V. Newton.
2050. T. O. Small.
2054. J. Tandy.
2056. G. Gowland.
2057. W. Roscoe.
2060. S. Worssam.
2062. W. E. Gedge.
2077. F. Versmann and A. Oppenheim.
2135. L. Engler and E. F. Krauss.
2207. C. Duplomb.
2213. W. Hartley.
2335. J. Hunter.
2293. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March 2nd*, 1860.]

February 27th.
596. H. D. P. Cunningham.
597. T. H. Jennens.
February 28th.
632. T. Brown.
604. E. F. Jones.
627. W. Taylor.
641. W. Muir.
649. G. Bower.

[*From Gazette, March 6th*, 1860.]

March 1st.
610. C. Pauvert.
616. T. Gray.
March 2nd.
598. J. Murphy.
667. C. Lungley.
717. W. E. Newton.
March 3rd.
620. W. Leuchars.
654. G. T. Bousfield.
655. R. A. Coward.
666. G. Hawksley.
694. F. A. Fitton.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, March 2nd*, 1860.]

February 20th.
456. E. S. Brookes, J. Black, G. Stevenson, and W. Jones.
February 27th.
535. S. Colt.
538. S. Colt.
February 28th.
526. M. Vetillart.

[*From Gazette, March 6th*, 1860.]

March 1st.
571. T. W. Dodds.
March 2nd.
651. C. H. Wild.
659. W. Blinkhorn.
March 3rd.
601. G. Collier.

Journal of the Society of Arts.

FRIDAY, MARCH 16, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of RECENT Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

The days for receiving articles (which must be forwarded to the Society's House *carriage paid*), are Thursday, Friday, and Saturday, the 22nd, 23rd, and 24th March, but no article can be received unless space has been previously allotted, for which application should be made to the Secretary without delay.

Illustrated Catalogues of the Society's Annual Exhibitions are published; a short but clear description of all Inventions exhibited will therefore be required for the Catalogue, with an engraved wood block (when it is possible) for illustration.

These descriptions must be written in a clear hand, on one side only of each half-sheet of foolscap paper, with an inch margin on the left side of the page.

All Drawings exhibited must be framed.

Articles which have been included in previous Exhibitions of the Society of Arts *cannot be readmitted.*

No charge is made for space.

EXAMINATION PRIZE FUND, 1860.

The following are the donations up to the present date:—

John Ball, Examiner in Book-keeping (3rd donation)	£5	5
Charles Brooke, M.A., F.R.S.,	2	2
Harry Chester, Vice-Pres. (3rd Donation)	5	0
C. Wentworth Dilke, Vice-Pres. (5th Donation)	10	10
Thomas Dixon (annual)	1	1
Fred. Edwards (annual)	1	1
George Goff	5	0
Seymour Haden (annual)	2	2
W. Haldimand (2nd Donation)	10	10
James Holmes (annual)	1	1
Henry Johnson (3rd Donation)	10	10
Sir Thomas Phillips, F.G.S., Chairman of the Council	5	0
Charles Ratcliff (annual)	10	10
William Radford	1	1
Rev. Dr. Temple (2nd Donation)	5	5
T. Twining, jun.	10	0
Rev. A. Wilson (2nd Donation)	2	2

EXAMINATIONS.—LOCAL BOARDS FOR 1860.

The following additional Local Boards have been appointed:— *

* For the 1st List see *Journal* for Feb. 3rd, page 171.

*** Those marked with three asterisks have not taken part in the Examinations of former years.

Local Board for the Glasgow Athenæum.

The Very Rev. Thomas Barclay, D.D., Principal of the University of Glasgow, *Chairman.*
Mr. W. G. Blackie, Ph.D., Printer, 50, St. James's-road.
Rev. John Eadie, D.D., LL.D., Professor of Theology, United Presbyterian Church, 13, Lansdowne-crescent.
Mr. James Gourlay, Banker, 25, Carlton-place.
,, Robert Grant, M.A., Professor of Astronomy, Glasgow University.
Rev. W. Hetherington, D.D., LL.D., Professor of Theology, Free Church College.
Mr. James McClelland, President of the Institute of Accountants and Actuaries in Glasgow, 10, Claremont-terrace.
,, James McIntosh, Shipowner, 6, Carlton-place.
,, John Mayer, Teacher, 2, Carlton-place.
,, William Neilson, Insurance Agent, 69, Glassford-st.
,, Alexander Ritchie, Accountant, 97, West George-st.
,, John Strang, LL.D., City Chamberlain, Council Chambers.
,, Michael Thomson, Accountant, 3, Abbotsford-place.
,, Moses Provan, Accountant, 110, West George-street, Glasgow, *Secretary.*

Local Board for Leicester.

Rev. T. S. Carlyon, Glenfield, near Leicester, *Chairman.*
Mr. S. Clarke, Leicester.
Rev. J. W. Fletcher, Leicester.
,, W. Hill, Leicester.
Mr. T. Ingram, Leicester.
Rev. T. Jones, Leicester.
Mr. Richard Luck, Leicester.
Rev. W. B. Moore, Evington, Leicester.
Mr. T. Nevinson, Leicester.
,, T. North, Leicester.
,, Sarson, Leicester.
Rev. R. Stephens, Belgrave, Leicester.
,, D. Vaughan, Leicester.
,, J. O. Picton, Leicester, *Secretary.*

Local Board for Manchester.

The Mayor of Manchester, *Chairman.*
Mr. Thomas Bazley, M.P., Manchester.
Professor Bowman, Victoria-park, Rusholme, Manchester.
Mr. W. Fairbairn, F.R.S., Manchester.
Professor Greenwood, Principal of Queen's College, Manchester.
,, Hall, Independent College, Brook's Bar, Manchester.
Mr. Oliver Heywood, Bank, Manchester.
,, E. R. Langworthy, Victoria-park, Manchester.
Professor Newth, Lancashire Independent College, Manchester.
Mr. A. Ransome, St. Peter's-square, Manchester.
Rev. Charles Richson, M.A., Canon of Manchester.
Mr. Robert Rumney, Ardwick, Manchester.
Dr. R. Angus Smith, 20 Grosvenor-square, Manchester.
Mr. James Keyton, Embden-street, Greenheys, Manchester and Mr. Joseph Manchester, Stretford, near Manchester, representing the Manchester Mechanics' Institution.
Mr. E. Hutchings, Cheetham, Manchester, *Secretary.*
With two representatives from any Institution sending candidates for examination.

Local Board for the Metropolitan Evening Classes, Sussex Hall (London).

Rev. M. W. Lusignan, 2, Little Bush-lane, Cannon-street, E.C., *Chairman.*
Mr. E. C. Bowra, Her Majesty's Customs, and Norwood, S.
Mr. Thomas Brodribb, 24, Walbrook, E.C., and Privy Council Office, S.W.
Mr. S. L. Cressall, 2, Royal Exchange-buildings, E.C.

Rev. Thomas Hugo, 57, Bishopsgate-street, E.C.
,, J. W. Laughlin, 13, Hatton-garden, E.C.
,, Charles Mackenzie, 39, Porchester-terrace, Bayswater, W.
,, J. V. Povah, 16, Tavistock-square, W.C.
Mr. E. P. Plowman, Privy Council Office, 28, Great George-street, S.W.
Mr. W. R. Stevens, Carthusian-street, Charterhouse-square, E.C.
Rev. Richard Whittington, Chapter-house, St. Paul's Churchyard, E.C.
Mr. H. W. Hansen, Sussex-hall, Leadenhall-street, E.C., *Secretary*.

*** Local Board for Oldham.

Mr. Jno. Geo. Blackburne, F.G.S., Civil Engineer, President of the Lyceum, Union-street, Oldham, *Chairman*.
,, Fredk. Bromley, M.R.C.S., Curzon-street, Oldham.
Rev. Jas. Bumstead, M.A., Green-hill, Oldham.
,, R. M. Davies, Soho, Oldham.
,, C. W. Robberds, M.A., Lyon Dam, Oldham.
Mr. John Taylor, Cotton Spinner, Mumps, Oldham.
Rev. John Hodgson, Queen-street, Oldham, *Secretary*.

Local Board for Portsea (Watt Institute).

Rev. Professor Main, Royal Naval College, *Chairman*.
Mr. Thomas Brown, Royal Naval College.
,, Edwin Lang, Royal Dockyard School.
Rev. Edward S. Phelps, Chaplain R.N., Cosham.
Mr. Robert Rawson, Head Instructor, Royal Dockyard School.
,, Andrew Murray, C.E., Royal Dockyard, *Secretary*.

*** Local Board for the South Staffordshire Union.

The Right Hon. Lord Lyttleton, Hagley-park, near Stourbridge, *Chairman*.
Mr. W. Akroyd, Stourbridge.
,, T. Bagnall, Pattingham.
Rev. Mr. Bailey, Walsall.
Mr. J. Bidlake, Wolverhampton.
,, J. Blackburn, Walsall.
,, S. W. Blackwell, Dudley.
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,, J. Bradshaw, West Bromwich.
Mr. Britten, Wednesbury.
Rev. T. H. Campbell, Grammar School, Wolverhampton.
Mr. James T. Chance, Handsworth, near Birmingham.
,, R. L. Chance, junr., Smethwick.
,, H. Chance do.
,, J. Cowley, Walsall.
,, J. T. Crump, Walsall.
,, W. Eagles, Walsall.
,, W. England, Stourbridge.
Rev. G. H. Fisher, Willenhall.
,, H. S. Fletcher, Bilston.
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Rev. S. J. G. Fraser, Her Majesty's Inspector of Schools.
Rev. N. F. Garry, Handsworth.
,, G. H. Gibson, Stourbridge.
,, H. Girdlestone, Wordsley, near Stourbridge.
,, D. Gordon, Walsall.
Mr. R. D. Gough, Willenhall.
Rev. J. W. Grier, Amblecote, Stourbridge.
,, Hathaway, Darlaston.
Mr. John Hatton, Bilston.
,, C. Hicks, Smethwick, near Birmingham.
,, E. Hollier, Dudley.
Rev. S. Hunter, Grammar School, Wolverhampton.
,, J. H. Iles, Rector of Wolverhampton.
,, A. C. Irvine, Grammar School, Walsall.
Mr. J. N. Langley, Grammar School, Wolverhampton.
Rev. J. Lloyd, Grammar School, Wolverhampton.
Mr. Sampson Lloyd, Wednesbury.
Rev. Mr. Newbold, Grammar School, Walsall.
Rev. J. P. Norris, Her Majesty's Inspector of Schools.
Rev. H. Rherrard, Stourbridge.
Rev. H. R. Sandford, Her Majesty's Inspector of Schools.
Rev. J. H. Sharwood, Vicar of Walsall.
Mr. F. Smith, Brierley Hill.
Mr. C. E. Swindell, Stourbridge.
Rev. J. H. Thomson, Cradley.
Mr. G. Thomson, West Bromwich.
Dr. Walker, Brierley Hill.
Mr. A. W. Wills, Grammar School, Wolverhampton.
Mr. Wright, Dudley.
Mr. Fred. Talbot, Messrs. Chance's Schools, Spon Lane, West Bromwich, *Secretary*.

Local Board for Wakefield.

Rev. J. S. Eastmead, Independent Minister, Wakefield, *Chairman*.
Rev. Goodwyn Barmby, Unitarian Minister, Wakefield.
Mr. Geo. Wm. Harrison, Merchant, Wakefield.
,, Wm. Shaw, Barrister, St. John's, Wakefield.
,, Wm. Williamson, Ch. Clerk, Probate Court, Wakefield, *Secretary*.

The following address has been issued by Lord Lyttelton, Chairman of the Local Board for South Staffordshire :—

"A Board has been formed for the purpose of promoting, in the South Staffordshire mineral district, the system of Examinations instituted by the Society for the Encouragement of Arts, Manufactures, and Commerce, commonly called 'The Society of Arts.'

"It applies specially to members of Mechanics' Institutes, and similar bodies; and, as chairman of the Board, I take the liberty of calling your attention to the subject.

"The general features of the system may be described in a few words. The Society of Arts holds an Annual Examination of members of, and students of classes in, Mechanics' and other Institutions, of both sexes, being at least 16 years of age; and to those who pass with credit, the Society of Arts grants certificates of attainment, which may serve as valuable testimonials in after life. Prizes are also awarded to those who specially distinguish themselves in any subjects.

"The Society of Arts is a body which has existed for upwards of a century, but which has only recently been incorporated by Royal Charter.

"In its present state it is imperfectly described by its title. Its objects may be said to embrace whatever tends to the intellectual and industrial progress of the people. It is a powerful and able body, presided over by the Prince Consort, and with ample means to conduct such a scheme of Examination as I have mentioned, and to impart to its results a high value in public estimation.

"It is needless to dwell on the general advantages of the principle of emulation, brought out by collective examinations and rewards in the education of youth. But I wish to point out that, speaking generally, the Society's examinations are the only existing system by which this principle can be applied to one large and important class of society; and that without it that class is left at the disadvantage of being the only one upon which the principle in question is not brought to bear.

"From time immemorial, children of all classes have been stimulated in their course of instruction by competition for prizes in the schools which they attend.

"The children of the upper classes pass direct from school to college, where they are under the same system till they arrive at manhood.

"To the class just below these, reaching down far into the middle class, the same advantage, substantially, is now offered for the time subsequent to the school period, by the recent establishment of what is well known as the Oxford and Cambridge Middle-Class Examination Scheme.

"For all below these—the lower middle class, and that of artizans and workmen of all kinds, which supply the

Members of Mechanics' Institutes and the like—there is no system in operation, or in prospect, except that which the Society offers.

"On these simple grounds I venture strongly to recommend this scheme to the Members of such Institutions in this district; and I would hope that they will not lightly neglect a means of improvement which has already been taken up with good success in other parts of the kingdom, and which may have very important effects on the welfare of a large class of our people.

"There are, of course, many details to this question, into which in this notice I cannot enter. Full information concerning those may be obtained from the Secretary of the Board, Mr. F. Talbot, Messrs. Chance's Schools, Spon-lane, Birmingham; and as the Society's Examinations are held in the spring, it is necessary that communications should be addressed to him without delay.

"I am, your obedient servant,

"LYTTELTON."

FIFTEENTH ORDINARY MEETING.

Wednesday, March 14, 1860.

The Fifteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 14th instant, Sir Thomas Phillips, F.G.S., Chairman of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Lyttelton, Lord | Reid, T. Wemyss.

The Paper read was—

THE ART-TREATMENT OF GRANITIC SURFACES.

By John Bell, Sculptor.

The subject on which I am about to make a few remarks this evening is the Sculptural Art Treatment of Granitic Surface, or the Surface of Granite. Although I shall have occasion to speak of the practice of the ancient Egyptians as our masters in this art, yet I shall not do this abstractedly, but with a practical relation to the present day.

Although granite has occasionally been worked in this country locally, it did not come largely into use in our national and large structures until within the last 100 years, Old Westminster, and Southwark, and London bridges, by the Rennies, being nearly the earliest of these public works in which it was the main material. The style of workmanship adopted in these cases has been in blocks, large, simple, and massive; and whether in connection with large engineering works, other public structures, or pedestals for public statues, this appears the treatment proper for it. The Egyptians treated it in the same manner, but with this difference, that they also added to the broad surfaces thus attained a variety of decorated and illustrative encised ornament.

This has not been our practice up to the present day, but it appears to me that we might adopt it with advantage; that is, not of course by copying the Egyptian figures and hieroglyphics, but by only following occasionally that encised method of sculpture which may surely be held to be as proper for British granite as for Egyptian, and the illustration of this idea forms the main object of this paper.

Various of the oldest structures in the world are in granite. Some of the simpler features of those in Egypt now existing, nearly perfect, date back between 3,000 and 4,000 years; and on the other hand some of the most modern erections in this city, among which I may cite New Westminster bridge, now in the course of rapid completion, are of granite. Therefore it may be allowed that the value and interest that attaches to this material for architectural purposes, spreads over a great extent of human time.

This, however, is of course but yesterday, compared with that remote period when the granite was itself formed. It is an igneous or volcanic rock, unstratified in the common sense of the word, yet, as explained by Professor Hunt on a former occasion in this room, liable to divisions of a bubble form, like the layers of an onion, or hyacinth root, "which had been cut at right angles to its axis, and set on its base." These divisions are known to the quarrymen as the "bedway." This structure is however on so vast a scale as not to interfere with the obtaining of straight blocks 100 feet in length. In other respects, except where occasional joints occur, this rock is equally close and compact in all directions, which adds of course to its endurance and stability.

The well known constituent parts of granite are felspar, mica, and quartz, but these questions are not in my specialty. Enough has been said to show that these are compounded into one mass of great compactness, and also, as we know, in different cases, of various colours. On the table are a few specimens of these, chiefly the produce of the British Isles, which, however, have not the slightest pretension to being an adequate illustration even of the varieties of colour.

In these few examples, however, you see that red and grey form the two great varieties of colour in granite, yet that there are also many intermediate gradations in which nature appears to have arranged her tints to suit all tastes. Most of these are vastly improved by polishing, then also affording examples of completeness combined with endurance of surface not to be reached by any other material except gems. In thus speaking of this quality of stone I of course include the syenites, basalts, and porphyries, which are of the same family. Black basalt was used occasionally, both in Egypt and Assyria, for art purposes, as also porphyry, both stones of great beauty and hardness; also occasionally in modern times. I dare say many of those present have seen the porphyry sarcophagus of Napoleon I., in the noble cenotaph in the chapel of the Hotel des Invalides in Paris, rising from the centre of the vault in so grand a manner, and which is destined to hold the ashes of the great warrior. The block of porphyry out of which this was formed, was of such hardness that no one person or set of men could be obtained to go through with the execution of it. Nearly every workman in Paris had a touch at it, but necessarily gave it up in weariness. It broke their hearts as well as their tools. Not that each did not do something, for each did, and thus eventually it became completed and polished, and a magnificent sarcophagus it is; but it was too intractable to suit the vivacity of our French neighbours. All this was told me by a young French carver, whom I employed do so some work for me when I was in Paris in 1855, who added that he himself had had three days of it, which was quite enough.

Indeed the hardness of this class of material is one of the considerations that renders the vast architectural and sculptural works achieved by the ancient Egyptians, so great a marvel. Although modern research has told us so much about Ancient Egypt, and, lit greatly by the lamp of that invaluable Rosetta stone in the British Museum, has so well deciphered the hieroglyphic writing, that an invitation to dinner and a reply might well pass between two "savans" in that character; although we have found out so much about the history and manners and even domestic customs of ancient Egypt, we do not know how she worked her granite. It is true that for other purposes they had tools of steel, as knives, represented blue in their paintings, as well as copper or bronze ones, represented red, yet in the paintings the chisels for stone work are usually painted of the latter colour. Thus it is considered that they used bronze chisels. If so, they must have had a very superior mode of hardening that alloy to any we possess. I must ac-

knowledge, however, that I have heard that the Hindoos have a method of hardening it equal to steel; and we know the swords of old were made of brass or bronze, as the sword of Achilles described by Homer. However, even as regards steel, our own chisels of modern times soon get abashed before the surfaces of the harder granites. "Any one," Sir Gardner Wilkinson says, "who has tried to cut a block of Egyptian granite will acknowledge this; and the labour experienced by the French engineers who removed the Obelisk of Luxor, from Thebes, in cutting a hole in its pedestal, suffices to show that even with our modern implements we find considerable difficulty in doing what to the Egyptians must have been one of their least arduous tasks."

A similar difficulty was experienced by ourselves as to the well-known fragment of Memnon, in the British Museum, more properly Thothmes III. This great bust has, as you may notice, a fracture on the shoulders. In fact, the head was first obtained, and the other portion was afterwards sent over to us by the French. To attach this to the other portion, it was thought fit to have a hole made to receive a bar to connect them. Our workmen were six weeks in making this hole, and broke a great number of tools in the operation.

The use of emery powder, and of the drill and wheel, has been suggested as having aided in cutting the encised work on granite, and any one who has witnessed the rapid manner in which this process cuts our hardest glass, hardly to be scratched even by anything but a diamond, will acknowledge the unexpected power of this process.

It has also been conjectured that emery powder was also used in sawing Egyptian granite. No doubt it was in polishing it, of which we have many representations. This, however, does not assist us much as to the more general fashioning of the great granite structures of Egypt. One element of workmanship, however, the ancient Egyptians possessed in profusion, under their despotic system, namely that of labour and time. Undoubtedly the marvels of Egyptian granite workmanship were mainly produced by the unpitying use of these. Water dropping will, in the end, wear a hole in the hardest stone, but we do not now like to see human hands and energies lavished in drudgery of that description. We desire the utmost economy of these now. They had no such ideas. Year after year, for instance, no doubt passed in fashioning an obelisk, and completing its decorations. They had no steam machinery, but they had unlimited labour, which they used without stint or compunction. I have no doubt, however, that our steam power, if properly applied, would easily accomplish within weeks what the Egyptians took years to achieve. In modern days the great columns of St. Isaac's church in St. Petersburgh, which are each of one block of red granite, 50 feet high, and 10 feet across at the base, took a long time in executing. But time in Russia is not valued so highly as in England. These magnificent shafts are also polished. The shaft of the column of Alexander in the same city, is yet higher than these, being 80 feet in one block. The block out of which it was fashioned was originally 93 feet, the same height as the great obelisk at Karnak, but the proportions of the column having been decided on, they cut off 13 feet, which seems a pity!

In our own country, machinery has been applied to turning granite pillars, to working mouldings and to polishing, but not as yet, I believe, to cutting decorations. Were there, however, sufficient encouragement for this class of work, we should no doubt soon see the strong arm of steam fashioning granite into art-forms as readily as arresting our larger operations in planing iron like wood, and rifling steel guns. As it is, however, modern times have never as yet reached to the achievements of ancient Egypt, either in the works of granite or the decoration of its surface.

It may always be noticed that each material demands, at the hands of art, a different and special treatment. For instance, wood suggests one treatment, glass another, pottery and porcelain another, metal another,—and even the different kinds of stone suggest different phases of treatment. Among these, granite, from the large, compacted masses in which it occurs, and its extreme hardness, suggests a broad and massive style of art-use. The delicate work put on Parian or Carrara marble could hardly be achieved in granite, and a Corinthian capital, with all its delicate acanthine undercuttings, would indeed be a long work in granite. The Egyptian had not the marble of Paros, but he had the granite of Syrene, an island in the upper part of the Nile, and various other quarries, as those about Philæ, along its course, which possessed the advantages of direct water-carriage.

Urged by his religious faith, which included a firm belief in future existence, to be spent, however, on this earth, he built prospectively for that time, and granite was ready to his hand.

Thus it came that the Egyptian built in granite, and the nature of the material had evidently, as I have already indicated, great influence on the character of his architecture and art. The blocks of which his structures were composed, were hewn by the side of the Nile, and they were brought down by the Nile to the place of their erection. The Nile indeed did a great deal for the Egyptian. Perhaps it was no wonder that in those twilight days he deified his great river. Even the very land he stood on was in great measure the gift of the Nile, for the whole Delta is considered to have been alluvial soil brought down by its waves in the lapse of ages. For the noted luxuriance of his crops, the Egyptian depended on its annual inundation. It also afforded to his lips what is considered to be the sweetest water in the world—that which will keep the best, and is most agreeable to the human taste. It supplied him with fish, with much vegetable food, and the paper on which he wrote his books. It floated his vessels and conveyed his merchandise, and lastly was the great railroad for his building materials. We shall also see that he was greatly indebted to it directly for his Art.

I have said that the Egyptian, besides his other obligations to the Nile, was also greatly indebted to it for his art, as thus—it was chiefly from the flowers and plants with which it abounded that he drew his more prevalent types of architecture. Of course, I do not suggest that all the Egyptian art-forms were floral. The pyramid, for instance, is not floral, nor the obelisk. The temple, also, in itself is not a floral form, but no one can regard its façade, and view its more decorative architectural parts, as the capitals of the columns, without perceiving that they are floral forms. The shafts, also, are bundles of stems bound together, and the bases have the character of roots.

The two great types from which most of these and their decorations arose are the papyrus and the lotus. On the walls are sketches of these two plants, which I have had made for the occasion, the *Papyrus Antiquorum*, or papyrus of Egypt, the full size of the plant, and the *Lotus Nymphœa*, or sacred lotus of Egypt, one half more than the scale of nature. These abounded in the waters of the Nile, and are still found there. You see how graceful they are in themselves, and how well-adapted to suggest fine forms for the capitals of columns, and for vases, &c., in which the Egyptians also so much copied them. To illustrate this, in consequence, on the walls you see, represented in outline, vastly less, however, than their real size, some of the celebrated ancient capitals of the Egyptian columns drawn from these types. In those which turn over and outwards, at the top, you recognise the papyrine type, except where the bud is imitated. In those which are convex and egg-shaped at the sides you perceive the type of the lotus flower. In the first instance the block forming the capital was fashioned into a lotus or papyrine form, and afterwards the various lines of incised ornament were added to complete it, suggesting the petals of a flower or separate flower forms, and occasional leaves and stems, as of the fern and palm, o lotus and papyrus over again.

You see how these grand and accepted features of Egyptian granitic art were founded on floral treatment, the types being chiefly the papyrus and lotus of the Nile. Those were beautiful suggestions to the Egyptian. But it is not in Egypt alone that such suggestions are made. Nature—inexhaustible Nature—is rich in such everywhere, and nowhere perhaps more so than in our own meads, moors, woods, and waters. To take a kindred example. What can be more beautiful than what may be called our own Lotus, the Nymphæa alba—the Queen of the Thames, the White Water-lily ?—

> " The Water-lily to the light
> Her chalice rears of silver bright,"

and her golden sister is a worthy companion. Nothing can be more graceful than those plants, nor more agreeable, I conceive, as subjects for the incised method of decoration used by the Egyptians, but now, as I propose, to be applied and modified to suit our own purposes.

As this incised method of sculpture, however, was peculiar to that people, and they carried it to great perfection, it is natural to refer to them in treating it.

Most of my hearers are probably well aware of the usual treatment of relievo, or relief, in sculpture, as in the Greek and Roman relievi, in the British Museum, and as usually practised in the present day. This consists of a flat surface, or background, from which the sculptured figures project, more or less. This has been the practice of this class of art among most nations, but it was not the practice of the Egyptians. Their figures in relievo did not project, but were rather impressed, being tacked in, as it were, round the edges into the surface—the highest part of the figures being only level with the surrounding plain face into which they were cut, and this is called incised relievo, in contradistinction to projecting relievo.

This, for instance, is a cast of a small piece of Egyptian relievo. You see how it is cut into the surface, the centre portions alone between the lines being left equal with the surface, instead of the figures projecting as they would in the usual relievo.

Now, doubtless this mode was recommended in a degree to the Egyptians by its convenience as well as by the simplicity of its workmanship. For instance, the faces of an obelisk, or tomb, or temple, might be hewn down quite plain without any previous arrangement of projections left for the sculpture, the very subject of which might be left for after consideration, as was evidently occasionally the case in Egyptian works.

The ease and convenience that thus, in this respect attached to the method then, would, of course, equally attach to it now. Take, for instance, the large granite forms of a bridge. These might be hewn with the greatest breadth and simplicity, and yet, afterwards, either before or after erection, the blocks which compose it might receive the decorative enhancement of incised relievos.

One remarkable art quality also must not be overlooked in this encised method of relievo, viz., that while it finely decorates a surface it does not disturb its breadth, enough of the true original surface always remaining to assert that. Nor does it take away from the impression of solidity, but rather the contrary. Also, it does not injure the profile. You may recognise at once how the effect of an obelisk, for instance, would be destroyed by any projecting relievo on its faces; how, in that case its grace and character would be lost at once, while, on the other, hand, any degree of incised enrichment is applicable to its faces, without any disturbance of the original contour. This would suggest that this mode is applicable also to columns of elegant proportions.

Another advantage of this style of work is its enduring character, especially when worked in granite. There is nothing to knock off. In fact, it excels in endurance the other styles of relievo as much as the material excels other stone, as is illustrated by the endurance of various Egyptian works of ancient time, in which some of this incised relievo has stood exposed to the atmosphere for more that 3,000 years, without being materially injured.

I am, however, only, of course, suggesting the use of this kind of relievo occasionally, in addition to that which is the general practice, and this only in reference to certain features of architecture wherein an unbroken general line of contour is desirable. Also, as regards material, in reference to granite, metal, and such hard stones as would retain the sharp lines of the bounding incision. I conceive, however, that on a large scale it is suitable to granite surface specially, and this probably also more for the introduction of emblems and floral decoration than for any elaborate treatment of the human figure. For instance, I conceive it might occasionably be well introduced on the granite pedestals of our public statues, as calculated to give them interest, and as relieving the surface without disturbing their simplicity. In consequence I am myself using it cautiously, and in small degree, on the sides of the granite pedestal of the Guards' memorial, in Waterloo-place. On each of the two sides of this, in incised ornament, are being worked, besides the names Alma, Inkermann, Sebastopol, a pair of bayonets crossed, a wreath, and three stars, according to the outline you see on the walls, which is a working drawing, full size. Of course this is but a small instalment of this method, but I hope it will meet with favour.

The whole gist of what I would suggest amounts to this, that whereas we have now for the last 100 years begun to use our native granite largely in public structures, yet we have not (except in some isolated instances, in which the Egyptian architectural style and details have been followed in the decorations themselves, which is not what I suggest, as well as the method of encising,) applied this facile method nationally; that is, using the method, but applying it to forms and decorations of our own time and country. I conceive that it might be well if we did, and that in that case it would open up a fine fresh field for design. Not satisfied with thinking of this and talking about it, you see I have begun putting it in practice to a small extent, and some few and inadequate examples of my attempts are before you.

Before we go into this subject, perhaps it would be interesting to you just to glance over our own chief localities of native granite,—where it is quarried; and also to say a few words as to the mode of obtaining it from its native bed. All the British isles yield granite. The Scotch granite of Aberdeen and its neighbourhood is much and justly celebrated; that from the quarries of Darncing-Cairn-Rubislaw and Tyrebagger is grey; around Peterhead the red granite chiefly prevails, of a fine deep colour; and in the neighbourhood is some of a tint between the two, of a fine appearance.

The West of Scotland also yields fine granite. This is a specimen from the Isle of Mull. Ireland also yields granite of various qualities, from Wicklow, Down, Newry, &c.

Various parts of England also yield granite. Leicestershire yields, among others, this brownish red kind, the Mount Sorel, which is very hard, and has come into use much of late for paving. The Channel Islands, as Guernsey and Jersey, also yield granite of good quality. These are specimens.

Of the southern part of our Isles, however, no portions are in this respect more celebrated than Devon and Cornwall. On the extended plains of Dartmoor, in the former county, lie, on the surface, or only partially embedded, boulders of granite, sufficiently large, apparently, to furnish blocks as large as those used in Egypt. There is a specimen of Heytor granite from the same county. Also a specimen of nearly white granite from the same county, near Okehampton.

Cornwall however is, on the whole, a most prolific county for granite. These are specimens of various of the granites of this county used in the new Westminster-bridge and elsewhere, from the quarries of Lamorna, Penryn, &c. The quarries of Cheesewring, also in the same county, so called

on account of its near neighbourhood to a crude and early example of gothic architecture, have furnished granite largely for the new bridge, and it gives much satisfaction. This granite is of a fine even texture, of which the crystals, while sufficiently large to show well as granite, are yet not so large as to interfere with the appearance of work put on it, and it is therefore well suited for the incised decoration of which I have been speaking. From its delicate grey tint also, when polished especially, it forms a most pleasant combination with gold, as in letters and devices cut into the surface and gilt.

The modes of working the granite in all the British quarries are, I believe, much alike. Holes are drilled, or jumped, as it it called, into the rock; these are supplied with gunpowder and fired, and thus the great masses are blasted out, which are afterwards split into blocks with gear consisting of steel wedges and "feathers," as they are called. This block, in which you see these inserted, is partially split, the crack being started. They are afterwards fashioned with a large hammer, called a muckle, and pitching tool, and various picks, points, and chisels, such as you see on the table. If a fine surface is required, it is axed.

This is a surface rough axed. This is one fine axed. This the common axe thus used. An improvement of this implement has lately come into use, and is called the patent axe. It consists, as you see, of several axes placed side by side, with small intervals between their edges, and not only works plain surfaces, but is easily adjusted so as to work mouldings of any profile.

When holes are to be made, they are frequently, as I have said, jumped. This is the tool with which this is done, which consists of a long bar, thick in the centre to hold by, with a chisel edge at either end. It is used thus, by being raised and let fall with a jumping motion, whence its name, and, being turned partially after each blow, thus wins its way through the hardest block. Polishing, when required, is now done greatly by steam. This process much enhances the appearance of most granite, but is, from the hardness of the material, necessarily costly. In a general way the cost of polishing may be set down as an addition of one-half the previous price. Thus, if a column costs £20 fine axed, it will cost £30, or something more, polished.

Perhaps, before I leave this subject, it will be interesting to you to hear of three different ways in which long blocks of granite, adapted to columns and obelisks, have, in different countries, been safely detached from their native bed.

In Egypt the blocks are said to have been greatly wrought on three sides in their native bed; the stone in front, above, below, and at each end, having been worked away, so as to leave them projecting, and attached only by one side to the rock. Then the process was also to cut, between it and the rock, holes at intervals. Into these holes were driven, quite tight, very dry small billets of wood, exactly fitting them, which, afterwards, being amply and continuously supplied with water, swelled by absorption, and burst off the block. This mode was formerly used in some of our own quarries.

In India, a long block was in a similar way fashioned horizontally on its native bed, at last, in like manner, hanging to the side of it. But this was detached by a different process, the aid of fire being called in as well as water; as thus:—On the top surface, between the obelisk and the rock, a long deep groove was chiselled extending the whole length. This was kept full of fire—of live embers—at a great heat for some days, when all at once were these swept out and cold water poured in the whole length of the groove, when the sudden contraction split off the mass neatly from end to end.

In Russia, a still different method was applied—that of frost, which was so ready at hand. When the huge columns for Saint Isaac's Church had been similarly wrought in their native bed, holes were made all along their attachments, and filled with water, which, expanding in freezing, burst off the block. So you see that there are several ways in which this apparently difficult process may be simply effected. Practically, however, in the British quarries, when a large block is pretty near separation, and is left for a night, it frequently detaches itself, owing, also, as is supposed, to some effect of change of temperature.

I would now come to the art treatment in our own days, now—of incised decoration on this most enduring of nature's materials, one also that is so widely spread in this country, and which is justly coming every day more into use. In saying this, however, I must premise that I have but the result of a very short and limited experience to put before you, and therefore no doubt many shortcomings may be perceived, and I hope excused. In truth the chief objects in connection with which I have considered the subject have been mostly confined to tombs, pedestals, obelisks, and drinking fountains.

Last year I read to you in this room a paper, which, among other matters treated rather largely of the obelisk, as a monumental feature of art suited to the present time, especially with the addition of some delicate scientific modifications of its lines and surfaces, in some respects analogous to the entases of Greek architecture. The Society thought so well of this, that they, quite unexpectedly to me, honoured me with a medal for it. In studying thus the obelisk I naturally thought of the incised decoration of its surfaces analogous to the hieroglyphics which were wrought on these features of art by the Egyptians. Inscriptions in our own character of letters, carefully adjusted and arranged, would effect this. Also a treatment by means of emblems, especially floral and foliage ones, as the rose, shamrock, and thistle, for the British Isles, the lilies for France, &c., supposing a symbolizing of different nations was desired. Also for a public drinking fountain the obelisk might have appropriately incised on it the flowers and ferns of our island that delight in pure water. Thus, by this means, the surface of the obelisk would tell an appropriate tale, and the decorations have their symbolic and apposite meaning, as the hieroglyphics had on the obelisks of Egypt, which caused Strabo to call them "open books," only in a fresh manner. The two little sketch models which are on the table are a partial illustration of this scheme of floral decoration applied to this feature of art, one as the surmounting form of a drinking fountain; the other as a memorial of the Treaty of Commerce, the rose, shamrock, and thistle, and the French lilies being incised on its surface.

At the time of the temporary success of the Trans-Atlantic Telegraph I conceived the idea of two colossal winged Androsphinxes, "the emblems"—as the old author, Clement of Alexandria, calls them, "of intellect with force." One of these I conceived at Valencia Bay, the other on the opposite side of the Atlantic, in America, and that they should respectively hold each end of that magic chain which connected for a time the two lands—the body of the lion for Britain, the wings of the eagle for America, and intellect in the human head for both, were as emblems of the character and energies of the two great sections of the Anglo-saxon race. However I only introduce this incidentally for the sake of the base, on which I had imagined, incised on its granite surface, as marked on the little sketch model in red, beside other emblems, two hands stretching across the waters, and grasping each other in amity over the waves—symbol of that thorough cordiality which should exist between Britons and Americans, and of which the Transatlantic Telegraph would be so strong a bond—a bond indeed which all lovers of what is good and great, Christian and progressive, must earnestly hope to see again ratified and restored, and permanently established across the deep blue waves of the Atlantic.

Again, being interested in the subject of public drinking fountains in London, another good thought, but in a different way, I conceived that no material would be more agreeable for them than hard marble and granite, and that

it might be desirable not only to decorate these, but to do so simply, and in a method that would not be liable readily to injury. Of course we may see many ways in which the establishment of public drinking fountains in this motropolis is calculated to bear good fruits socially. However, I will not enter on this now. There is one thing, however, I may naturally allude to, viz., to the real value of suitable simple art-treatment in these objects. It is a fact, which affords a pleasant proof of the influence of the agreeable in art over the mind, that people will stop and drink at an agreeable-looking drinking fountain, who would not think of refreshing themselves at a pump with an iron ladle. Observation has fully tested this. Especially, therefore, does the making these features of public utility pleasing as well as enduring, appear an appropriate subject of art. If they are to be made enduring, we may allow that no materials are better than granite and hard marble. Also, as they are, especially during the summer months, in much use, that kind of decoration which is least likely to be injured by the touch is that which may be thought frequently appropriate. And the incised decoration which we have been considering has this advantage, that there is nothing to knock off, it being protected by being sunk. It also leaves the outer surface so as to be easily polished.

I am not saying, by any means, that these are the sole materials suitable for drinking fountains. On the contrary, there are cases and situations where metal or other materials are preferable, and perhaps essential. Nor am I saying that incised ornament is the only kind of decoration suitable for such purposes. Quite the contrary—I only suggest it as one of the suitable methods. In whatever way, however, these objects of utility and social benefit are designed, it is important that they be designed suitably in each case in reference to their site, and so as to enhance and never to detract from the surrounding features already existing, especially as, for public utility, they naturally occupy prominent situations.

In accordance also with the impression that in all cases, when possible, decoration should tell some true tale, and be in accordance with the object with which it is associated, I conceived naturally that among others, nothing would be more readily pleasing for these objects than a floral treatment, namely of water plants, of which we have been considering such fine results in the art of the Egyptians. And in this respect, in the way of art suggestion, it is pleasant to know that our Flora is quite as graceful as that of any other country; old England being quite as fruitful in such suitable natural types as old Egypt. There are our beautiful ferns, with their feather-like fronds, easily traced on the granite or marble, so many of which delight in the margins of pure water. There is the Phyllitis, or hart's tongue fern, either the plain or the fingered, which loves to hang from rocks which distil fair water, "Les rochers qui pleurent," as the French have it—the rocks which weep.

Then there is our well-loved forget-me-not, the *Myosotis palustris*, which delights in the sides of brooks. This, however, cannot be said of the iris, *fleur de luce*, or wild flag, which loves the shade of willows.

Of all the British plants, however, of which the names even as casually repeated, transport us, in imagination, to charming country haunts, none are so inviting, perhaps, for the present purpose as the beautiful white and yellow water-lilies of our waters—the *Nymphœa Alba*, or white nymph, and the *Nymphœa Lutea*, the yellow or golden lily.

> Oh, Thames of many waters!
> See on thy placid breast reclines
> The fairest of thy petalled daughters,
> That pure white nymph that buds and binds,
> In raft-like forms, her flowers and leaves,
> In flakes upon her glassy bed;
> And with her gold-haired sister weaves
> A chaplet for thy head.

Nowhere, indeed, shall we find these two sisters of the floral kingdom in more beauty and perfection than in many of the windings of the upper part of the Thames, as near Maidenhead, Cookham, Great Marlow, Henley, or Pangbourn, where, in the months of June, July, and August, they may be seen flourishing side by side in great perfection. Every point about these two plants is beautiful; the long graceful steams, the cool green leaves, either aspiring up from the clear blue depths, pointed like a spiral shell, or spread out broadly over the surface of the water. It is needless to speak of their buds and blossoms, they are so known and admired; beautiful as each plant is, they afford, at the same time, so charming a contrast as to be especially fitted for combination in ornament. Even the seed vessels and fruit are of beautiful ornamental forms. Altogether, Old Gerard, who lived in Holborn, in his Herbal, or Great Old Book on Flowers and Plants, published more than 250 years ago, calls them, *par excellence*, "the roses of the waters." Moreover, he adds, "if taken with meat they do invite purity and temperance," so that in this respect, as a moral and æsthetic symbol also, they are *d'accord* with the objects of public drinking fountains.

But not to hold you longer, out of the element of these beautiful flowers, treated, however, of course, somewhat conventionally, I have woven two or three designs of this nature. And as a little practice is occasionally worth many words, I have ventured to place them before you as examples of floral treatment, as applied to designs of granitic character. As granite and marble, however, are rather heavy materials to transport to this room, I have been obliged chiefly to content myself with these models.

Did we, in the kingdom of the lilies, wish to go further a-field, among the beautiful varities of their class which Nature affords us, we shall find, perhaps none more beautiful, nor certainly any one so magnificent as Euryale Amazonica, or *Victoria Regia*, of the river Amazon, which in that river flourishes to that degree that its leaves are 5 feet across, and a child can stand firmly and safely on one of them while floating on the water. In one stage of its perfection the noble flower of this plant, more than a foot across, assumes a most exquisite and almost unprecedented floral form of the highest ornamental character. This takes place in its transition from bud to blossom, as indicated here; and when only half the leaves are open and retroverted, the inner ones retaining the form of a bud. It is then bud and blossom all in one. As this plant has now become comparatively familiar in the gardens at Chatsworth, Kew, and the Crystal Palace at Sydenham, many of those present may probably have seen the flower in this stage.

I have, as you see, in the models and marbles before you, availed myself to some degree, inadequately as yet, of some of the elements of form suggested by these lilies. The standard drinking-fountain, of which there is a model in the centre of the room, takes its type of decoration from our own white and yellow waterlilies, as also the vase by my side. In the marble mural one on the table, the Victoria Regia lends the art-suggestion in the bud, blossom, and leaf—in this case however, smaller than Nature—for its decoration, jets, and basin. This is not specially a granitic design, yet it is of a character easily effected in that material,—indeed, I have no idea of confining my suggestions of such treatment solely to incised decoration, although that mode now naturally presents many advantages in its application to large masses of hard stone. Also, when flowers are used as the types of decoration, I have no idea of suggesting only water plants. Egypt was simply the great valley of a mighty river, and many circumstances which I have alluded to made the Egyptians look to that river for almost everything. But in the British Isles we are in quite a different position. With our extensive seaboard and variety of scenery and climate, greater, I believe, than any that occurs in any other portion of the world's surface and of consequent variety of flowers and plants, among these are types appropriate to very many subjects. For drinking fountains, water-lilies may be appropriate, but these and other features

of art may well also, I conceive, receive the enhancement of various other floral suggestions which nature offers for our acceptance, as the roses, the gladioli, the flowering rushes, the white lilies of the garden, the primrose, the cowslip, the passion flowers, the lily of the valley, the orchids, the heath, the harebell, the hyacinth, the honeysuckle, and wood anemone, and many others of the beautiful and cherished denizens of our gardens, woods, valleys, lakes, rivers, and hills.

As regards, however, the whole question of floral decoration, I trust I shall not be misunderstood. No one would take exception more than myself to direct "natural ornament," as it is called, forming the staple of art decoration at all times. On the contrary, I only conceive it may occasionally be used with effect, and that the incised method we have been considering to-night affords one agreeable opportunity for the introduction of it in certain cases, on the surface of granite and other hard stones.

As for my own attempts at practical illustration before you, they, I hope, will be excused as being those which I had readiest at hand and most easily removed, and this will plead probably as some excuse for their shortcomings as well as for their introduction.

You will recognise, also, that in the above remarks I have avoided somewhat the consideration of architectural structure, confining myself more within my own specialty to such examples of smaller features of art as I had in some degree considered. I did this intentionally, leaving the larger field to others.

In conclusion I would beg to add that no one will be so much gratified as myself if some of those present, who are better able to treat these subjects, will kindly supply my shortcomings, and so favour the present assembly with some further remarks on the subject which I have only attempted to open up to night.

DISCUSSION.

The following communications have been received by the Secretary:—

Sir Gardner Wilkinson says:—The admirable remarks of Mr. John Bell have presented many convincing arguments in favour of the employment of granite; and a judicious treatment of the material itself, with a proper introduction of ornament, adapted to that massive stone, and in accordance with our wants, our tastes, and our climate, is capable of introducing a new era into the use of granite for monumental and ornamental purposes. This, in the hands of Mr. Bell, promises to be carried out with success. But in the treatment of it we ought to be satisfied with no mere copy. We require it to be original and English; and no imitation of Egyptian work will satisfy or accord with English requirements or taste. We may derive hints from those who, like the Egyptians, have had great experience in its use, but we should hesitate to adopt Egyptian ideas, either in the form of granitic monuments or in our mode of ornamenting them. I can fully appreciate the merits of Egyptian architecture, but I can see its faults; and though I admire the vastness of conception, the knowledge of constructiveness, the skill they showed in sculpturing as well as in transporting granite, I must allow that the Egyptians were deficient in real taste; and while it is the exception to find any object of Greek workmanship deficient in grace and beauty, it is the exception in Egypt to find it possess those high recommendations. There is little that we can adopt from the Egyptians, either as tasteful in itself, or adapted to the style of our monuments. The curve of the cornice, which is broad in its character, the simple shaft of one of the old Egyptian columns, with its graceful shallow grooves (the prototype of the Greek Doric), and a few devices—as the papyrus, the lotus, and some others,—are of a pure and elegant form, but the general character of Egyptian architecture is remarkable rather for solidity than beauty; and though the Egyptians deserve credit for being the first to lay down the principle of variety in the juxtaposition of columns with different capitals, and in avoiding the monotony of repetition of form and ornament throughout a building, we can neither imitate their columns, the style of their buildings, nor the character of their sculpture. Mr. Bell recommends the adoption of flowers as ornaments, to be sculptured in "incised relief" (or, as I have termed it, "relieved intaglio") in granite; but it is a question how far floral ornaments, such as ferns and similar delicate plants, are suited to a material which requires the ornamentation to have the broadest kind of treatment; and I agree with him when he says that the flowers should be treated conventionally, and not present an appearance at variance with that character of ornamentation required by the nature of the material. The Egyptians did not fail to perceive this; and the granite pillars of Karnac are ornamented by water plants in high relief, of the boldest and broadest character. For though the Egyptians sculptured granite in intaglio, and in relieved intaglio, they sometimes cut figures of men, and plants, and even hieroglyphics, in relief on the same kind of stone; and one temple, at Bebayt, in the Delta, presents hieroglyphics in high relief upon all its granite walls, as well as on the columns, architraves, and other parts of the building. I have also seen the human figure sculptured in relief on granite to the height of nine inches above the surface; and Egyptian figures in relief may be seen in some museums of Europe.

Remarkable instances of floral, heraldic, and various fancy devices, as well as human figures, cut in relief upon granite, are met with in various parts of Cornwall; and the church of Launceston, built in 1524, is covered with them, transferred from an unfinished house in the neighbourhood, which was to have been decorated with these sculptures, which, however, I must confess, are heavy and graceless, and little worthy of imitation.

Mr. Bell mentions the extent of the quarries in Egypt, and very justly calls attention to the quantity of granite, suited for monumental and ornamental purposes, which we possess in the British Isles; and such is the extent of the quarries in Dartmoor and in other places, both in England, Scotland, and Ireland, that the remark made by Pliny respecting the porphyry quarries of Egypt might well be applied to them—"quantislibet molibus cœdendis sufficiunt lapidicinæ."

With regard to the erection of obelisks in England, I confess I am altogether opposed to their adoption for monumental purposes, as I have elsewhere had occasion to state. We attach no meaning to them; we have no association connected with them; we do not even appear to understand the use for which they were invented; and we employ them in places and positions diametrically opposed to their character and to the principle which led to their adoption by the Egyptians. They served as a vertical line to contrast with the long horizontal character of the Egyptian temple, where their effect and position were admirable. We place one by itself in some open space like a monster gnomon; and, what is worse, we even design a chimney in imitation of an obelisk. We also spoil the character of the obelisk by mounting it on a Roman pedestal, which entirely interferes with its general form and character, and we depress its apex as if we wished to deprive it of an important feature which constitutes one of its peculiar beauties.

The mere imitation of an ancient monument, in no way suited to our wants, tastes, or predilections, is a sad sign of deficiency of inventive talent; and unless an obelisk is so placed as to accord with the purpose for which it was originally devised, it is a false application of an ill-understood principle. The right application of it will, I have no doubt, be duly considered and determined by a sculptor of Mr. Bell's great proficiency and taste, and we shall then no longer have to condemn obelisks as unmeaning

objects, and as the refuge of those who are destitute of invention and the ability to design an original monument.

It is by the adaptation of an older or a foreign principle that many of the fine monuments of Greece and other countries have been devised. It is no disgrace to borrow an idea from another style. It is only the mere slavish copy which is a proof of want of genius; and the whole history of architecture proves how one style has grown out of another, by adoption and adaptation, according to the wants and requirements of each people. This adaptation seems to be one of the great principles which Mr. Bell takes as his guide; and his intention of introducing a suitable art treatment into our modern monuments—as public fountains and other structures—will confer a benefit on public taste.

33, York-street, Portman-square, March 13th, 1860.

Mr. Joseph Bonomi writes:—I am sorry I shall not be able to be present at the paper on "The Art Treatment of Granitic Surfaces," to see the new applications, appropriate to our new wants, and appropriate to us as Englishmen.

I have read Mr. Bell's admirable paper on the subject, and I quite agree with him that the Egyptian style of basso-relievos he has so well described, is particularly suited to granitic monumental designs, because of its enduring nature, and because of its not disturbing the outline. The whole surface must be first destroyed before you can entirely obliterate the figure or emblem in that style, and I have no doubt the cunning workmen of Egypt adopted it, knowing that it was the most likely way to hand down to posterity the record of their greatness. We know they were of the same family who said, "Let us make us a name."

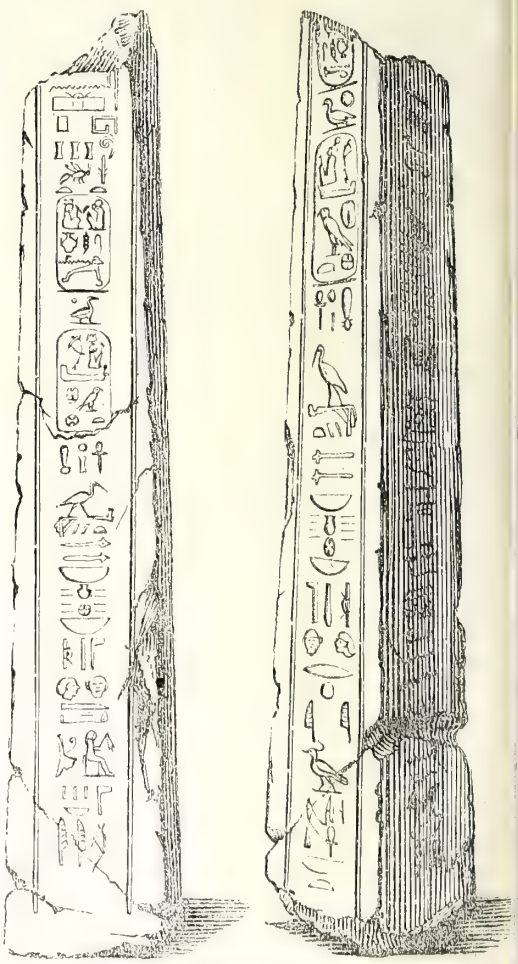
Mr. Robert Hunt, F.R.S., said the very able and comprehensive manner in which Mr. Bell had dealt with the subject of the art-treatment of granite surfaces, left but very little for him to say upon it, and he did not know that he should have been disposed to say a word upon it, had it not been for something which had fallen from him (Mr. Hunt) on the occasion of the discussion of a recent paper, read before the Society, upon building stones. The question arose as to the permanence of granite, and reference was made in the paper to London bridge and Waterloo bridge as affording specimens of granite decay. He was quite willing to accept the reference to those structures as specimens of granitic durability during the time—although it was comparatively a short one—that they had stood. A question arose as to the causes which led to the disintegration of granite, and they were told that, in the case of Waterloo-bridge, they would see the felspar crystals decomposing, and leaving holes in the stone. Now, this was not the fact, and any one walking over old Westminster-bridge would find projections known as horse-teeth, consisting of felspar crystals, standing high up. The other constituents of granite had decayed, and the felspar remained intact. He stated on that occasion that he did not believe in the decomposition of felspar having produced, for example, the China clay, which was referred to as an instance of the results of the decomposition of granite. Time would not allow him to go into this question, but he might state generally his views upon it,—views not hastily arrived at, but after many years examination of all the granite masses of England. He found that there were granites, as he belived, of very different ages, certainly of very different characters. On Dartmoor, and at many other places where they were working granite for building purposes, they found a very hard and durable material, containing little or no evidences of being metalliferous; but if they took a band of three miles in width, extending from Okehampton in the north to Plympton in the south, they could find a granite which was richly stanniferous; and the whole of that granite they would find in a friable state, and unfit for building purposes. Another formation resting on this appeared to be the China stone or China clay, and similar formations were to be found in Cornwall, especially at Penryn and St. Austell. Mr. Bell had stated his opinion that granite was an igneous rock. He (Mr. Hunt) did not think it was so in a strict sense. It was not like the greenstone or basalt. It was not a mass poured out in a molten state from below; but seeing that the granitic masses contained particles of water, his impression was that the granite was formed from the solution of its constituents in water at a high temperature; and these softer granites and decomposed portions were not really granites which had been decomposed, but granites which, so to speak, had never been properly formed by nature; and he believed if they took the granite which nature had finished making, they had one of the most durable stones that could possibly be obtained. Mr. Bell had referred to the incised ornamentation of granite. Any one who was familiar with Cornwall was aware of the large number of ancient crosses existing there. They were of three distinct periods. Some of them he believed to be as old as the introduction of Christianity into Britain: others he imagined to be about the time of King John; but taking the most ancient of them, they found a considerable amount of incised ornamentation, similar to that which was presented by the Egyptian works, which was as perfect at the present time as the day after it was chiselled. The beating of Atlantic storms upon these crosses had produced little or no impression. He found two or three cases in which the driving of the sand had had an effect upon them, although the weather appeared to have exercised no influence whatever. There was one point on which he would venture to suggest that Mr. Bell was somewhat in error. Referring to the quarries from which the beautiful Cheesewring granite was obtained, Mr. Bell had told them that there was a work of art in the neighbourhood from which the stone derived its name. He (Mr. Hunt) believed that was an error. The Cheesewring was unquestionably the work of nature. There had been enormous masses of softer granite disintegrated from the harder portions during the lapse of time, and the masses which remained in a solid form constituted the Cheesewring. With regard to the duration of granite and the ornamental work upon it, he might refer to the remains of the churches which still existed upon Dartmoor. Those churches were built during the reign of King John, when that monarch granted peculiar privileges to the "tinners" as they were called. At that period, there was evidently a large population upon Dartmoor, and many churches stood where houses were now scarcely to be found. Those churches were ornamented in a very elaborate manner, and though now covered with moss, the work was quite perfect at the present time. It appeared, therefore, as regarded the duration of granite, that it was a material particularly suitable for the recording of noble deeds which were worthy of being immortalised. Mr. Bell had dwelt at some length upon the numerous varieties of granite. It should be remarked that singularly white and beautiful variety alluded to existed, not in the ordinary form, but as a huge granite vein running into the other mass of granite, and thousands of tons of it might be readily obtained. They had upon Dartmoor many varieties of grey granite, and, in small portions, some beautiful specimens of red granite. If they went to Cornwall they found the bright granite of the Cheesewring, which ranked amongst the most durable of all; and from its peculiar structure, and from there being no very great difference between the sizes of the respective crystals of felspar, quartz, and mica, it appeared to be a quality of stone well suited to the purposes of the artist. In Leicestershire they found some varieties of granite, and a great deal of stone was brought from that county into London, which was called granite, but which he thought would be more correctly termed syenite and green stone. Another very beautiful granite was the Shapfell, a specimen of which was to be seen in the hall of the Museum of Practical Geology. The

durability of that stone had been shown, up to the present time, not so much by works of art, but at Redcar, on the eastern shore of Yorkshire, they would find boulders of this granite which had been brought there by icebergs in ancient geological times, and lodged upon that shore where they had remained till the present day. And here was shown the disintegration—not of the felspar—but of the other constituents of granite, in the same way as in the case of Old Westminster-bridge. He begged to express his acknowledgment of the great service which Mr. Bell had rendered in calling the attention of the meeting to the most durable of British stones, which was shown to be valuable not only for building, but also for ornamental and decorative purposes.

Sir John Rennie, F.R.S., had listened with attention and interest to Mr. Bell's paper, and he wished to bear his testimony to its merits. There could be no question that, practically speaking, granite was the most durable stone they could employ. He had himself seen in the quarries of Egypt, to which reference had been made by Mr. Bell, specimens of the granite which had been used for the obelisks of the Egyptians, and on which the ornamentation was such as Mr. Bell had described. They would observe at Alexandria, in the case of Cleopatra's Needle, that the only means by which the granite had been disintegrated was from the action of the sand driven by the Simoom winds, the attrition of which had worn away the edges. He was struck with the power of the wind to carry the sand when, in coming from Egypt, some 40 years ago, he was surprised to find the capstan and the rigging of the vessel in which he was sailing, covered with fine sand. He inquired of the captain of the vessel how far they were from the nearest land, and was informed about 130 miles. To show what might be done with granite, he would mention that it was used by Smeaton for the Eddystone Lighthouse. At that period it was called Moor-stone, and it was so hard that they could not get workmen to look at it. It was got from the moors in large blocks, but the working it was considered an impracticability. It was, however, used for the Eddystone Lighthouse. without any dressing, in combination with mortar. When the construction of Waterloo-bridge was contemplated, in 1809, his late father proposed that it should be of granite; but he had great difficulty in getting masons to work upon it. The consequence was, the granite of that bridge was procured at a cost of 7s. 1d. per cubic foot, which he need not say was an enormous price. The balustrades, which were of Aberdeen granite, cost £3 15s. each. They could hardly realise the idea of such prices in the present day. Shortly after that he was engaged, under his father, in the erection of Southwark-bridge, for the foundations of which it was necessary to get large blocks of granite, weighing from 15 to 18 tons each. That was thought impossible. However, they were obtained, and were brought from Peterhead to London, and were worked at 20 per cent. less cost than had been the case with Waterloo-bridge. Then followed the present London-bridge, the upper portions of which were decided to be of Aberdeen granite. Owing to the experience that had been gained in the other instances he had alluded to, the stone for that bridge cost only about 5s. 3d. per cubic foot, being a reduction of 30 per cent. upon the former cost of the material, merely as the result of experience. When they came to polishing red granite the cost was enormous. He had paid £25 for a small slab forming a sideboard, which at the present time could be had for £10. In Portugal the whole of the northern district of the country was a mass of granite. The Portuguese were a very industrious people, and the churches of Oporto, formed of granite, were very elaborately ornamented, and in them he had not been able to detect the smallest disintegration of the material. From his own observation and experience, he was satisfied that the more granite was introduced into this country for building purposes, the more economical the buildings would ultimately be, inasmuch as it was impossible to calculate the duration of that material. He might particularly instance the granite column at Ramsgate, which had been exposed to the influence of the south-west winds and storms for about 30 years, and they could not see the least effect upon it.

Professor Tennant would follow the example of Mr. Hunt in referring to the paper read in that room a fortnight since. On that occasion, in the course of some hasty observations which he made, he stated that the cost of transporting materials from Windsor to London was, in former times, before the introduction of railways, about £3 10s. per ton. Since then he had referred to the authority whence he had obtained his information, and he wished to correct that statement. He ought to have said 30s. per ton, and, by water, 9s. per ton. The present charge by railway was 2s. 8d. per ton. With regard to granite there was much misconception. If they referred to any good geological work, they found that granite was composed of three simple materials, quartz, mica, and felspar, and it was to the preponderance of one or other of these substances that the characteristics of the different varieties were due. There were also several kinds of felspar. Sometimes the colouring of the granite could be traced to the felspar, and the white granites were partially composed of albite,

Fig. 1.*

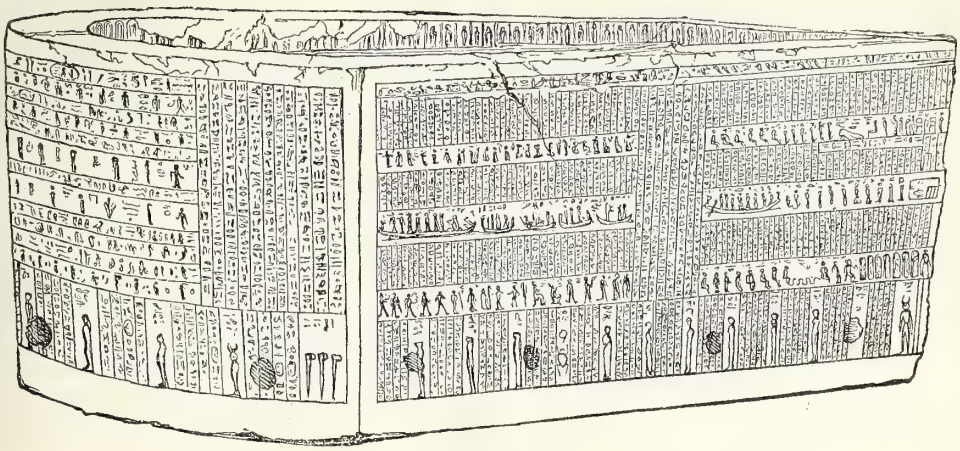


Egyptian Obelisks.

* The Blocks have been kindly lent by Messrs. Clowes.

and the syenite consisted of quartz, felspar, and hornblende—the latter taking the place of the mica of the true granite. The Mount Sorel stone, near Liverpool, was of this character, and was extensively worked for road material; and another beautiful example of the same kind was afforded in the Malvern granite. Then they had basalt, which was used by the Egyptians to a great extent, fine examples of which were to be seen in the British Museum. The Rosetta stone was an example of this. There were also two obelisks (Fig. 1) of that material there, upon which there were several thousand characters engraved, and these were amongst the finest monuments of antiquity in that magnificent collection. There was one beautiful illustration of the syenite in this country which was very little known. That was an obelisk at Kingstone Hall, near Wimborne, in Dorsetshire, brought over by the late Mr. W. J. Bankes, in 1819. He had seen a description of it. There were three Greek inscriptions on the pedestal. Syenite was composed of felspar, quartz, and hornblend, with occasionally very minute scales of mica. The decomposition of that material was, in his opinion, greatly due to the mica. The water could get in between the plates and disintegrate the mass: the quartz itself would last for ever. If they wanted a thoroughly compact material, not capable of being acted upon by any of those influences, they must take porphyry, which was of uniform texture. The porphyry of Scotland, he considered, was equal to that of Egypt—equal also to the celebrated Swedish porphyry—and to some which was found in Bohemia. Then there were the conglomerates, a sarcophagus of which material was exhibited in the British Museum. In a work published by Charles Knight, there was a drawing and description of that sarcophagus (see Fig. 2), in which it was stated that the

Fig 2.



Egyptian Sarcophagus.

characters engraved upon it amounted to no less than 21,700. This conglomerate was composed of brecciated jasper, which would last for ages, exceeding the durability even of granite.

Sir John Rennie remarked, that in the paper of Mr. Burnell upon building stones, it was stated that decomposition of granite might be observed in London-bridge and Waterloo-bridge. He certainly was not aware of anything of the kind. There might be some discolouration from the oxide of iron, but as to disintegration or decomposition of the granite in those structures, he had never seen it.

Mr. Robert Rawlinson, as an old mason, could say something practical upon this subject. In the early part of his life he was engaged in some works where more granite was used, perhaps, than in any other place,—viz., the Liverpool Docks. He thought granite had not been used in this country to the extent it ought to be, and might be, used. One inseparable barrier to that was the cost. They were living in an age in which cheapness and free-trade ruled everything. They had great difficulty in inducing individuals or a free government to adopt anything more expensive than the cheapest material. The cost of granite at the quarry, as compared with freestone, was as 3 to 1; in some cases it was as 5 to 1; and the cost of working those granites in the plainest manner would be in about the same proportion. It was well known that freestones and limestones disintegrated very rapidly in this country. This deterioration took place generally in the drip stones, which were most exposed to the action of the water. It appeared to him that if a material upon which water had no action, such as granite, were introduced at these points, it would preserve the other material of the building intact, and would also give a beautiful variety and relief, by introducing a little of the Byzantine character. It had been correctly stated, that to work granite in any, even the plainest manner, was very expensive, and when anything like raised ornament or mouldings was introduced, the cost became enormous. He could mention the instance of the door-case of the Police-station at St. George's dock, at Liverpool, which cost £95. Granites were very largely used in the Liverpool docks—not as ashlar but as rubble. The sea and dock walls were, many of them, built of small stones. They had begun in the first instance by quarrying enormous blocks of from eight to fifteen tons each, until vast quantities of *débris* were accumulated in the quarry, which induced them to supersede the use of ashlar, and to construct the walls with granite rubble, which he thought would prove as durable as the granite itself.

Sir John Rennie inquired what was the first cost of the granite delivered from Dumfriesshire to Liverpool, because he apprehended there was some mistake upon this subject.

Mr. Rawlinson said the prices varied from 2s. 6d. to 4s. and 5s. per cubic foot for the rough stone delivered at Liverpool. The price depended upon whether the stone had been scabbled or not. It was frequently sent unscabbled, and for scabbling they paid 1s. per superficial foot.

Sir John Rennie was surprised to hear such a price. He had had the finest Penryn granite delivered at Ramsgate at 2s. 3d. per cubic foot.

Mr. C. H. Smith called attention to a large granite tomb which was erected in the burial ground of St. John's,

Westminster, to the memory of the Master Mason of King George 1st. He believed the date of that tomb was about 1722, and he thought it was the oldest specimen of ornamental granite in London. It showed no signs of decay.

Professor Morris remarked that the use of granite by the Egyptians in early ages, as Mr. Bell had pointed out, was clearly indicated by the numerous objects of Egyptian antiquity which had been handed down to them. Those were probably the largest and most enduring monuments that ever existed. The Romans, also, largely used granite. Subsequently, during the period called the dark ages, the material was very little used, until the application of it was restored in Italy, about the year 1379, by an Italian artist of the name of Peruzzi, who established a manufactory for the working of hard stones. A similar manufactory was established, in 1472, by an Italian named Ferucci, who worked largely upon these hard stones. Granite was also much used in Florence, and one hundred and sixteen years after, an establishment was erected by Ferdinand, Grand Duke of Tuscany, which remained up to the present time, and in which the numerous works in granite and pophyry from Florence had been and were still produced. With regard to the general use of granite, he could add his testimony to that of Mr. Bell as to the extreme desirability of extending the employment of that material, more especially when they found that all that had been done of late bore no comparison with the extent to which granite was used in past ages. In a report by the Commissioners of the Paris Exhibition, it was stated that the Louvre contained more monuments of antiquity in granite and porphyry than had been executed in Europe since the period of the *rénaissance*. With regard to what had fallen from Mr, Hunt as to the probable origin of the granite formations, they all knew the fact that granite was not an irruptive rock. Whether molten or not, it had never been poured out upon the surface of the earth; but there was evidence to show that felspar, quartz, and mica belonged to that class of minerals which did not contain water, but were considered to have their origin from the crystallisation of mineral matter in a state of igneous fusion at great depths, assisted, perhaps, by the action of water in a state of steam. These two forces combined, acting for a lengthened period while the mass was gradually cooling, had engendered that peculiar crystalline form which characterised granite. Another point which Mr. Hunt would admit was,—that they found granite in the form of veins, not only the newer granite pervading the older, but frequently intruding into the adjacent strata. There were two kinds of granite in ordinary use; and a more careful study of their composition might enable us more accurately to compare their relative durability. The granites mentioned as having been used by Mr. Macdonald were of two kinds,—the red and the grey; but he believed both consisted not only of felspar, mica, and quartz, but of two kinds of felspar, one of which was the ordinary felspar of granite, the other a felspar containing a certain amount of soda, or a felspar of the sixth system. One other point was as to the working of granite, to which the attention of Mr. Bell had probably been especially directed. He was not aware whether that gentleman had visited the celebrated works of MM. Bigot-Dumaine and Hermann, at Paris, who were probably two of the largest workers of granite in that city. He had been informed that they worked and polished their granite by the use of a species of black diamond obtained from Brazil, fixed in wood or brass. In Sweden, at Akershuus, a prison near Christiania, prisoners were employed in polishing granite, and it was stated that the manner in which the work was done left nothing to be desired. Another point was the peculiar decomposition of the granite itself. Mr. Bell had probably noticed the colossal arm of Thothmes III. in the British Museum, which was called Egyptian syenite. There was a peculiarity which bore upon the working of that granite, as it did upon all other kinds, which was this—that it appeared to decompose or exfoliate in layers, presenting a rough cleavage structure, parallel to the planes of the worked surface, but at right angles to the force employed in working it. In that arm the granite did not break off in the direction of the crystals, but broke off parallel with the circular form of the arm itself, the direction of the exfoliation having no relation to the crystalline structure of the felspar or quartz, but he believed there was a law still to be worked out as to the occurrence of this exfoliation. The columns of Peterborough cathedral, constructed of Barnack rag, were an example of it.

Mr. Rawlinson attributed the exfoliation in the manner described by Prof. Morris, to the jarring effect of the blow upon the stone in working it. This had the effect of disintegrating the stone to a certain depth below the surface.

Sir John Rennie mentioned that granite had been used for the construction of a large dry dock at Sheerness, and the cast iron gates, weighing 59 tons each, were fitted into the granite so closely that the connections were perfectly water tight.

The Chairman said that however interesting the discussion might be—and he ventured to think it was of more than ordinary interest—it was now time to bring it to a close. It was very useful to them to hear men of great practical knowledge of the subject explain the qualities of the important stone which had been the principal object of consideration that evening. But he rather regretted that more attention had not been directed to the special object of Mr. Bell's paper, which was the art treatment of granite, especially with regard to incised decoration. In the consideration of that question their attention was naturally directed to that remarkable people to whom and to whose works Mr. Bell's paper greatly referred—the ancient Egyptians, who had left a more lasting impress upon the face of the globe than any other people. They had produced works whose antiquity it seemed scarcely possible to determine, exhibiting qualities of conception, invention and treatment which he ventured to say would be remarkable in any age, and were eminently remarkable in the age in which they were produced. They had erected structures the vastness of which could only be conceived fitly by those who had seen them. As to their actual beauty, many might differ, but as to the great skill with which they had been executed he thought there could not be much doubt; though such works could hardly be appreciated now, owing to our ignorance in many cases of the circumstances which they were intended to commemorate, or the purpose for which they were designed. It had been his good fortune to look upon some of these works in Egypt itself, and he would especially refer to that gigantic work on the western side of the Nile, in the valley known as the "Gates of the Kings." They there found themselves in the midst of stupendous excavations made 3,000 years ago; and the mode in which that ravine had been excavated and tunnelled into corridors of great length, and chambers of great extent, was such as to astonish every beholder. They found the whole of these surfaces, extensive as they were, covered with the incised decorations to which Mr. Bell had called their attention. Standing in one of those chambers, they saw the first step was to produce a polished surface equal to marble; then that surface was covered with the drawings intended to be represented; after the drawings had been made the incised surface was produced, and the objects were presented with a truth, precision, and peculiar grace (although the latter was not generally regarded as a characteristic of Egyptian decoration), which could hardly be excelled at the present day. He had stood in one of the chambers which was left incomplete in its decorations, part of the walls being covered with drawings of remarkable beauty. All this went to indicate the extraordinary care, and wondrous labour, and great expenditure of time, which characterised the works of this ancient people. With regard to the incised sculpture, he thought it must be admitted that it contributed largely to architectural effect. He had

brought with him some notes of observations taken when he visited that country, but at that late hour he would not detain the meeting by reading them. He should therefore conclude his duty by doing that which he was sure would be gratifying to them—proposing a cordial vote of thanks to Mr. Bell for having brought this highly interesting and important subject before their notice.

The vote of thanks was then passed.

The Paper was illustrated by various specimens of British granite, as well as by tools for working it from the quarries, and by drawings of Egyptian capitals, and of the floral types from which they were taken, as the lotus and papyrus. Also by drawings of the English water lilies and of the *Victoria Regia*, and by illustrations of their application as floral decorations to obelisks, drinking fountains, and other features of art in granite and marble.

The Secretary announced that on Wednesday evening next, the 21st inst., a Paper by Dr. Guy, of King's College, "On a New Method of obtaining Crusts of Arsenious Acid, with other Sublimates, and, incidentally, on a new Class Lens and Microscope," would be read. The chair will be taken at 8 o'clock.

The following communication has been received from the Chairman since the meeting:—

My Dear Sir,—The following notes, made during a visit to Egypt in 1842-3, may not be an inappropriate supplement to Mr. Bell's paper, inasmuch as the Egyptians have, in a far greater degree than any other people, employed what Mr. Bell terms incised sculptural decoration, and seem almost alone to have wrought out that decoration on the difficult materials of granite, syenite, and porphyry. But for the length of the discussion on Mr. Bell's paper, it was my intention to read those notes at the close of the evening.—I am, &c.,

T. PHILLIPS.

Temple, 15th March.

The characters of Egyptian architecture are solidity, vastness in their edifices as a whole, and massiveness in the several parts of which they consist, whence result grandeur of effect. These qualities are seen in the simplicity of their propylea, the beauty of their noble gateways, the size of their columns, and the vastness of their halls and columnar courts. Examined in detail, many of their forms, proportions, and arrangements may be obnoxious to criticism; but the disposition to criticise is overpowered before the propylon, or in the peristyle court of Medinet Abou, amongst the ruins of the Memnonium, in front of the lotus-headed pillars of Luxor, and still more within the gateway of the Hypostyle Hall of Karnak.

The sculpture and painting of the Egyptians constitute important elements in the architecture of that people, and are only seen on their edifices, or within their tombs. Their walls, columns, obelisks, and the pedestals, sides, and backs of their statues, are covered by figures, either carved and coloured, or, as is sometimes, but rarely the case, carved only. Their obelisks marked the approach to their gateways, as at Luxor, or ornamented the interior of their courts, as at Karnak. Their sphynxes lined the avenues to their palaces, as at Karnak, or marked the entrances to their temples, as at Djireh, whilst their colossal statues were placed at the entrance of their gateways or doorways, as at Luxor, Karnak, and the Memnonium. All their sculpture thus contributed to, or was modified by, architectural effects and arrangements, and the conjoint operation of their sculpture and architecture should be considered in estimating the merit of either.

To illustrate my meaning, let us consider an objection which has been urged against Egyptian architecture that the blank walls of their propylea are heavy when compared with the columnar approaches to Greek structures, and that the horizontal line in which all Egyptian edifices terminate, presents an unfinished appearance when contrasted with the pediments which meet the eye in approaching Athenian temples. But it should be remembered that the colossal statuary which was placed in front of an Egyptian propylon, carried the eye towards the summit without allowing it to dwell upon the blank wall of which the propylon was composed, whilst the beautiful obelisk broke the continuity of line which the summit of the edifice would otherwise have presented. So, too, the simplicity and severity of form in Egyptian sculpture, and even the angularity of line which it presents, possess a peculiar propriety when beheld in connexion with the architecture of the country, of which it formed a necessary part. In considering the design of the Egyptian sculptor we experience the great disadvantage of very imperfectly comprehending the mythology of that people, to illustrate, and enforce, and perpetuate which so large a portion of their sculpture was employed.

If we except the battle scenes on the walls of their palaces, and, perhaps, some of their statuary, every sculptured production which meets our eye is connected with the mythology of the people. The forms of that mythology were conventional, whether we regard them as intended to convey the belief that objects such as they have sculptured really existed amongst the gods, or as meant to represent, by sensible forms, the attributes or powers of divinity. Those forms, therefore, remained unchanged through all periods of Egyptian art, as the works executed under the government of the sovereigns of the Greek dynasty, show that, although in the greater or less rounding of the figure, and the more or less accurate representation of the inflexions of the human body, Greek art may have influenced Egyptian manipulation, yet the energy and influence of so flexible and progressive a people as the Greeks produced no effect upon the conventional forms of Egyptian mythology. That Egyptian art was not inventive or progressive seems a reasonable conclusion from the works they have left.

Innovation would be rejected in their mythological or sacred subjects, from religious motives; but no such motive can have restrained the artist who was employed to represent scenes of battle or of human triumph. And yet, on the walls of Luxor, Karnak, the Memnonium, and Medinet Abou, where we find sculptured the triumphs, not of one, but of several monarchs, the design in each instance is the same, and the treatment of the subject nearly so. In each the strength and courage of the hero are represented by his colossal size, and his position; in all the action of his horses is a pawing gallop; in all his own unaided arm secures the victory, whilst the minor incidents present a striking resemblance to each other. I must confess those scenes greatly disappointed me; the spirited and graphic description of the sculpture on the propylon at Luxor, contained in Mr. Hamilton's Egyptiaca, had prepared me to expect a work of high interest and much beauty; but although all the objects described by him may perhaps be discovered by a strong eye and a ready imagination, the quaint design and rude execution of these stories, scarcely repay the trouble it costs to decipher them. The sculpture of the Egyptians is divisible into three classes:—the perfect statue, of which are found great varieties — first, the human figure, usually (perhaps always) of colossal size, whereof the standing figure was usually attached to a pedestal, and extended one leg before the other at one unvarying angle, and the seated figure always faced the spectator fully, the arms being placed flat on the thighs, the hands resting on the knees. The prevailing character of such figures is a pleasing expression of face (which is always in calm repose, the mouth relaxed into a slight smile), and a careful delicate manipulation; and the form of the face and head is given

with an accuracy seldom seen in the hands, feet, or other portions of the body. The second class is bas-relief, a style frequently used in the palaces, and sometimes in the temples, of the Egyptians, for the figures of men and animals, and often in the tombs, for hieroglyphical symbols. The works in this class are of varied excellence. The form of the human figure is always conventional, but the lines, although angular and partaking of a geometrical character, are well defined and firmly cut. In the early Egyptian works, the relief was low, the surface flat, and but little if any attempt was made to show the roundings of the human figure, or to exhibit the inflexion of the human form. But both in this class as well as in the next, animals and birds are given with spirit, truth, and life. As time passed on, and changes of government led to a closer intercourse with Greece, an observation of Greek Art seems to have influenced Egyptian workmen, who afterwards attempted, and often with success, by increasing the relief and lessening the angularity of outline, to give roundings to the figure and exhibit the inflexions of the human form. Instances of this influence are perceptible in the sculpture of the statues of Isis, at Denderah, Karnak, and the Hill side, at Gourum, but even here the conventional character of the figures was retained. The third class of Egyptian sculpture is produced by cutting into the surface of the stone an outline of the figure, which has first been drawn thereon, and raising the figure within the sunk space by cutting deeply and vertically along the outline, and rounding the surface as might be found necessary, to represent the form of the figure intended to be produced. This kind of sculpture is called by the Italians "intaglio rilevato," and is that which I have described as intagliated. This is the kind most commonly met with in the temples and palaces, and is that used to represent the human figure in the tombs. As in the former class so in this, the works of the earliest periods exhibit the least depression and the slightest attempts to give rounding, whilst in the later periods the intagliated lines were cut deeper, by which more shadow was cast upon the figure, which was itself more rounded, and given with more attention to inflexions and form. In whatever mode the figures of men and animals were produced upon the flat surface, they were afterwards coloured, the arrangement of the colouring being simple and conventional, inasmuch as many objects are always coloured alike, and never are represented as they would be found in nature. The colours themselves were bright, and of equal force throughout the space allotted to each colour, often glazed, and in many instances they still remain as bright as when they were laid on. This is remarkable in the tombs where the colours have been preserved from atmospheric agency; but is as strikingly the case in many of the gateways, and more especially on the ceiling of the colonnade in the second Court of Medinet Abou, where the blue has singular force and brightness, notwithstanding an exposure of more than 2,000 years, not only to atmospheric agency in an open court, but also to the more destructive operations of man, which have here been so actively at work. The colour still stands out, bright and powerful as the blue of an Egyptian sky, and is now more brilliant than the last preserved works of Titian or Paul Veronese.

THE INSTITUTION OF NAVAL ARCHITECTS.

The inaugural meetings of the Institution were held in the Hall of the Society of Arts (by special permission) on Thursday, Friday, and Saturday, the 1st, 2nd, and 3rd of March. The first meeting took place at eleven a.m., Thursday, March 1st, the Right Hon. Sir John Pakington, G.C.B., in the chair. The papers read were—On the Mathematical Theory of Naval Architecture, by the Rev. Dr. Woolley; On the Wave Line Theory, Part I., by J. Scott Russell, Esq., F.R.S.; and On the Strength of Iron Ships, by J. Grantham, Esq. At the evening meeting, on the same day, the Earl of Hardwicke presided, and papers by the the Astronomer Royal, On the Compasses of Iron Ships; and by G. W. Lenox, Esq., On Chain Cables, were read.

On Friday, the 2nd instant, the members and friends of the Institution assembled at eleven a.m., J. Penn, Esq., in the chair, when a paper, by W. Fairbairn, Esq., F.R.S., On Iron Ships; and another, On Finding the Centre of Gravity of Ships by Experiment, by F. K. Barnes, Esq., of the Admiralty, were read. At the evening meeting, J. Scott Russell, Esq., presided, and the three following papers were read, viz., 1. On an Improvement in the Form of Ships, by Joseph Maudslay, Esq.; 2. On Diagonal-built Ships, by J. White, Esq., of West Cowes; 3. On the Economising of Fuel in Steam Ships, by Robert Murray, Esq., C.E., of Southampton.

On Saturday, the 3rd instant, the company again assembled at the concluding meeting of the series, the Rev. Dr. Woolley in the chair. N. Barnaby, Esq., of the Admiralty, read a paper, On Inventions in Naval Architecture; and J. Scott Russell, Esq., completed his description of the Wave Line Theory.

The meetings were not only eminently successful, in so far as the general objects of the Institution are concerned, but were also attended by one very important result, which the public will learn with satisfaction. It is well known among shipbuilders and shipowners that "Lloyd's Rules" have been very widely denounced as a great hindrance to improvements in shipping, owing to the fact that no shipbuilder is at liberty to depart from them unless he forfeits all claim to registration of his ships in Lloyd's List, without which merchants will not venture their cargoes in them. How this difficulty was to be removed has been a matter of grave but fruitless consideration, because, while on the one hand the existence of some well-defined rules was absolutely necessary, on the other it was practically impossible for Lloyd's surveyors to keep pace with the rapid disposition to improve evinced by modern shipbuilders. At the meetings of the Institution of Naval Architects this subject was brought forward on two successive days, in the papers read by Mr. Grantham and Mr. W. Fairbairn, both of whom stigmatised "Lloyd's Rules" as obstructive and injurious to the public. An amicable discussion followed the reading of these papers, in which Mr. James Martin and Mr. T. Ritchie, Lloyd's two chief surveyors, took part. After disclaiming all disposition to obstruct the progress of the art, they frankly undertook to co-operate in all reasonable ways with the Institution of Naval Architects (of which, indeed, they are officers), with a view to the continual improvement of the art of shipbuilding. Thus a most serious question has been settled to the manifest advantage of the public, for, while every real improvement of our passenger and merchant ships that may be suggested will be guaranteed against obstruction, no countenance will, of course, be shown to any injurious change by the practical shipbuilders who compose the Institution. This single result will amply repay all the pains taken in the establishment of the Institution of Naval Architects.

Home Correspondence.

LIME LIGHT.

Sir,—Few of those who have used the lime light will, I expect, speak ill of it, as it is so thoroughly efficient, and in some respects convenient, for the particular purposes to which it has been applied hitherto. There have been, however, difficulties in the way of extending its use, and some information on the manner in which these have been surmounted would have probably been acceptable to those who heard the paper read on the subject.

Without alluding to its commercial aspect, the follow-

ing particulars appear to me to want further notice, if we are to form a notion of the availability of the light.

The efficiency of the lime holder to maintain a steady light may be perfect, but if so, it was not relied on in the Society's room, where four lights contributed to maintain the brilliancy when one failed.

The mode in which the public is to be supplied with the lime light seems very obscure. Several persons imagined that a service-pipe for oxygen gas was to be laid down, but Mr. Baxter's letter, in the *Journal* of the 2nd instant, leads to a contrary inference, without stating how the supply is to be effected. Will the company sell it over the counter in small gas-holders, or deliver it from house to house daily, as regularly as we receive milk, or will they occasionally replenish larger reservoirs? and if there is no existing supply of coal gas how is this to be obtained?

Again, the gas bags and pressure boards are too cumbrous an apparatus for general use.

Perhaps all these matters are provided for, but we have still to look for this information, which it can hardly be "inconsistent with sound commercial purposes to make public."

With regard to danger, I fear the precaution is not satisfactory. The safety-jets may, indeed, have successfully prevented accidents for forty years; but it is not from burning the mixed gases, or, indeed, ordinary coal-gas at the jet that explosions are likely to occur. The mixed gases must be guarded every way from the chance of accident, for the use of two bags, as ordinarily arranged, does not prevent this mixing. The explosion to which I alluded at the meeting occurred by the careless handling of a bag detached from the apparatus, and which, having been originally charged with oxygen only, was erroneously supposed to contain the same. Dr. Bachoffner's remark was quite correct—that with proper care there is no need for fear; but can proper care be expected of those who do not understand what they are dealing with? In Dr. Holland's recent paper on "Accidents in Mines," he refers many of the explosions to carelessness, and carelessness to ignorance. This remark would probably be verified in the common use, by those who cannot be expected to know their properties, of such elements of danger as are now to be offered to the public, if no additional security is provided.

Its intensity is a valuable condition of this light for particular purposes. I am glad to find from Mr. Baxter's letter that it can weather a storm.

I am, &c.,

F. H. M'LAUCHLAN.

March 7th, 1860.

UNSINKABLE SHIPS.

Sir,—I notice, at page 251 of the *Journal of the Society of Arts*, a letter from Charles Atherton, on "Unsinkable Ships." As it implies some preceding discussion, and possibly an attempt, in 1860, to revive what Mr. Walters, architect to the India House, endeavoured to carry out in 1818-20, possibly it may interest your correspondent, as well as your readers, to know that Mr. Walters not only published a pamphlet on that subject about that period, and produced models, but also included a plan for the prevention of hogging of ships of war.

As I was a friend of Mr. Walters, as well as of Sir Robert Seppings, I discussed both matters with them separately, and suggested another mode of not only preventing ships sinking, but also reducing materially the incessant labour demanded in pumping leaky ships. It included, further, the means of extinguishing fires in the holds—of which presently.

Mr. Walters' plan for rendering ships unsinkable consisted in the introduction of copper cylinders between the timbers and beams beneath the decks, calculating the displacement and difference of specific gravity of the timber used in the construction of the vessel. His method therefore, applied mainly to the preservation of the hull leaving the cargo involved as a question of specific gravity; and really the constantly wet timber, the bolts and other iron work, masts, sails, and cordage, reduced the ship to that condition termed "water-logged."

Some years previous, I had turned my attention to the formation of a floating dry-dock, to enable vessels at any of our outer anchorages to replace sheets of copper; indeed to effectually dock vessels at Spithead, without the removal of guns or stores. The original drawing of this is now before me.

I then proposed to Sir Robert Seppings (before September 1821) so to construct our ships of war that they should be virtually what our gasometers now are, that is to close "ciel" and under-deck them, adapting extra hatches to fit from beneath and be screwed up, in opposition to the top hatches; the space between, if needed, to be filled in by hot fluid pitch, sand, and other matter, so as to form an air-tight mass. By the inversion of the pump boxes, air would be forced into the hold, and would eject the water by the orifices by which it entered, and this amount of air, once introduced, would, as a matter of simple science, need no further attention beyond the casual leakage of air.

Now it must be evident that in this arrangement no risk of fouling or injuring the pumps, by grit or constant pumping, would be incurred, and also that the labour of displacing the water would have no comparison to lifting it to such a height as to cause it to flow from the upper decks into the sea. A very simple experiment will prove this sensibly, by using a glass tube to suck up water from a bucket by exhausting the air, and oppositely blowing globules out into the water.

The objections then raised were, first, the blowing up of the decks; next, the interference with Sir Robert Seppings' plans for ventilating by spaces left between the timbers; and, lastly, the very great objection to "cieling" the hold beams from beneath.

All these points, as matters unconnected with safety, and the disposition of wooden vessels built for war, I left to their fate. But in our present construction of iron vessels every facility exists for carrying out this principle in every sectional compartment; in fact, of introducing Mr. Walters' plans of the tubes with the adaptation of my own for the expulsion of any water which may force them. And reverting to ships of war constructed of wood so far back as 1835, when the fitting of H.M. ships *Erebus* and *Terror* was confided to me, I then, in the *Terror*, first introduced the compartments, and that vessel was saved by the aftermost. If any accident had occurred, and I had been in command, it assuredly would have been my first effort to shore her decks to withstand pressure from beneath, as to permit my carrying out this principle; and the *Terror* was for that object (as previously in 1830 had been also H.M.S. *Etna*) provided with "Blake's screw bringing to bolts" for that precise object. It is well known among my professional brethren that I have strenuously urged "the welling off of leaks in bow and stern" from a very early period. It was once attributed to a distinguished naval peer "as having been practised by him," but his lieutenant most generously denied that any such accident ever occurred, or was so treated in his ship. (Admiral Smyth.)

But, before parting from this subject, the question was again mooted as to constructing a floating dock at Bermuda, in 1822-4, during the period of Admiral Sir Thomas Briggs' superintendence of that dockyard, and a small model was then constructed to explain my object. It consisted of a rectangular box, three feet long, by one wide and one deep, and having at each end a glass plate, to enable us to watch the operation of displacing the water. The bottom was open—the top air-tight, with a glass tube inserted at one end near to the glass, so as to observe with facility the action of the air from the lungs.

We had, therefore, when filled (by taking out a vent plug on the top) three cubic feet of salt water, equal to $3 \times 64{\cdot}4 = 193{\cdot}2$ lbs. Now, by blowing down this tube, and stopping at pleasure to take breath, in a very short

period I displaced the three cubic feet nearly, or sufficiently so as to admit of its floating freely on the water, and a bag containing 112 lbs. of shot was, of course, freely borne on it.

But it is not only as regards sinking or leaking that I deem this question important. I have repeatedly urged on Her Majesty's Government the importance of having the command over fire by the arrangement now referred to. It must be manifest that if we can either exhaust or condense air in air-tight compartments, we can not only command the limit of combustion, but we may also flood compartment after compartment, and drive the water successively from one to another without endangering the vessel, and probably in very many cases without injuring the cargo.

On the 28th December, 1857, I addressed a letter, in repetition of similar previous commmunications, to the Admiralty in relation to the burning of the *Sarah Sands*, and calling attention to "the fittings of H. M. ships *Erebus* and *Terror*," and received the thanks of their Lordships for the same on the 12th January following. I have within the last few months again pressed the same subject. I do not assume to myself any priority of claim, but I wish it to be fully understood that the subject of unsinkable ships is not new, either to the mercantile or Royal Navy.

Reverting to the other portion of Mr. Walters' pamphlet, "On the Means of Preventing Ships 'Hogging.'"

The plan invented by Mr. Walters to meet this great evil, occurring principally in ships of war, and resulting from the great weight of guns, anchors, &c., placed at the extremities, was as follows:—

From the gripe or forefoot of the stem, and also from the heel, at the junction of keel and sternpost, he brought up diagonal iron plates to the upper part of the central timbers of the midship section. The plates, about 4 inches wide, and ½ an inch in thickness, were let in flush into the exterior sides of the timbers, which were afterwards planked over.

It will be evident to the mind of the practical builder, that where these bands so passed, any spaces occurring being filled up solid, that it was, by the abutting principle, nearly equal to bolting the timbers horizontally together.

But his model, which excited great interest, and plainly exhibited the slight strain exerted on these plates of iron, was thus arranged:—

A solid model of a vessel, 3 feet in length, was cast in lead, and a slight "saw-cut" run over the lines I have indicated, that is, from the upper side of centre timber-head, abreast the mainmast, forward to the gripe; and aft, to the heel, just imbedding a whipcord. The model was then sawn into 5 equal lengths, and tied firmly together by the whipcord.

At the point of balance a ring bolt was screwed in, about the position of the mainmast, and a purchase was applied to lift the mass gently from its state of level rest.

When free, the line of keel remained straight thus suspended. It was then lowered on a bar amidships, to represent a rock; its figure remained perfect, this slight cord being quite adequate to retain the parts in their places.

The Admiralty, to prove the question practically, directed the experiment to be tried on a brig, moored with line-of-battle ships' chains forward as well as aft, off the north end of Portsmouth Dockyard, where I witnessed her unstrained. I cannot give precise dates for that experiment, but I have ascertained that in January 1819 this plan was directed "to be introduced into frigate built ships."

I am, &c., EDWARD BELCHER.

Union Club, Trafalgar-square, March 5, 1860.

Proceedings of Institutions.

Faversham Mutual Improvement Society.—The annual soirée of this society was held on the evening of Tuesday, February 28, at the Assembly Rooms, Faversham. There was a large gathering, upwards of 300 ladies and gentlemen assembled. The room was tastily decorated with festoons of evergreens, arranged under the direction of the President, F. W. Monk, Esq., and presented a very beautiful appearance, being also ornamented with a variety of engravings, stereographs, maps, &c. Among the articles exhibited in the room were a collection of photographs and chromo-lithographs lent by the Society of Arts; prints and stereoscopes, by Mr. J. Higham; Indian curiosities, by Mr. Packer; Chinese and other curiosities, by Thomas Spong, Esq.; stuffed birds, &c. Various musical performances took place. The President occupied the chair. The Mayor (S. G. Johnson, Esq.,) addressed the meeting at considerable length, on "The Life of George Stephenson." Mr. Monk presented a statement of the society's affairs, and in doing so, expressed himself in every way satisfied with its position at that time. It had had but a humble origin, and probably few among its originators ever expected that it would attain such a position as it had now done. Its income had risen from £14 in the first year, to upwards of £100, and he trusted to see it still further increased; its members numbered 450, and though this was very satisfactory, yet he wished to see that number raised to 600, when it was the committee's intention to commence a reading room in connection with the society, and thereby supply a want much felt in the town. The library was increasing, and now contained nearly 700 volumes, the issue of which was at the rate of 100 per week; and besides all this they had classes and lectures, which had been well attended.—Professor T. Rymer Jones, F.R.S., of King's College, London, next delivered a brief address on the wonders of the microscope.—The Rev. W. B. Davies congratulated the members on the success which had attended their efforts, and especially on their present meeting.—Mr. Tong proposed a vote of thanks to the president, which was given amid loud cheering.—Mr. Monk, in responding, said the success which had attended them was owing to the committee with which he acted, and the manner in which they were supported by the members. He begged to move a vote of thanks to them, and to the ladies who had so materially contributed to the evening's enjoyment by presiding at the refreshment tables. The vote was carried with acclamation, and a similar compliment to the singers and musical performers was proposed by the mayor, and passed.

St. Leonard's Mechanics' Institution.—The Rev. A. J. Hatchard, M.A., recently gave two readings of poetry at the St. Leonard's Assembly Rooms, in aid of the funds of the St. Leonard's Mechanics' Institution. The programme of the first reading was as follows:—"Cotter's Saturday Night," Burns; "Man was made to Mourn," Burns: a portion of the Temptation, Book 9th, "Paradise Lost," Milton; "Song of the Shirt," Hood; "The Armada," Lord Macaulay; "Ivry," Lord Macaulay; fifty-three stanzas of the "Time-piece," Cowper; "John Gilpin," Cowper. The efforts of the rev. gentleman were attended with entire success; the audience was very numerous, including many of the members of the Institution, for whose benefit and amusement the reading, on the second occasion, was especially intended. The list of subjects on the second occasion varied somewhat from the one selected for the previous reading; a portion of the "Temptation," in book ix. of "Paradise Lost," and the "Song of the Shirt," being substituted for the first act of "Hamlet." In some introductory remarks which he made at the commencement of the readings, he explained that he had a two-fold object in view, viz., to benefit the funds of the Institution and to provide an evening's amusement to the members and others who might favour him with their company. Several of the pieces were prefaced with some explanatory remarks by the reader. At the close of the readings Mr. S. Putland (Hon. Sec. of the Institution) tendered his thanks to the Rev. J. A. Hatchard, for his efforts on behalf of the Institution, and the audience endorsed that expression of thanks by applause.

To Correspondents.

Letters from Mr. S. Sidney, Mr. P. A. Halkett, and Mr. J. H. Gilbert, having reference to Mr. Alderman Machi's paper on "Town Sewage," have been received, but they are necessarily omitted this week for want of space.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
British Architects, 8. Dr. Barlow, "On Symbolism in Art, with especial reference to Christian Art and Architecture."
Medical, 8½. Mr. Henry Smith, "On the Pathology and Treatment of the painful Ulcer of the Rectum.
United Service Inst., 8½. Mr. E. Loysel, "Loysel's Process for making Tea and Coffee in large quantities for Troops." Capt. J. Grant, R.A., "Grant's New Cooking Apparatus, as introduced into the Army."
Tues. .....Royal Inst., 3. Professor Owen, "On Fossil Reptiles."
Civil Engineers, 8.
Statistical, 8. 1. Mr. F. D. Fenton, "On the Aboriginal Inhabitants of New Zealand." 2. Mr. C. Swarbeck Hall, "On the Vital Statistics of Tasmania."
Pathological, 8,
Wed. .....Royal Soc. Literature, 4½.
London Inst., 7. Conversazione.
Meteorological, 7.
Society of Arts, 8. Dr. Guy, "On a New Method of obtaining Crusts of Arsenious Acid, with other Sublimates, and, incidentally, on a new Class Lens and Microscope."
Ethnological, 8½.
Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Philosophical Club, 6.
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri. .....United Service Inst., 3. Mr. Lawrence Oliphant, "China and Japan."
London Inst., 7. Mr. Thomas A. Malone, "On Certain Principles of Vegetable and Animal Chemistry, and their Application to the Arts and Purposes of Life."
Royal Inst., 8. Mr. N. S. Maskelyne, "On Diamonds."
Sat. .....Royal Inst., 3. Dr. Lankester, "On the Relation of the Animal Kingdom to the Industry of Man."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on February 28th, 1860.

15. Railway and Canal Bills (117. Atheury and Tuam; 118. Caledonian, Edinburgh and Glasgow, and Scottish Central; 119. Conway, Llanrwst, and Bettws y Coed; Denbigh, Ruthin, and Corwen; 120. Egham and Woking; 121. Epsom and Leatherhead; 122. Faringdon; 123. Hamilton and Strathaven; 124. Haylings Railways and Harbour; 125. Great Northern and Metropolitan Junction; 126. Kilkenny Junction; 127. London Railway Depot and Storehouses; 128. Midland Great Western of Ireland)—Board of Trade Reports

Delivered on February 29th, 1860

10. Valuation Rolls (Scotland)—Return (a corrected copy).
58. St. George's-in-the-East—Return (corrected pages).
35. East India (Education)—Return.
106. Cinnamon, &c.—Return.
112. Committals (Central Criminal Court)—Return.
15. Railway and Canal Bills (129. Petersfield—130. Pontefract and Castleford—131. Rugeley and Abbots Bromley—132. Sacriston Junction and South Shields—133. Salisbury and Yeovil—134. Stockport, Disley, and Whaley Bridge—135. Tewkesbury, Upton-upon-Severn, and Malvern Junction—136. Thetford and Bury St. Edmunds—137. Waterford and Kilkenny — 138. Waterford and Limerick, and Great Southern and Western)—Board of Trade Reports.
76. Local Acts (24. Medway Valley Waterworks—25. Greenock Harbour—26. Belfast, Holywood, and Bangor—27. Fenn Valley)—Admiralty Reports.

Delivered on March 1st, 1860.

49. East India (Public Instruction at Madras)—Return.
82. Bankruptcy—Returns.
110. East India (Army Organisation)—Return.
76. Local Acts (28. London and South Western (Kingston Extension) Railway—29. Cowes and Newport Railway Extensions—30. London, Brighton, and South Coast Railway (Deviations, &c.)—31. Swansea Local Board of Health—32. Sacriston Junction, and South Shields Railway—33. Tewkesbury, Upton-upon-Severn, and Malvern Junction Railway—34. Tenbury, Bewdley, Kidderminster, and Worcester Junction Railway—35. River Fergus Navigation Improvement and Embankment)—Admiralty Reports.
85. Harbour, &c., Bills (7. Blyth Harbour and Dock)—Board of Trade Report.
51. Bills—Petitions of Right—(Amended).
52. „ Endowed School (No. 3).
54. „ Municipal Corporation Mortgages, &c.—(Amended).
55. „ Oxford University—(Amended).
France—Additional Article to the Treaty of Commerce.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 9th*, 1860.]

Dated 14th January, 1860.

102. W. Barton, Shoreditch, and F. Ross, Clerkenwell—Ornamenting textile fabrics known as American cloth.

Dated 21st January, 1860.

160. H. Landrin, 79, Rue de Seine, and L. J. Soulé, 4, Rue de Montholon, Paris—Imp. in washing ores and minerals. (Partly a com.)

Dated 23rd January, 1860.

166. J. Potter, Manchester—Certain imp. in self-acting mules.

Dated 11th February, 1860.

367. H. D. Denison, 17, Brunswick-street, Leeds—Imp. in the construction of suspended weighing machines applicable to cranes and other lifting apparatus.

Dated 14th February, 1860.

398. J. Leach, Rochdale, and T. Clayton, Manchester—Imp. in pressing, ornamenting, and finishing woollen and other fabrics, and in the machinery or apparatus employed therein.

Dated 15th February, 1860.

410. W. C. S. Percy, Manchester—Imp. in arrangements and mechanism or apparatus for the manufacture of bricks, tiles, pipes, and other articles formed of plastic materials.

Dated 21st February, 1860.

466. J. F. F. Leroux, 44, Rue Volta, Paris—An apparatus for facilitating the collection of money on counters.
470. T. Jackson, 21, Orchard-street, Portman-square—Imp. in the action of upright pianofortes.

Dated 22nd February, 1860.

474. C. Greves, Birmingham—Imp. in fire-arms.
476. W. E. Newton, 66, Chancery-lane—Imp. in digestors for dissolving quartzose rocks. (A com.)
478. R. Davison, London-street, London—An imp. in boiling worts and other liquids.
480. S. S. Bateson, Bolton-street, Mayfair, Middlesex—Imp. in generating steam and in heating apparatus, and in the apparatus employed therein.
482. E. Wilkinson, Grimesthorpe, near Sheffield—Imp. in sheep-shears.
484. J. H. Tuck, Great George-street, Westminster—Imp. in the manufacture of cylinders, tubes, and other hollow bodies.

Dated 23rd February, 1860.

488. W. Haynes, Bank-place, Holywell, Flintshire—Imp. in obtaining metals from their ores or matrices.
490. J. Bottomley, Laister Dyke, near Bradford, Yorkshire—Imp. in means or apparatus used in spinning fibrous substances.
492. S. Gilbert, Coleorton, near Ashby-de-la Zouch, Leicestershire—A new machine for excavating sewers, tunnels, and other such like underground work.
494. J. Pegg, Leicester—Imp. in battens employed in weaving.
496. L. J. Levisohn, 18, Helmet-row, Middlesex—An imp. in portemonnaies and certain other portable receptacles.

Dated 24th February, 1860.

497. F. Boissau, 4, South-street, Finsbury—Imp. in apparatus for the extraction of pit coal and other mineral products.
498. T. Dean, J. Knowles, and T. Knowles, Manchester—Imp. in machinery or apparatus for obtaining motive power.
499. E. Mucklow, Bury, Lancashire—Certain imp. in the treatment of madder roots, munjeet, or other plants of a similar class.
500. S. Roberts, Hull—Imp. in steam engines.
501. J. Thompson, Bilston, Staffordshire—Imp. in the manufacture of iron, steel-iron, and steel, and in the apparatus to be employed in such manufacture.
502. J. B. Howell, Sheffield—Imp. in casing ships, batteries, and other structures for the purpose of resisting shot, shell, and other projectiles.
503. R. Salisbury, Preston—An improved method of adapting sheds and other buildings to the purpose of drying pipes, tiles, bricks, and other articles made from clay or other plastic materials.
504. R. A. Brooman, 166, Fleet-street—Imp. in quills, spools, or bobbins. (A com.)
505. J. J. Baranowski, Chalcot-terrace, Middlesex—Imp. in presses specially adapted to the copying of letters.
506. S. Ward, Battersea, Surrey—Imp. in sewing machines.

507. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the reduction of friction in the working parts of machinery, applicable also to the transmission of motive power. (A com.)
508. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in forming the fastenings of caps or stoppers for jars and bottles, and in the machinery or apparatus employed therein. (A com.)
509. A. Barclay, Kilmarnock—Imp. in pumping engines.
510. C. Wetter, 67, Myddelton-square, Middlesex—Imp. in the manufacture of fermented and spirituous liquors.
511. W. H. Walker, Leicester—Imp. in the manufacture of boots and shoes.
512. T. North, Oxford—Improved apparatus for receiving and recording votes by ballot.

Dated 25th February, 1860.

513. J. Lightfoot, Accrington, Lancashire—Imp. in fixing pigments and other colouring matters on textile fabrics and yarns.
514. E. T. Hughes, 123, Chancery-lane—Imp. in boring apparatus. (A com.)
515. B. Annable and J. Blench, Newcastle-street, Farringdon-street, London—Imp. in printing machines, rendering the same more compact, of less bulk, and more available for use.
516. J. Gillespie and J. Gillespie, Kingsbarns, Fife, N.B.—Imp. in reaping and mowing machines.
517. W. Dean and C. Peach, Derby—An imp. in the manufacture of wreaths or trimmings for ladies' bonnets and other articles of dress.
518. H. R. J. Denton, Leicester—Imp. in hay rakes, horse rakes, and similar agricultural implements.
519. C. W. Siemens, Great George-street, Westminster—Imp. in the construction of electric telegraphic cables and conductors, and in machinery connected therewith.
520. E. E. Scott, Dundee—Imp. in and pertaining to breech-loading guns and fire-arms.
521. T. Lambert, Short-street, New Cut, and O. Wakefield, Union-place, Lambeth—Imp. in steam and other valves or cocks.
522. G. Jenkins, Tyne-cottage, Hanwell, Middlesex—Imp. in children's metal cots or bedsteads.
524. C. E. Green, 13, Blandford-street, Portman-square, and J. Green, Charlotte-street, Portman-place, Middlesex—Imp. in breech-loading fire arms.
525. S. Varley, Birmingham—A new or improved chain, and machinery to be employed in the manufacture of the said chain.
526. J. Lang and C. Chevalier, Birkenhead—Imp. in targets.
527. T. Silver, Philadelphia, U.S., and J. Hamilton, Glasgow—Imp. in apparatus for governing or regulating the speed of steam and other engines and machines in motion.
528. W. Birks, sen., and W. Birks, jun., Nottingham—Imp. in machinery for the manufacture of bobbin net or twist lace.
529. J. Lee, Lincoln—Imp. in the manufacture of crank shafts from round or square iron or steel.
531. J. Faber, Stein, near Nuremberg—Imp. in ever-pointed pencil cases.

Dated 27th February, 1860.

532. J. B. Rowcliffe, Manchester—Imp. in pin winding machinery.
533. R. G. Lowndes and J. Gildroy, Auldhousefield, Renfrew, N.B.—Imp. in embossing and finishing woven fabrics.
634. A. Melville, 54, George-street, Portman square, Middlesex—Imp. in the preparation and manufacture of compounds for marking on paper and other fabrics and substances.
535. R. B. Cooley, Nottingham—Imp. in the manufacture of plain or ornamental woven or looped fabrics from certain descriptions of yarn, and for the application of such fabrics to the making of various articles of dress, and for other uses, such as hats, caps, gloves, hosiery, lace shawls, mantle and other cloths, curtains, table, umbrella, and other covers, such fabrics being made with or without terry, plush, or cut pile surfaces.
536. T. C. Eastwood, Bradford, Yorkshire—Imp. in means or apparatus for preparing and combing wool, cotton, and other fibres.
537. P. H. Desvignes, Lewisham, Kent—Imp. in apparatuses for exhibiting photographic, stereoscopic, and other pictures, models, figures, and designs.
538. S. F. Shore, Clifton-hall, Derbyshire—An imp. in or addition to casks to prevent their becoming foul.
539. J. A. Bassett, Salem, Massachusetts, U.S.—Imp. in apparatus for decomposing steam.
540. W. Munslow and H. Wallwork, Miles Platting, near Manchester—Imp. in weighting and clearing rollers used in machinery for preparing and spinning cotton and other fibrous materials.
541. J. A. Bassett, Salem, Massachusetts, U.S.—Imp. in the manufacture of gas for illuminating and other purposes.

Dated 28th February, 1860.

543. E. I. Asser, Amsterdam—A process of photographic proofs with printing or autographic ink for the purpose of either using them as such, or placing them back on lithographic stones or on metal.
545. W. Davies, Queen's-road, Everton, near Liverpool—Imp. in moveable window shutters
547. J. W. Midgley, Keighley, Yorkshire—Imp. in machinery for spinning wool, mohair, alpaca, and other fibrous substances.
549. M. Menson, Edinburgh—Imp. in gas meters.
551. A. Anderson, Lancaster, Ohio, U.S.—An imp. in governors of motive power engines.

Dated 29th February, 1860.

553. J. Blair, Caledon Mill, Manchester—Certain imp. in machinery for preparing and carding cotton and other fibrous materials.
555. J. Rickard and W. Rickard, Derby—Imp. in the manufacture of chenille and other piled fabrics, and also in the machinery connected therewith.
557. W. Williams, Merthyr Tydvil—Imp. in machinery or apparatus for effecting ventilation.
559. H. Swan, 5, Bishopsgate-street Without—Imp. in stereoscopes, stereoscopic pictures, and cameras for taking the same.
563. G. Wilson, York—Improved machinery for moulding the caps of bottles and jars.

Invention with Complete Specification Filed.

568. W. Bush, Dulwich, Surrey—Manufacturing granulated seidlitz powder.—1st March, 1860.

Patents Sealed.

[*From Gazette, March 9th*, 1860.]

March 9th.
2068. W. Ross.
2086. E. A. F. Lebourgeois.
2095. C. Beslay.
2100. J. Addenbrooke.
2154. E. B. Dimock and J. L. Baker.
2306. C. F. Beyer.
2154. A. V. Newton.
2562. F. D. Jones.
2638. E. T. Hughes.
2642. P. Marchand, E. Marchand, and J. Marchand.
2774. J. Combe.
2278. W. E. Newton.

[*From Gazette, March 13th*, 1860.]

March 13th.
2083. A. B. Seithen.
2091. C. G. Gumpel.
2092. J. Marritt.
2096. N. Defries.
2099. J. Robinson.
2103. H. Winter.
2105. J. W. Hadwen.
2108. B. Lauth.
2110. T. Richardson.
2113. J. Luis.
2115. J. Luis.
2116. J. Luis.
2117. J. Luis.
2118. J. Luis.
2119. J. Luis.
2122. T. Elliott.
2130. T. C. Eastwood.
2140. W. McIlwraith.
2153. J. Harrison.
2202. C. Stevens.
2209. W. Kempe.
2248. J. M. Rose, R. Carte, and W. Pikesley.
2313. A. Whytock.
2315. F. A. Lohage.
2410. G. T. Bousfield.
2832. S. C. Lister and J. Warburton.
2964. J. Engelmann.
54. H. Chance and T. Howell.
90. A. C. Twentyman.
145. P. Moore and P. Moore, jun.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March 9th*, 1860.]

March 5th.
645. H. Greaves.
648. J. Woodley and H. H. Swinford.
659. L. Barton & E. S. Brookes.
663. R. M. Ordish.
675. C. Sharp.

March 6th.
681. S. Faulkner.
689. A. V. Newton.

[*From Gazette, March 13th*, 1860.]

March 8th.
682. E. Cook and J. Stokes.
702. R. L. Jones.

March 9th.
698. W. C. Day.
715. G. Travis.
726. H. Bridges.
904. R. Wardell.

March 10th.
716. J. Shaw and W. Manwaring.
718. W. E. Newton.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, March 9th*, 1860.]

March 5th.
557. T. W. Cross.
574. T. W. Dodds.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,238	Feb. 25th.	Carpet Quoit	Peter B. Cow	46, Cheapside, E.C.
4,239	,, 27th.	Improved School Desk	James B. Rowe	Industrial Department, Schools of Compassion, Charles-street, Drury-lane, W.C.
4,240	March 3rd.	A Furnace	Charles Wheeler John Hedges	Speenhamland. Bucklersbury, E.C.
4,241	,, 7th.	Metallic Joint	Entichus Whittle	Wolverhampton.

Journal of the Society of Arts.

FRIDAY, MARCH 23, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of recent Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection.

Any persons having in their possession works by Sir William Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

EXAMINATIONS, 1860.—NOTICE TO LOCAL BOARDS.

The following circular has been issued :—

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-street, Adelphi, London, W.C.,
16th March, 1860.

Dear Sir,—I am directed to draw your particular attention to Par. 11 of the Examination Programme, and to suggest that your Local Board should now make arrangements for holding the Previous Examination :—

"11.—The Previous Examinations must be held by the Local Boards sufficiently early in the year to allow the results to be communicated to the Council on or before the 10th of April, 1860, *i.e.*, four weeks before the 8th of May, the day fixed for the commencement of the Society's Final Examinations."

I shall be obliged by your informing me, *without delay*, whether you expect to have any candidates desiring to be examined in Music, as, if so, I will furnish you with a form of test to be used at the Previous Examinations, as mentioned in paragraph 86 of the Programme.

I am, dear Sir, yours faithfully,
P. LE NEVE FOSTER, *Secretary*.

SIXTEENTH ORDINARY MEETING.

Wednesday, March 21, 1860.

The Sixteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 21st instant, W. B. Carpenter, Esq., M.D., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Arnold, Augustus Walter.	Rolls, J. Gouldsmith.
Burnell, George Rowdon.	White, H. C.
Goodwin, Josiah.	Whitehead, Charles.

The following Colonial Institution has been taken into Union since the last announcement :—

South Australian Institute.

The Paper read was—

ON A NEW METHOD OF OBTAINING CRUSTS OF ARSENIC AND CRYSTALS OF ARSENIOUS ACID, WITH OTHER SUBLIMATES; AND INCIDENTALLY, ON A NEW CLASS LENS AND MICROSCOPE.

By Dr. Guy, of King's College, London.

I ask the attention of the Society this evening to a series of adaptations and inventions, bearing on the practice of a minute chemistry, and the use of the lens and microscope; incidentally also on a new method of mounting photographs, and on some new forms of museum apparatus, with which I have had something to do in the way of suggestion.

As the simple chemical manipulations of which I am about to speak have for their aim to prepare a new class of objects for examination by the lens and microscope, and as the other suggestions to which I have alluded have either grown out of the use of a disc of glass, instead of the usual microscopic slide, or imply the substitution of the one for the other, I will begin by saying a few words about these discs of glass.

For some years past I have been in the habit of using these discs, and of late especially, on account of their convenience for comparative chemical experiments on the small scale. They are almost necessary for sublimates obtained by heat, and very useful when we wish to obtain a number of crystalline deposits from solutions at the same time. A great many of these discs can be put under one bell glass, and protected from the intrusive London dust.

It is a very small matter to speak of, but I may state here, that for these minute chemical operations I find a little instrument, consisting of a spear-shaped piece of common window-glass, mounted in a wooden handle, more convenient than the common glass rod. It acts as a spatula, a coarse filter, and a good drop at the same time. You can put a small quantity of a salt on a piece of window-glass, rub it down with the flat side of this glass spatula, suck up the clear solution by the capillary attraction of the two surfaces of glass, and then drop a large or small drop from the point. I send round a specimen of this very simple chemical tool. I may add that in using the common solutions for these small experiments, I always employ a drop bottle of the form which I now send round. It is a hollow tube drawn to a point, and ground as a stopper into the neck of a bottle; a small hole at the top of this tube converts it into a pipette.

To the other and more important use of the glass disc, (I mean for obtaining sublimates by heat,) I shall allude presently, after I have spoken of the size of the disc, of the mode of adapting it to the microscope, of similar discs made of other materials, and of the art developments to which the use of it has led.

I annex a section of the disc and holder, Fig. 1.

The circular disc of glass is an inch in diameter and by dropping it into a wooden holder, of the shape and size of the common microscope slide, with a central circular aperture bordered by a sunken ledge, it is readily adapted to microscopic use.

I have also made some use of circular discs of the same size turned out of wood, bone, or ivory, and thought at one time that some advantage might accrue from reviving the old-fashioned fixed microscopic cell, with its two circles of talc and ring of brass wire; substituting glass for talc, retaining the wire, and adapting the disc to the microscope by means of the universal holder just described. As I have altered my opinion upon this point, I will only add that I have lately found a new use for these cells, of which more bye and bye.

Fig. 1.

It occurred to me, also, to try rings of gutta percha, turned out of tubes of that material, and I thought that, on a larger scale, and in conjunction with larger discs of glass, they would form good museum cells for flat objects. My plan was to attach the glass discs to the gutta percha rings by heat, after placing the object between the glasses, and then to fill the space with liquid through a wedge cut out of the ring, which wedge was afterwards replaced. I made some experiments with this liquid cell, and should, probably, have tried others till I succeeded, but that it occurred to me to have recourse to my friends, the Messrs. Powell, of Whitefriars, who soon superseded my experiments in this direction by blowing a museum or specimen cell, with an excellent flat surface. The object is introduced by an opening at the back; the glass is filled with liquid, and corked, or otherwise secured. I am informed that a small glass of this kind has been adopted in the Museum of the Royal London Ophthalmic Hospital, and a specimen, which I place on the table, from King's College Museum, and which has been now mounted three or four years, shows that preparations may be so dealt with as to combine the desiderata of perfect display with very slow evaporation of spirit. When the weight of the glass and the small quantity of spirit required are taken into account, this flat specimen glass is certainly economical. Some elegant and useful forms, mounted on stoppered stems, have also been introduced, and, by the kindness of the Messrs. Powell, are now on the table.

The success of the Messrs. Powell in producing this flat liquid cell was so complete, that it occurred to me to show the excellence of the flat surface by means of a photograph introduced through the opening at the back. This photograph of the Crystal Palace, by Mr. Delamotte, is now on the table, with some good specimens of photographic chemicals, placed in small specimen glasses, by Messrs. Burfield and Rouch. This mode of displaying the excellence of the flat surface of these glasses, was the source of the elegant art of mounting photographs on glass, of which, in the shape of vases, and panels, and of pictures, opaque and transparent, you have so many beautiful specimens on your table.

I have made considerable use of the larger discs of glass for dry preparations. The object is placed between the two glasses, separated if necessary by a disc of paper, pasteboard, or gutta percha. It is then secured in a wooden cell, with central circular opening and ledge, for temporary purposes by a brass ring, after the fashion of the old microscopic mountings, or permanently by putty. There are some specimens secured in both ways on the table, and to show that they have the incidental advantage of being available for examination by the microscope, there are crystals of white arsenic and a crust of metallic arsenic mixed with crystals, under the microscope, and two specimens of microscopic poisonous seeds.

I now return to the small glass discs. I have stated that I have been in the habit of using them for microscopic purposes. I send you round specimens of objects mounted dry on those discs; I also send round some specimens mounted, by a friend, in Canada balsam, in the usual way; and I place on the table the simple modification of the instrument usually employed for making the circles of Brunswick black. Some simple arrangement for fixing the discs more securely will make it as easy to mount objects in this way on these discs as on the common microscopic slide.

I have said that these discs are serviceable for obtaining chemical sublimates, such as those of metallic arsenic and white arsenic, by heat. I think it quite possible that the habit of using these discs proved suggestive of the very simple modification of the common reduction tube of which I am now to speak.

For obtaining crystals of arsenious acid, or crusts of arsenic in medico-legal inquiries, the chemist uses a glass tube, of small bore, about three inches long, open at one end and sealed at the other. The tube has the proportions of the test tube I hold in my hand, but the bore is much smaller. This tube should be of German glass. It should be carefully dried before it is used, and the white arsenic, or the mixture of this with charcoal, or of the sulphuret of arsenic with black flux, or the metallic arsenic itself (the result of some previous chemical operation) must be introduced into the tube without soiling its sides. Then, having passed the middle portion of the tube through the flame of the spirit lamp, the flame is applied steadily to the sealed end. The white arsenic in sparkling eight-sided crystals, or the crust of the metal, collects on the sides of the tube about an inch or so above the sealed end.

This operation is a delicate one, and many minute precautions must be observed in order that it may be satisfactorily performed; and, when the crystals or crusts have been obtained, they are certainly not in a favourable condition for further examination and identification. When, for instance, the crystals of white arsenic are small, they are not readily identified by lens or microscope upon a rounded surface with a sharp curve, and streaked with lines in the length of the tube.

The number of precautions to be observed, and of fallacies to be guarded against in this mode of procedure, led me to adopt the modification which I am about to describe. In the place of a small reduction tube of green glass, three inches long, I use a larger specimen tube, about three-quarters of an inch long, of common white glass. Into this short tube, from which the moisture is readily driven off, I introduce the white arsenic, the metal, or the mixture. I place the tube in a vertical position and support it there by letting it fall into a circular hole punched in a sheet of copper or drilled in a slab of porcelain. This holder may be supported either on a frame attached to the spirit lamp (in which case it should be made to turn over the flame or from it) or on a common retort holder, the spirit lamp being removed at will. The specimen thus adjusted and fixed is then heated to expel the moisture it contains, and the substance to be operated on is dropped into it from the point of a penknife. A disc of common window glass, thin, white, and free from defects or scratches, is then dried and heated in the flame of the lamp, and placed upon the mouth of the tube. On heating its contents, the crystals or crusts are deposited partly on the sides of the tube, and partly, but chiefly, on the flat disc of glass. The coating of the glass disc may then be examined by the lens or microscope, and may be treated, in every respect, as an ordinary microscopic object.

As my object this evening is to describe apparatus, and not to enter into details of chemical manipulation, I will content myself with going through this simple process with white arsenic, using for this rough class experiment a larger tube of the length of the specimen tube itself, and I will send round the crystals for your inspection. Minute details respecting this simple chemical manipulation will be out of place here, but, I must add that, for some purposes, especially when I wish to transfer small quantities of the metal, arsenic, or antimony from porcelain to glass, I improvise a short tube by placing one of the square perforated bits of glass, used for making liquid cells for the microscope over the object to be transferred, cover it with the glass disc and proceed as before. In this way the crusts of arsenic and antimony yielded by Marsh's test, may be transferred from the porcelain to the glass, and examined under the microscope.

I will illustrate the delicacy of this method which I have been describing by an extract from a paper on the subject, published in Dr. Beale's Archives of Medicine, No. iii., 1858.

"Four small slips of microscopic glass, each bearing a minute fragment of a crust of arsenic, were weighed in an assay balance, and found to weigh respectively 0·280, 0·230, 0·137, and 0·141 of a grain. The slips having been carefully heated in a small specimen tube three-quarters of an inch long, suspended in a metal holder, yielded distinct circular mists, and lost respectively 0·003,

0·003, 0·001, and 0·001 of a grain; so that two of the crusts weighed each the three hundred and thirtieth part of a grain, and each of the two remaining crusts the thousandth of a grain. Examined by the lens, all the mists were found to consist of brilliant detached points, distributed evenly over the surface, which under the microscope could be readily identified as octahedra. Both the mists yielded by the thousandth of a grain could be easily resolved into octahedra, under an eighth power of the microscope, and one of the two, by the successive removals just described, was found to consist of crystals, which could not be less numerous than 250,000,000 to a grain of metallic arsenic, a number which I believe to be greatly under-estimated. Successive experiments with minute quantities of metal, apparently not exceeding the thousandth of a grain in weight, all yielded the same decisive result: so that I feel justified in stating that by this simple method a crust of less than the thousandth of a grain of metallic arsenic may be identified with ease and certainty."

I shall perhaps commend this plan to the Society if I state than one of the very earliest results accruing from the use of it, was the discovery that metallic arsenic when deposited from its vapour, on cooled surfaces, presents itself in the form of globules. This fact is partly of importance as giving extension and precision to our knowledge of the properties of a most important poisonous substance, and partly as connecting arsenic with other elements with which it was already known to have analogies, I mean sulphur, mercury, and selenium, which, like arsenic, are deposited in a globular form. There are specimens of all these substances under the microscope as well as of some other sublimates obtained in this manner. I need scarcely add that this method gives great facilities for examining the crystals of arsenious acid, which, though usually described (and correctly) as right octahedra, sometimes assume the shape of right prisms, and occasionally, though only rarely (as I have ascertained), the form of the cube.

This is all that the time at my disposal will allow me to say on this modification of the common reduction process. I have still two new adaptations to speak of, one relating to the lens and microscope, the other to the preparation and display of a certain class of microscopic objects. I will describe the first under the title of a "class lens" and "class microscope;" the second I shall call an illuminated cell.

I had long wished to have a lens and microscope so arranged that I could first fix the object to be examined, then adjust the focus, and then send it round to a class of pupils for inspection; for I know by experience how difficult it is, in the common use of the lens, to make the two hands and the light co-operate to a distinct view of the object under examination. Having explained my wishes to Mr. Baker, of Holborn, two days sufficed to place me in possession of what I required. He made me the instrument I now send round for inspection, in which I have not thought it necessary to make any change. He also converted two eye-pieces, which I happened to have in my possession, into class microscopes on the same principle. The construction of the class lens is sufficiently explained by the annexed woodcut, Fig. 2, in which the central figure represents a short brass tube mounted on a handle; the figure to the left, a Coddington lens, inserted in a screw, which, working in the handle, adjusts the focus; and the figure to the right, a cap with female screw, which fits the male screw shown in the handle.

The object, mounted on a glass disc, is dipped into the circular cup represented on the central figure, and it is then fixed in its place by screwing on the cap.

Some of the class lenses are made with a slot, to receive the common microscopic slide, so that the instrument is equally adapted to the disc and to the slides.

It is obvious that this instrument is well adapted to the examination and display of transparent objects. The power is quite sufficient for the identification of crystals of arsenious acid of the size usually obtained, and of other crystals deposited from strong solutions. It is also quite sufficient for the identification of the poisonous microscopic acids, displayed as transparent objects, that is to say, in the form of cuticle. But as it was obvious that the

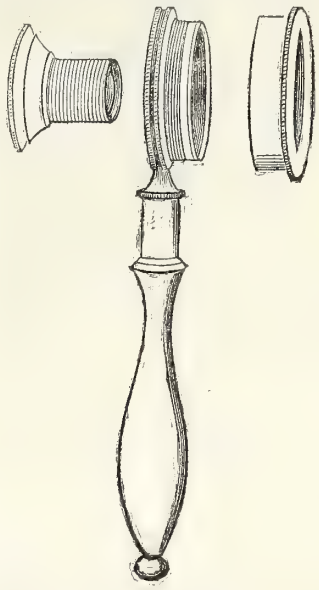


Fig. 2.

instrument, whether used for scientific or popular purposes, would be limited in its use if it were not fitted to opaque objects, I have devised an illuminated cell, which supplied this defect. The cell is shown in section in the woodcut, Fig. 3, in which the curved line represents a circular piece of common tinsel, moulded into a concave form by a small pestle and mortar of box-wood, and with a small central aperture. The silver surface of the tinsel is turned towards the object, mounted on a small disc of black paper, attached to a disc of microscopic glass. The disc of glass is attached by a paper label to the surface of one of the wooden discs, of which I have already spoken, while a small piece of microscopic glass, mounted on another label, fills the central opening of the reflector disc. The second label is attached to the other surface of the wooden disc. This illuminated cell is dropped into the cup of the instrument, with the aperture of the reflector towards the eye, and the object turned from it, and secured in its place, in the manner already described. The illumination thus obtained is found to be sufficient for the complete identification of such objects as microscopic seeds, or for the effective display of popular objects. That this is the case, the specimens I now send round will prove. They are best seen by sloping the instrument so as to look a little from the light, and to cause it to enter the enclosed space obliquely.

Fig. 3.

The lens has been, at my suggestion, placed in a box with the usual microscopic instruments, discs of glass, and gummed labels, to which pieces of microscopic glass are attached. By moistening these labels, objects may be secured to the dics of glass with almost the facility of postage stamps.

I have to add that Mr. Matthews, of Portugal-street, Lincoln's-inn, has devised an ingenious portable instrument, which may be used either as a microscope or telescope, carried in the hand or fixed on a small compact stand. The microscopic portion of the instrument has the same arrangements for fixing the object as the class lens; for the glass discs, the circular cup; for the common microscopic slide, the slot. The instrument is on the table. It seems well-adapted to medical and medico-legal uses.

I must not detain the Society any longer with matters which may seem trifling to some of its members. But I will conclude by expressing a hope that the simple apparatus which I have described for obtaining a new class of microscopic objects, and for rendering the common lens more available in the class room and in the field, and for purposes of amusement and instruction at the fire-side, may not have been deemed uncongenial with the practical and popular objects cultivated by this Society.

I trust, too, that those who are attached to the study of forensic medicine will find the many medico-legal specimens now on the table sufficiently interesting to repay them for the sacrifice of their time.

At the conclusion of his paper, Dr. Guy called the attention of the meeting to an ingenious method of displaying minute natural history objects, adopted by Mr. Charlesworth. This method may be briefly described as follows:—A magnified drawing is made of any minute object, and the paper upon which the drawing is made being cut to any required size, a circular hole is punched with a gun punch between the edge of the paper and the drawing. A piece of millboard, cut to the same size as the paper, is then punched in the same way, and the paper fixed upon the millboard, the circular aperture in one being over the aperture in the other, but the punch used in making the hole through the millboard is a size larger than that used for the paper, so as to render an exact adaptation of the edges of the two perforations unnecessary. This circular hole is next converted into a cell, by simply backing it with a piece of card or thin millboard covered with black paper, and the object is then carefully fixed with gum upon the centre of the dark ground. The drawing is then glazed and bound with paper at the edges, the paper margin being made wide enough to admit of such writing upon it as may be required. The depth of the cell must, of course, be adapted to the depth of the object by using millboards of various thicknesses.

Minute objects, which in public museums are often lost to general visitors, are made instructive by this plan, while at the same time their perfect security against dust or ordinary accidental injury is secured.

DISCUSSION.

The Chairman said he was sure the Society would feel deeply indebted to Dr. Guy for the interesting paper with which he had favoured them, and which presented a great number of points for discussion. The special application of the microscope which Dr. Guy had brought before them that evening—that which had given the title to his paper—and which was undoubtedly of the greatest importance, was its application to the detection of minute quantities of arsenic, either as arsenious acid, or as a sulphide, and the easiest mode of obtaining these in the form best suited for microscopic inquiry had also been pointed out. No doubt, it was a great advantage to get those deposits upon flat surfaces. In the use of the ordinary reduction tube the deposit was made upon the inner surface of a small cylinder, and in that case, if they submitted it to the action of the microscope, they could only have a small portion in focus at once; and practically speaking nothing more powerful than a hand-glass had been usually applied to the examination of these deposits. That was because the form of the tube made it difficult to apply the microscope to it with advantage. Dr. Guy's method was to use a short tube, and to place a disc of glass across the open top of it to receive the sublimate. While speaking of this subject, he would mention another application of the microscope to the detection of minute quantities of chemical substances; and that was in determining whether ammonia was exhaled from animal bodies in an ordinary state of health, in their breath. It had been asserted that such exhalation did take place, though this had also been denied. Within the last few years, however, a series of experiments had been made by Dr. Richardson, by an arrangement very similar to that which Dr. Guy had now brought before them. The plan of Dr. Richardson was to take a tube with a rather wide orifice, shaped like a trumpet, with a bulb below it, the bulb containing a small quantity of hydrochloric acid. Across the mouth of the tube there was placed a slip of glass—(Dr. Guy would use a round disc)—and the breath was made to pass through this tube for some little time. The consequence was, if ammonia was contained in the breath, when it came in contact with the vapour of the hydrochloric acid, it would form chloride of ammonium, which would be deposited in the glass in the form of excessively small crystals. In this way it was shown that ammonia was exhaled in minute quantities from the breath, especially in cases where there had been a surplus of nitrogenous food in the system. He did not mention this fact with a view to start a discussion upon the physiological circumstances under which exhalations of ammonia took place, but rather to show the value of this mode of application of the microscope to inquiries in which very minute quantities of substances were concerned, and the advantage that there was in getting the deposit upon a flat surface, instead of upon cylindrical tubes, which was the old method. Dr. Guy, in connection with this subject, had brought forward a number of interesting applications of the use of the circular disc. He (the chairman) had been so long in the habit of using the ordinary microscope slides, three inches by one inch, that the circular disc did not come so handy to him, as no doubt it did to Dr. Guy himself; and they were all more or less prejudiced in favour of their own methods. At the same time he did not uphold the old plan as that which was best, in fact he saw many advantages in Dr. Guy's system. With regard to the flat surface bottles which Dr. Guy had suggested the adoption of, there again he felt that there were great advantages. Vessels of that kind were most useful in museums. With regard to the new class lens introduced by Dr. Guy, he would remark that the principle employed was a useful one; but no doubt some such arrangements had been carried out by various persons for the purpose of class demonstrations, every one of which might have its own value. In the case of Dr. Guy the variation consisted principally in the application of the glass disc. He believed that many persons used a lens, screwing it into a socket and adjusting it by the turn of the screw. With regard to the illuminated cell recommended by Dr. Guy, he might mention that some very curious specimens of injections had been prepared in a somewhat similar way by Lieberkühn himself, which were in the museum of the College of Surgeons. Each specimen was mounted with its own concave reflector, known as the lieberkühn. Dr. Guy's adaptation of a piece of tinsel for the same purpose was a very great simplification, certainly a much easier method of obtaining a reflector than the grinding of a silver speculum.

Dr. Letheby had great pleasure in stating that he had put into practice in his own laboratory the method employed by Dr. Guy for recognising the presence of arsenic in small quantities, and he, in common with all who practised toxicology, felt thankful for the introduction of any process which rendered the discovery of poisons simple and easy. When they looked at the state of things in this respect at the commencement of the present century, and saw how, little by little, the process had been simplified up to the present day, they must feel great satisfaction at the progress which had been made in the art or practice of toxicology. No farther back than the year 1815, when Donald was tried for the murder of his mother-in-law, in Cornwall, the tests given for the recognition of arsenic were such as made the proof of its existence so doubtful that a jury was unable to convict. A little while before that, the proof of the existence of arsenic by the metallic test, as described by Hahnemann, required ten grains of the poison to make it satisfactory as evidence in a court of law. They had gone on from that time until now improving the processes, and at the present moment they were informed that it was

possible to recognise the presence of even the two hundred and fifty millionth part of a grain of arsenic. The first great improvement, after the process which required ten grains of arsenic for the discovery of the metal, was that of Dr. Black, who so perfected the method of reduction as that he could rely upon the recognition of arsenic when he had only a grain of that substance to operate upon; and when Dr. Christison avowed that he could detect the presence of even the 16th part of a grain, it was thought to be a marvel of toxicological skill, but that evening they were told how to discover the 250 millionth part of a grain. One great advantage of the plan brought forward by Dr. Guy was, that it was applicable to every reliable process that had been advanced for the discovery of arsenic during the last 50 years, and that too whatever might be the material operated upon. It was therefore a most important means for the recognition of arsenic in case of suspected crime. All the steps made in this direction were not only important to science, but they were still more important in a social point of view. They found that the crime of secret poisoning had been practised with so much dexterity that it required considerable skill on the part of men of science to expose it, and he regarded every step towards the simplification of the processes for rendering the recognition of poison more certain as an advantage, not only to the scientific world, but to the community at large. Another point to which he would refer was this, that the application of the microscope to the discovery of poison might be extended beyond the recognition of mineral poisons, as, for example, to the discovery of those poisons which too often baffled the chemist—he alluded to the organic poisons. Means were thus afforded of identifying the crystals of various alkaloids, especially when they were precipitated with appropriate reagents, and the process adopted by Dr. Guy would, in his opinion, elucidate that branch of toxicology, which, no doubt, was at the present time involved in obscurity.

Mr. Wentworth Scott said, that he considered it of great importance that the surface for receiving a deposit of either metallic arsenic or arsenious acid should not only be perfectly flat, but should also possess a tint suitable for showing the microscopic crystals well both by reflected and transmitted light. For this purpose and for some others he had had specially prepared small glasses coated on one side with a thin film of "*opal glass*," both surfaces being very brightly polished, which answered this object so well that he never applied porcelain to the same use. On these opal glasses, a specimen of which he submitted for inspection, the metallic deposit was admirably shown by reflected light, while crystals of arsenious acid were best seen by directing a powerful light through the opal, all the inconveniences arising from the great reflective power of many microscopic objects being avoided by its use. While upon the subject of arsenical deposit, he wished to a say a word against the ordinary form of Marsh's apparatus as supplied by philosophical instrument makers, which he considered as wholly unfit for researches of any practical importance; the bulbs—generally not more than an inch and a quarter in diameter—were far too small for the purpose intended, and he preferred to use a small Wolffe's bottle, fitted with a bulb-tube of more appropriate size. He thought, moreover, that one phenomenon, which he had observed in testing for arsenic and antimony by this process, had not been noticed in any work upon the subject, and that was, that when the animal matter, supposed to contain either metal, had not first been completely oxidised—more especially perhaps, when liver was being operated upon—a deposit was obtained greatly resembling arsenic, and with a distinct metallic lustre, but consisting in reality of carbon, or some peculiar carbonous matter, requiring a very powerful microscope to detect it. He had known many analysts who had been deceived by this appearance, and, although, of course no one ought to be content with a single test, in an investigation of any importance, still he thought that this point should be more prominently brought forward in our schools of science than it was. He had employed sulphuric acid and bichromate of potassa for oxidising, with very good results. He was sure that all chemists must feel indebted to Dr. Guy for the various ingenious appliances he had laid before them that evening, particularly the Lieberkühn arrangement. Some remarks had fallen from the chairman relating to the experiments of Dr. Richardson on the presence of ammonia in the breath, and on the great value of the microscope in detecting it. Having had the honour of being very intimately associated with Dr. Richardson in those experiments, he could fully corroborate the chairman's observations, and he had detected very minute quantities of ammonia in the breath and blood of animals—as little as the ·008 of a grain, and in some cases even less.

The Chairman remarked that as mention had been made of Marsh's process, he should be obliged if Dr. Letheby would give them some information, with respect to a modification of it, which he (the chairman) had found to be a very valuable one, and which he believed was first practised by Dr. Letheby himself, viz. the boiling the zinc which was to be afterwards used in Marsh's tube, with the solution to be examined, first acidulated with nitric acid.

Dr. Letheby, in complying with the request of the chairman, said that when the delicacy of Marsh's test was pointed out by Dr. Christison and other eminent chemists, and when, soon afterwards, Dr. Taylor directed attention to the great value of Reinsch's process, it then occurred to him that by using zinc in the place of copper, taking care that there was no acid present which would evolve arseniuretted hydrogen, that the delicacy of Marsh's test, might be combined with the certainty and facility of Reinsch's process. His plan was slightly to acidulate with nitric acid the liquid suspected to contain arsenic, and having raised it to nearly a boiling temperature he introduced the zinc into it, and in the course of a few minutes, if arsenic was present, the zinc became coated with black metallic arsenic. After a few minutes the zinc was removed and washed with distilled water, and used in the ordinary way for the generation of arseniuretted hydrogen, which was recognised by the usual reactions. He admitted that the process of Marsh for the discovery of arsenic in organic matter was, unless the greatest care had been taken to get rid of all the organic matter, open to many sources of fallacy; but who would venture to decide, merely from the appearance of a black deposit upon a piece of white porcelain, that that deposit was arsenic? It was necessary to follow out the reactions of the black sublimate and to convert it into arsenious acid; and here Dr. Guy's operation could be applied with great facility and advantage. One of the specialities of that process was that the arsenious acid was deposited upon a flat surface, and thus they could detect the nature of the substance, and place its identity beyond all doubt. He was not aware that his zinc process had been largely brought into practice, because so many simple tests were already in existence. With regard to Marsh's and Reinsch's tests, they were both open to one great objection, namely, that they failed to furnish evidence of the *quantity* of the poison found. In using Reinsch's test he had added copper day after day, to the arsenical liquor, and had not been able to get out all the arsenic. When this was desired, it appeared to him that the process of precipitation by sulphuretted hydrogen, as recommended by Christison, was the best; and then it might be followed out by the plan introduced that evening by Dr. Guy.

Dr. Thudichum said that one of the promised advantages of Dr. Guy's new method of obtaining crusts of arsenious acid was its applicability to medico-legal researches. He had paid great attention to the analysis for arsenic in particular, having, on the occasion of a late trial, examined most of the methods formerly or then in use, and he was compelled to say that he did not at present see at what stage of the proceedings Dr. Guy's method would come in usefully. The small reduction-tubes were

at the present day only used for proving the identity of small granules of white arsenic found in vomited matters, or in the intestines, and they would never be superseded by Dr. Guy's short, wide tubes, which rather deserved to be called sublimation tubes. Would the manipulation of Dr. Guy offer any advantages for the discovery of absorbed arsenic? The analysis for arsenic had several stages, which might be described as follows:—1. Destruction of the organic matter. 2. Isolation of the arsenic. 3. Proving its identity. To these another step had to be added, which had been adverted to by Dr. Letheby, the determination of the entire quantity of arsenic present in the matters examined. Leaving out of the question those methods which employed copper or zinc for precipitating the arsenic upon, without first destroying the organic matter, methods which were uncertain, and never yielded the entire amount of arsenic present, there remained three methods for destroying organic matter, the old method of Rose, by nitric acid, of Wöhler, modified by Orfila, who used nitre, and of Fresenius and Babo, in which chlorate of potash and hydrochloric acid were employed. Rose's new method of distilling organic matter with hydrochloric acid must also be mentioned. It yielded all the arsenic in the form of arsenious acid in the distillate, while the other methods yielded arsenic acid. This latter had now to be reduced, and in all analyses the second step, namely, the isolation of the arsenic, had to be effected. This was done by employing sulphuretted hydrogen, sulphide of ammonium, and carbonate of ammonia. The use of this latter reagent, which separated arsenic in a most perfect manner from antimony, had, he believed, been introduced by Mr. Bloxam, of King's College. The sulphide of arsenic obtained was the form in which arsenic could be weighed. Now, although it was already pretty certain that a yellow sulphide obtained by the above analyses, could be only that of arsenic, yet it was proper and necessary to make certain of that point, and as arsenic in its metallic state possessed such properties that it could not be mistaken for any other of the 60 elements, metallic arsenic must be obtained. That could be done by various processes,—by oxydising the sulphide and putting it into a Marsh's apparatus, or by reducing it, according to Berzelius, with cyanide of potassium in a current of hydrogen; or, better still, by reducing it with cyanide of potassium and carbonate of soda, according to Fresenius and Babo, in an atmosphere of carbonic acid; for in the last case the greater part or the whole of the arsenic was obtained in the metallic state, while by the methods of Marsh or Berzelius considerable quantities of arsenic were lost, either remaining with the zinc in the former, or going away with the hydrogen in the latter. Any chemist having thus obtained a black metallic mirror, might and would rest satisfied that he had arsenic before him and nothing else. This arsenic should be kept for demonstration in the court of law. But supposing any person, desirous of further submitting this metallic arsenic to confirmatory tests (a proceeding entirely superfluous, and which he, Dr. Thudichum, would not adopt), then the question arose, would he employ Dr. Guy's method and obtain crusts of arsenious acid? He thought that no analyst would do so, for several reasons. Firstly, there were excellent tests which might be applied to the arsenic in the tube, whereby the smallest loss of substance was prevented. Thus, filling the tube with hydrogen, and driving the metal to and fro by means of gentle heat was one; another was filling the tube with sulphuretted hydrogen, and transforming the metal into yellow and red sulphide; a third was the negative effect of hydrochloric acid gas upon the sulphide. They could even transform the arsenic in the tube filled with air, into crystals of arsenious acid, without using Dr. Guy's method. This latter method, on the other hand, required the removal of the arsenic into a little wide tube, a most difficult proceeding, and afforded no security against loss during sublimation, the tube not being hermetically closed, while the tubes adverted to by the speaker were kept hermetically closed during the operation. Then, ultimately, they had a few crystals, to be looked at with the microscope. This test was not only less characteristic than any of the chemical tests by transformation, but was also quite unnecessary. He (Dr. Thudichum) had for years made endeavours to use the microscope as a means of diagnosis in chemistry, and he must say that every day convinced him more and more that that instrument was useless for the purpose of ascertaining the chemical nature of substances from their shape. This micro-chemistry might, he was afraid, lead to very serious errors. The very example adduced by the chairman in favour of that method, he would use as a proof of its fallacy. Crystals had, no doubt, been sometimes obtained from the breath by the means adverted to, but whether those crystals were chloride of ammonium, or of the many hundred substituted ammonias, or whether they contained any ammonium at all, there was not the slightest evidence to show. The appearance of crystals of the chlorides of all the volatile Amine bases was so nearly the same, that he (Dr. Thudichum) should despair of distinguishing them from each other by the microscope. In conclusion, he assured the meeting that neither Dr. Guy's nor any other method would discover the 250-millionth part of a grain of arsenic anywhere, as had been implied by what fell from Dr. Letheby. One five-millionth of a gramme of arsenic was the outside of what could be discovered at a time, as had been proved by the French Academy in 1840 on the occasion of the trial of Lafarge. Nevertheless the analysis for arsenic, if not the most easy and certain process in analytical chemistry, was certainly one of the most reliable and best understood, and if errors arose in the course of such an analysis, not the method, but the exetution was imperfect. To the medico-legal chemist Dr. Guy's method at present would not afford any advantage; but it was a beautiful, and, (as could be seen from the many fine specimens on the table), in the hands of its inventor, a highly successful mode of producing minute sublimates, not only of arsenic but also of other volatile substances, suitable for demonstration in lectures and for amusement at the microscope.

Mr. Wentworth Scott would claim the indulgence of the meeting for a few moments longer, as he wished to make some cursory comments upon the observations of the last speaker. He must refer Dr. Thudichum to Dr. Richardson's Essay on the Blood, wherein it was distinctly stated that the presence of no particular ammonia had been determined. All that was sought to be proved was, that the solubility of the fibrine during life was due to an exceedingly minute quantity of an ammonia or volatile alkali of some kind. Every chemist was aware of the immense number of ammonias that existed, chiefly eliminated by the splendid researches of Hofmann, and of the very great similarity of appearance which the crystals of their chlorides presented under the microscope, but no one of any experience in such matters could for a moment mistake the chlorine compound of an ammonia for the chloride of anything else. He believed that a special ammonia was present in the blood of each distinct animal or class of animals, and trusted that the day was not far distant when this point would be determined. It might, perhaps, be unwise to speak of experiments as yet very imperfect, but he was under the impression that a methyl-ammonia was the solvent peculiar to the blood of sheep. He could not agree with Dr. Thudichum as to the uselessness of the microscope in medico-legal and other inquiries. He considered that it was an instrument of very great value, and one which no chemist could well dispense with. As regarded the processes he (Dr. Thudichum) had spoken of for the detection of arsenic, &c., they were all very well when there were five or six grains of the metal present, but were much too complicated when only very small quantities could be expected. Everyone would allow that simplicity

was the chief point to be held in view in these matters, and here the microscope was an important aid. He would mention, in conclusion, that if the organic substance under consideration were carefully dried at a very low temperature, and then treated with absolutely pure benzole, the whole of the fatty matter could be extracted, and the oxidation process would then be comparatively easy.

Dr. Guy, in replying upon the discussion said he was sorry that it had branched off into a subject which he had not intended to introduce before the meeting. His only object was to present a few mechanical arrangements which might be adapted to medico-legal purposes according to circumstances, and it was not his intention to lead to a discussion of a chemical nature, with regard to the various tests applicable to the discovery of the existence of arsenic. He felt indebted to his friend Dr. Letheby for the opinions he had expressed upon this subject, and upon another occasion he should be prepared to discuss the objections which had been made by the other gentlemen who had spoken. He begged to correct a misapprehension into which Dr. Letheby had fallen. He had not stated that so small a portion of arsenic as the two hundred and fifty millionth part of a grain could be detected. What he had said was, that the thousandth part of a grain would yield crystals, each of which might be calculated as weighing the 250 millionth of a grain. He begged to differ from Dr. Thudichum as to the value which he had put upon mechanical tests of this description. He did not hesitate to say, irrespective of all preceding steps or stages of the investigation, that if he found upon a glass disc, used in the manner he had described, a dew or mist of crystals which were resolvable under the microscope into octahedra, there was no doubt in his mind that what he had upon that glass was arsenious acid. Strychnine was obtainable in the form of octahedra, but not as a mist upon a piece of glass produced by sublimation. This could only be a result from the presence of arsenious acid. He also wished to correct a misapprehension that this process was only applicable to the recognition of metallic substances. It was as applicable as the ordinary reduction-tube to all kinds of sublimates. It was nothing more than the substitution of a short tube for a long tube and covering the open end with a piece of glass.

The Chairman then proposed a vote of thanks to Dr. Guy for his valuable paper.

The vote of thanks was then passed.

The Paper was illustrated by experiments, showing the mode in which the apparatus invented by the author was employed for obtaining sublimates; also by a collection of microscopes and microscopic objects contributed by Mr. Baker, and various specimens of museum cells and photographs mounted on glass, contributed by the Messrs. Powell. Specimens, mounted by Mr. Charlesworth's method, above described, were on the table.

The Secretary announced that on Wednesday evening next, a paper "On the Prevention of Forgery, arising from the Alteration and Falsification of Bankers' Cheques, Notes, &c.; with a Description of a Method of Manufacturing Writing Paper having the property of rendering Common Writing Ink Unalterable by Time or Fraud," by Mr. Robert Barclay, would be read. The paper will be illustrated with a variety of specimens. The chair will be taken at eight o'clock.

BUILDING CONSTRUCTION.

The following paper on this subject was set at the last Examination, held by the Department of Science and Art, for certificates in Science. Examiner, T. Bradbury, Esq.:—

(One Day. Seven Hours Allowed.)

[The different materials to be indicated by colours—as lake for brickwork, yellow for timber, Indian ink for stone, and blue for iron.]

A very substantially built warehouse, 110 feet long, 43 feet broad, with a basement story 7 feet high, and four stories above ground each 9 feet high in the clear, the warehouse to be divided into two by a cross party-wall 40 feet from one end: the whole basement story to be covered with groined arches on square brick piers, the ground floor to be paved with stone, laid on concrete on the back of the groining.

The upper floors of the larger division to be of girders carried on cast iron columns with bridging and flooring joists, and elm flooring boards, provision being made by trimming for a cast iron winding staircase to rise the whole height of the building; the roof to be a queen post roof with tie-beams, principals, &c., to allow a centre garret lighted by skylights in the roof, which is to be slated. There are to be two small rooms partitioned off on the ground floor, each with a fire-place, one for an office, the other as dwelling room for a porter.

The smaller division of the warehouse to be built fire-proof throughout, the floors to be of sheet iron plates laid on cast iron frames supported on the flanges of iron beams, resting on iron columns; the roof to be of iron, open to the upper story, one iron door in a stone frame in each story to be the only communication between the divisions; two windows with iron frames in stone in the front and back wall of each story of this part.

The larger division to have also two windows with wooden sashes and frames set in reveals, and a door in each upper story in the front wall next the street, with a drawbridge platform for landing goods from carts, the door to be closed by the platform when raised. An iron swing crane on stone corbel at the upper floor.

Section I.

Prepare the following drawings to represent the above warehouse.

1. A plan of the basement story with the piers for the groined arches.
2. A plan of the ground floor with the two dwelling rooms.
3. A complete cross section to show the walls, floors, roof, &c., with the party wall.

Section II.

1. A plan of the timbers of one floor with a section. (The flooring joists need be shown only in one compartment.)
2. A plan of the beams, frames, &c., of the iron floor, with detailed sections to show the constructions.
3. The timber truss for the roof, with plan and sections to show the framing.

Section III.

1. The elevation of the front next the street.
2. A longitudinal section from end to end, showing the windows, &c., in the back wall.
3. A drawing for the spiral staircase, with detached detail figures, to show the connexions of the several castings.

Section IV.

1. A working drawing of the entrance door, showing its frame, cill, pannelling, &c.
2 A drawing of one of the iron window frames and sashes.
3. A drawing of the wooden sash and frame for the office, showing the frame, boxings, shutters, &c.

Section V.

1. A section of the blocking course, gutters, and beams,

wall plates, and framing of principals into the tie-beams, &c.

2. A drawing to show one of the cast-iron pillars to carry the floor, to show how it carries the girder, and is also bolted by stirrups to the cap of the pillar in the story beneath, also the section of the iron girders, their mode of carrying the frames, &c.

3. A drawing of one door, with drawbridge platform, shewing the mode of raising and lowering it, its construction, and how it is to fit into the frame partly to close the door when raised, the rest being shut in by a flap shutter.

Section VI.

1. Write out a specification for the brickwork throughout.

2. Write out a specification for the timber and joiners' work.

3. Write out a specification for the stone and iron work.

N.B.—Each candidate to make his drawings and specifications accord as far as they go.

Section VII.

1. Draw a timber truss for a foot bridge of 30 feet span, with a cross section of the bridge.

2. Draw a timber truss for a partition of 30 feet span to have two doors in it, and to be independent of support by the floor beneath.

3. Design the centering for an elliptic stone arch of 60 feet span, and 18 feet rise, showing the mode of striking it gradually by withdrawing wedges.

Section VIII.

1. Show two or three modes of scarfing timber beams of long bearing.

2. Show how you would strengthen such a beam by an iron truss without cutting into the beam.

3. Show by the plans, of two courses at least of each, the bonding of brickwalls from one brick to three bricks thick.

Section IX.

1. Show by a section and part elevation the construction of a wharf wall built on piles, faced with granite, with retaining counterforts, with timber fender piles to keep off vessels.

2. Show the framing for an octagonal wooden spire 35 feet high, to be raised on a church tower 12 feet square.

3. A chimney 130 feet high to stand detached, to have four openings into it below ground with occasional courses of masonry, a granite coping, and provision for a lightning conductor.

INVENTIONS IN WOOLLEN MACHINERY.

On Monday, the 12th of March, a meeting of the Leeds Woollen Manufacturers' and Merchants' Association was held at the offices of the Chamber of Commerce, Leeds, for the purpose of receiving some information with respect to a new machine for certain processes in the manufacture of woollen cloths, invented by two French gentlemen, M. Tavernier and M. Vouillon, which is described by the patentees to be capable of "converting slivers or rovings as they come from the carding engine by felting and friction into threads suitable for weaving, without the intervention of any spinning machine."

M. Tavernier attended the meeting, and stated that the machine had been shown at an Exhibition lately held at Rouen, and a special gold medal had been awarded to it by the Emperor of the French, at the request of the manufacturers from nine departments. Several of the machines, it was stated, were at work in France, and amongst the merits ascribed to the invention were, that it prevented the necessity of the use of oil and sizing in the preparation of the raw material for weaving, besides, of course, superseding the necessity of spinning machinery. M. Tavernier further stated that by this machine a saving of thirty per cent. in the quantity of wool used in making cloth, as compared with the ordinary process, might be effected. He exhibited some threads which had been produced by it, and invited the members of the Association to see the principle of the invention practically manifested at the establishment of Messrs. Taylor, Wordsworth, and Co., machine-makers, Leeds.

The Association appointed a deputation to inquire further into the merits of the invention, and to test its practical utility by having a quantity of wool worked up with one of the machines (which M. Tavernier stated that he would have ready in the course of a month), then manufactured into cloth, and properly finished, in order to see whether the patent produced the threads successfully, and whether they at all depreciated in value either by this or any subsequent process necessary to perfect the manufacture of cloth.

The President of the Association, Mr. Dainton Lupton, subsequently brought under the notice of the meeting an invention of another French gentleman, M. Sylvester, for manufacturing cloth, the principle of which consists in wrapping a woollen thread round a cotton warp. A sample of cloth made by it was exhibited, which the inventor had stated could be manufactured seventy-two inches wide at 3s. per yard. The components of it were said to be :—

Cotton thread	26	per cent.
Pure wool.....	10	,,
Mungo of good quality	30	,,
Mungo of ordinary quality.....	35	,,

Several of the members of the Association, after examining the specimen produced, said that it was exceedingly cheap if it could be manufactured at the price stated, and none could be made like it in Yorkshire for the money.

It was stated, however, that the principle of the machine was by no means new, having been tried in this country in connexion with other branches of manufacture, and failed.

It was further added, that hitherto the French cloth manufacturers had not been able to compete with the English in low-priced goods.

Eventually it was agreed that the President should request M. Chevalier to examine one of the machines in France, and favour the Association with his opinions as to its merits.

MAGNETO-ELECTRIC LIGHT FOR LIGHT-HOUSES.

Professor Faraday in a lecture delivered at the Royal Institution on Friday the 9th of March, says:—"By means of a magnet, and of motion, we can get the same kind of electricity as from the battery; and under the authority of the Trinity House, Professor Holmes has been occupied in introducing the magneto-electric light in the lighthouse at the North Foreland; for the voltaic battery has been tried under every conceivable circumstance, and I take the liberty of saying it has hitherto proved a decided failure. Here, however, is an instrument wrought only by mechanical motion. The moment we give motion to this soft iron in front of the magnet, we get a spark. It is true in this apparatus it is very small, but it is sufficient for you to judge of its character. It is the *magneto-electric* light, and an instrument has been constructed consisting of a number of magnets placed radially upon a wheel—three wheels of magnets and two sets of helices. When the machine, which is worked by a two-horse power engine, is properly set in motion, and the different currents are all brought together, and thrown by Professor Holmes up into the lantern, we have a light equal to the one we have been using this evening. For the last six months the North Foreland has been shining by means of this electric light—beyond all comparison better than its former light. It has shone into France, and has been seen there and taken notice of by the authorities, who work with beautiful accord with us in all these matters. Never for once during six months has it failed in doing its duty;—never once, more than was expected by the inventor.

It has shone forth with its own peculiar character, and this even with the old apparatus—for as yet no attempt has been made to construct special reflectors or refractors for it, because it is not yet established. I will not tell you that the problem of employing the magneto-electric spark for lighthouse illumination is quite solved yet, although I desire it should be established most earnestly (for I regard this magnetic spark as one of my own offspring). The thing is not yet decidedly accomplished, and what the consideration of expense and other matters may be, I cannot tell. I am only here to tell you, as a philosopher, how far the results have been carried, but I do hope that the authorities will find it a proper thing to carry out in full. If it cannot be introduced at all the lighthouses, if it can only be used at one, why really it will be an honour to the nation which can originate such an improvement as this,—one which must of necessity be followed by other nations.

"You may ask, what is the use of this bright light? It would not be useful to us were it not for the constant changes which are taking place in the atmosphere, which is never pure. Even when we can see the stars clearly on a bright night it is not a pure atmosphere. The light of a lighthouse, more than any other, is liable to be dimmed by vapours and fogs, and were we most want this great power, is not in the finest condition of the atmosphere, but when the mariner is in danger, when the sleet and rain are falling, and the fogs arise, and the winds are blowing, and he is nearing coasts where the water is shallow and abounds with rocks—then is his time of danger, when he most wants this light. I am going to how you how, by means of a little steam, I can completely obscure this glorious sun, this electric light which you see. The cloud now obsuring the light on the screen is only such a cloud as you see when sitting in a train on a fine summer's day; you may observe that the vapour, passing out of the funnel, casts as deep a shadow on the ground as the black funnel; the very sun itself is extinguished by the steam from the funnel, so that it cannot give any light; and the sun itself, if set in the lighthouse, would not be able to penetrate such a vapour.

"Now the haze of this cloud of steam is just what we have to overcome, and the electric light is as soon, proportionally, extinguished by an obstruction of this kind as any other light. If we take two lights, one four times the intensity of the other, and we extinguish half of one by a vapour, we extinguish half of the other, and that is a fact which cannot be set aside by any arrangement. But then we fall back upon the *amount* of light which the electric spark does give us in aid of the power of penetrating the fog, for the light of the electric spark shines so far at times, that even before it has arisen above the horizon twenty-five miles off, it can be seen. This intense light has therefore that power which we can take advantage of,—of bearing a great deal of obstruction before it is entirely obscured by fogs or otherwise.

"Taking care that we do not lead our authorities into error by the advice given, we hope that we shall soon be able to recommend the Trinity House, from what has passed, to establish either one or more good electric lights in this country."

Home Correspondence.

ON TOWN SEWAGE.

Sir,—Being one of those who, from want of time, were not able to join in the discussion of Mr. Alderman Mechi's paper "On the application of Town Sewage to a large agricultural area," &c., I beg to submit to the readers of the *Journal* a few observations on some of the points at issue.

With regard to Mr. Alderman Mechi's illustration of the applicability of dilute town sewage for agricultural purposes, founded on the fact that the average annual manuring per acre of the cultivated land of the United Kingdom is acted upon by a much larger proportion of water (in the form of rain-fall) than is the human excretal matter in town sewage, surely little need be said. I may, however, mention in passing that, adopting Mr. Alderman Mechi's own figures, both as to the area of land under cultivation, and as to the number of animals of various descriptions yielding manure to it, I think he underrates the average manurial matter per acre when he reckons it from the data in question, as equal to that of two sheep only. There would, besides, be the whole of the unconsumed litter and of the purchased manure of all kinds to take into account in any such calculation. Even then, in the sense supposed by Mr. Mechi, "the ordinary farm manurial resources" are not diluted in anything like the degree he assumes, beyond the point of dilution of the excretal matters, &c., in town sewage. But, granting that they were so, just for the sake of argument, I am sure I need not tell Mr. Alderman Mechi that such a fact would have no direct bearing on the question of the utility of dilute town sewage for agricultural purposes, and none whatever on that of its economical application.

Let us suppose, however, with Mr. Mechi, that the excretal matters of two individuals of a mixed population will be equal to those of his two sheep, and that, whilst those of the latter will, on his view, be diluted with about 2,600 tons (26 inches) of rain, those of the two individuals will be mixed with only 160 tons of water. Now, the excretal matters of the two individuals, if brought to about the same condition of dryness and non-putrescence as the best Peruvian guano, would correspond very nearly, both in weight and in money value at the present ratio, to 1 cwt. of that imported manure. But the question we have to consider in regard to the town sewage is, not whether, supposing we could get the excreta of the two individuals on to the acre of land at the cost of, say, 13s. 4d., if in the portable form of guano (that is, the lawyer's fee of 6s. 8d. for the excrement of each individual), we should then be glad to have them acted upon in the soil by an extra 160 tons (1·6 inches) of rain coming from heaven both gratis and piecemeal; but it is surely whether, if the 13s. 4d. worth of constituents were mixed with 160 tons of water in London (or some other large town), the farmer could then get them delivered on to his land at a cost equivalent to their assumed value.

But to leave this point. Taking together Mr. Mechi's paper read before the Central Farmers' Club a few weeks ago, and that read at the Society of Arts on Wednesday last, I think I represent his views correctly when I say that, taking the population of London at 3,000,000, and the amount of sewage per head per annum at 80 tons, he proposes the whole should be distributed over 500,000 acres. For the sake of simplicity and brevity, I shall confine myself on the present occasion to indicating, from one particular point of view, some of the conditions and requirements involved in the accomplishment of such an end; and I shall endeavour to do so in such a manner as to aid in providing a starting point for the consideration of those who may wish to form an estimate of the practicability, in a remunerative point of view, of the distribution of the sewage of London over such an area.

Adopting the figures just quoted, the excretal matters, &c., of six individuals of the mixed population, of both sexes and all ages, would be appropriated to each acre of land. The constituents of the excreta of these six persons, if brought to the same condition of dryness and non-putrescence as Peruvian guano, would be worth as much as three cwt. of that substance—say 40 shillings, or 480 pence. But these 480 pence worth of excretal matter (at the rate of 80 tons per head, per annum, of water supply and rainfall), would be distributed through 480 tons of water. It is obvious, therefore, that we have only to suppose the cost of distribution of the sewage over 500,000 acres, to be at the rate of one penny per ton, and the manure of each acre would, on such a supposition, cost for distribution alone, 480 pence, or forty shillings—that is

to say, exactly the estimated value of the constituents if taken to, and put upon the land, in the portable condition of guano. There would then, on this supposition of cost of distribution, and taking the estimated value of the constituents of manure as above assumed, be no margin whatever left for payment to the citizens for their manure. It is for those who propose the investment of capital for the distribution of London sewage over such an area, to show at what cost they could accomplish their end—all difficulties and charges taken into consideration. They must also consider on the one hand, how far manurial constituents will maintain their present estimated money value, when such a large additional quantity is brought into the market; and, on the other hand, how far the fact of the constituents being distributed over the land in a large bulk of water, would increase or diminish their value.

But so far as the experience of liquid manure farms can be called to our aid, the conclusion would be that the sewage would yield the most produce if applied either exclusively to grass land, or, in the case of rotation, almost exclusively to the grass crop of the course. Now 500,000 acres is certainly much more than would be necessary to receive the sewage of London if the whole were under grass. Let us, then, for the sake of argument, suppose that it were under a four-course rotation, and that, in accordance with the experience of the most successful Ayrshire liquid manure farms, the whole, or nearly the whole, of the liquid, were put upon one-fourth of the land (the grass-crop) each year. We should then have costly arrangements for the distribution over 500,000 acres, at the rate of 480 tons of liquid per acre, per annum, whilst only 125,000 acres would receive the liquid each year, but at the rate of 1,920 tons of liquid per acre. It may be asked, would the advantages derived by the three other crops of the course, either from the occasional direct application of sewage to them, or from their following on the broken-up sewage-manured grass land, compensate for a somewhere about four-fold expenditure for distribution?

Supposing this question were answered in the negative, the obvious conclusion would be, to confine the distribution to grass-land. Nor do I think there need be much doubt that, if the application were so confined, the area might be considerably below 125,000 acres, to secure the maximum crops over a given area. The area here supposed would imply that about 2,000 tons of sewage, containing the excreted matters, &c., of about 24 individuals (equal in present estimated money value of constituents to about 12 cwts. of Peruvian guano), are to be applied to each acre of grass-land. But the question arises, whether it would not be more economical to limit the area of distribution at the cost of what might otherwise be considered as a waste of manurial matters. Concluding that it would be so, Mr. Lawes has suggested that, in this point of view, it might possibly be found desirable to apply, as a maximum, the enormous amount of 10,000 tons of dilute sewage per acre annually. This, taking a population of 2½ millions, and 80 tons of fluid per head annually, would require an expenditure for distribution to only 20,000 acres; and, at the rate of 3 millions of population, 24,000 acres. He at the same time stated, that the exact point at which, in a certain sense, waste of manurial constituents would be compensated by limitation of area, could only be settled by actual experience. In regard to this point, it should be borne in mind, however, that when the area is limited beyond the point at which a given amount of manurial constituents is the most productive, they cannot then be estimated at the same rate of value as when they are used in the proportion of their maximum productiveness.

It cannot for a moment be doubted, that an enormous increase of produce would result from the application to the land of the excretal matters of our town populations; and certainly, least of all, could those doubt it, who, like Mr. Lawes and myself, have devoted so much time and labour in investigating the chemical and agricultural bearings of the subject, Nor can it be doubted that these excretal matters, even when distributed through the enormous bulk of water as in town sewage, would, if judiciously applied, enormously increase the produce, particularly of certain crops. But is there, in these admissions alone, any basis upon which to conclude that the increase of produce would be obtained remuneratively?—Certainly not. All the evidence that can be adduced, showing the enormous increase of agricultural produce from the use of dilute liquid manure, is utterly irrelevant to the question, in a commercial point of view, unless it can, at the same time, be shown that such an increase can be obtained at a profit. The question of the application of town sewage, is, in fact, one not of increase of produce alone, but of increase of produce at a given cost. It is for those who believe that the increased production can be obtained at a profit, to prove the strength of their convictions, and the trustworthiness of their data, by largely investing their own money in a scheme for its accomplishment. And whether they succeed in making or in marring their own fortunes, the nation will owe them a deep debt of gratitude.

Should it happen that the excretal matters of our town populations cannot at all, or only in small proportion, be rendered profitable for agricultural purposes, when once diluted with the enormous quantity of water which our modern sanitary arrangements require, we shall have to decide between the loss of this large source of manurial constituents, and some plan for collecting them more nearly in their natural state of hydration than they occur in London sewage—in which there are about 4,000 parts of water to 1 part of the dry substance of human excretal matter! True it is, that each individual dwelling is the most perfectly cleansed of its own excreta by the use of large volumes of water; but this is not all gain, even in a sanitary point of view, so long as the excretal matters are thus carried into the nearest river, polluting the water perhaps of the immediate population, and also of all it may pass before it finally reaches the sea. We cannot, however, conceive of any exigency that would justify a return to the old cesspool system. But if it should be maintained that chemistry and mechanics, conjointly, cannot suggest a plan for collecting the excreta of our town populations, at once in a portable and in an innocuous form, it must at the same time be granted, that they have at present been no more successful in carrying them off by water, without simply removing them from one sphere of mischief to that of another, discharging them unused into the sea, or both.—I am, &c.,

J. H. GILBERT.

Harpenden, St. Alban's, March 9th, 1860.

Sir,—Mr. Mechi, in his remarks concluding the discussion upon town sewage, objected to my having put a value for grass of only 7s. per ton, saying that "mangold wurzel was worth 14s. or 15s. per ton, and grass was worth more." I will acknowledge this to be true, if the value of it is considered *per mensem* instead of only per annum; if it is taken for those months when irrigation will produce grass where otherwise none would be obtained. This I believe to be a valuable point in the liquid farm manure system, but there is a possibility of the liquid being put on at a cost too great to pay. Also, if you take the value of grass in particular localities it will be fully worth that sum. Near London it is frequently sold for £1 a ton. But is it worth more than what I have stated for meat-producing purposes? and I was forced to allude to it as such in my argument, when I was speaking of Mr. Dickenson's recommendations, and Mr. Telfer's and other men's practice, and I said that it was easy to show by figures that there could be no great profit, but rather loss, in the system of pipes, hose, and jet,—even with their amazing crops. Root crops are put down by nine farmers out of ten as not returning more than from 6s. to 7s. 6d. per ton. At a meeting of the Oxford Farmers' Club it was "put and adopted 'That in the opinion of this club 7s. is the value of a ton of Swedes, 5s. of white turnips, and 8s. of mangold

wurzel;'" and "grass land," says Mr. J. C. Morton, when averaging the value of grass for meat production, "worth 30s. per acre rent, may be supposed to yield 8 tons of green grass per acre per annum; and this may be able, by careful consumption, to produce £3 3s. in beef, at 6d. per lb." This, I think, will prove that I have not under-estimated grass. For my own part, I would be very glad if the contrary was the truth, as it would add to the value of my proposition for the application of town sewage to grass land. Certainly for the grass near London, which I propose to be grown by sewage irrigation, I take an estimate of a high value for the crops.

Mr. Sidney says, "Mr. Halkett had valued sewage at 2d. per ton. There was one ton of solid sewage to 600 tons of London liquid sewage. A ton of solid night soil could be delivered in Kent for 10s. In 600 tons of water, at 2d. a ton, it would be worth just £5, and he was at a loss to understand how 10s. worth was made into £5 by adding water." The answer is a very easy one; the liquid part is much more valuable than the solid, and in night soil the liquid part has mostly drained away and been lost. Professor Way says that 84 to 89 per cent. of the total ammonia (nitrogen) in the sewage exists in the soluble state. To give a fact in confirmation, I may state that at Rugby, where the portion of the daily sewage which may not be wanted by Mr. Walker is filtered through tanks, and flows into the river, the solid part, which is obliged to be used upon the land, is considered hardly worth the cartage. The value of this solid must be much less, therefore, than even 10s. a ton. But what is the value of solid and liquid before it is allowed to be lost. Dr. Hofmann, who was commissioned to examine the sewage, says, "The following are valuable in an agricultural point of view:—nitrogen, 6·7; phosphoric acid, 1·8; potash, 1·0; organic matters 30·7; total, 40·2 grains per gallon of sewage. The total solid matter per ton, taking guano at £11, would have a money value of £6 0s. 3d.," instead of 10s. He adds, "The money value of sewage, therefore, is 2d. per ton. These numbers are, to a certain extent, confirmed by the calculations of the value of the solid and liquid excrements of the whole population of London. The foundation of this calculation is confirmed by the analysis of a variety of specimens of sewage made by ourselves and by others. The chemical composition of the sewage of Edinburgh, and also that of Leicester, differs little from that of London." Again, I say, facts prove the chemist right, for, although the solid parts alone are not of great value, the solid and liquid together at Edinburgh have raised land, before nearly worthless, to a value (estimated by a jury at 33 years' purchase of the rent for the grass) of no less than £660 per Scotch acre, or £528 per imperial acre, and the annual interest upon the outlay is 100 per cent.

The value which I have taken for London sewage and liquid manures is that of the most eminent chemists in England, and in all the cases which I have yet examined, I must say that their analyses are perfectly in accordance with the increased growth of the crops. For more upon this question I must refer to my pamphlet, which may be had at Ridgway's, Piccadilly. I will only give two examples, and these extreme ones, to show that, whether strong or weak liquid is used, such is the case. Mr. Dickinson, who had 14 years' experience of irrigating with liquid manure, recommended no less than the enormous sum of £25 per acre for two years manuring in guano and nitrate of soda, to gain the same results as from the strong liquid manure, namely, one part of horse urine to from two to four parts of water, which he used. The value of this liquid, according to M. Bousingault's analysis for horse urine, would be about 40 pence per ton, and about 100 tons per annum per acre used to be put on, giving a value equal to £33 per acre for two years. My second case is at Milan, with so weak a sewage as one having six times more water, and a value of about one-eighth of that of London, or a farthing per ton, and where 8000 tons are put on in the year, practice has found that there is a difference of £4 8s. per acre advantage to those meadows irrigated with sewage over those with plain water; and solid manure is, therefore, constantly put to the latter, but never is any put to the former.

In irrigation of land, the commercial considerations to be taken into account when proposing the application of farm liquid manure, sewage, or plain water are quite different. The usual confusion of ideas among several speakers respecting these three, was evident last meeting. It will be observed above, that the difference in the manurial value of Mr. Dickenson's at 40 pence per ton, and that of Milan at a farthing per ton, is positively greater than that between guano at £12 10s. per ton and farm yard manure at 5s. per ton—or, in other words, greater than 50 is to one, which is the proportion between the two latter. The same reason, therefore, which holds good that farm yard manure cannot be carted 20 miles without the absorption of its entire value in cartage, while guano may be carted very much further because it would take 50 times 20 miles=1000 miles before its entire value would be lost in cartage, and it can profitably be freighted by ship from South America, is the reason why a great difference must be made in the consideration of the conveyance of these liquids. While the system of steam, with hose and jet, is the only one practicable for arable land, farm liquid manure may be allowed to be thus used, although it costs, according to Mr. Mechi, 2d. per ton to deliver the liquid. But with weak sewage it can only be put on, as at the Edinburgh meadows, by steam and gravitation, and where it costs but one-thirtieth of the above, namely, 1d. for fifteen tons. This, therefore, I maintain must be the system for the London sewage.

I am, &c., P. A. HALKETT.

Sir,—I quite agree with Mr. Rawlinson, that "a great question like that of the application of town sewage must be settled by stern reality and practical investigation, and cannot be forwarded by mere assertion;" but when he says that my statements as to the liquid manure farms "ought not to go forth to the world as truth," I think I have a right to give and ask for some explanations. Mr. Alderman Mechi has, he told us, "circulated gratuitously, among some hundred Institutions connected with the Society of Arts" a pamphlet, which, after being printed, he read at a meeting of our Central Farmers' Club. (Had the paper been in MS., I have no doubt Mr. Mechi would have modified some of the statements.) In that pamphlet he distinctly states that the liquid manure theory he recommends had been, and was being, profitably carried out by Mr. Kennedy, at Myremill, and by Mr. Telfer, at Cunning Park. That is to say, he reprinted a statement that had been quoted repeatedly during the last seven years by the advocates of pump and underground pipe irrigation.

There is no doubt about the extraordinary green crops that these gentlemen formerly produced; crops of grass and hay quoted, at a celebrated Tiptree Heath gathering by a visitor, with the view of "covering British farmers with shame" at their short grasscrops, to quote Mr. Mechi.

In answer to Mr. Mechi's illustration of liquid manure success on the Scotch farms, I stated, on the authority of eminent Ayrshire agriculturists, that Mr. Kennedy, a wealthy banker, after expending thirty thousand pounds on his farm, of which eighteen thousand was lost on farming, retired from farming, and in 1857 let his Myremill on lease. "The present tenant only uses pipes, which are laid over the whole 300 acres, for washing guano into a small part devoted to Italian rye grass." That is the first case. Next I will take Cunning, Mr. Telfer's. His farm was, perhaps, the neatest and most productive dairy farm of its size in the kingdom, yet for two years before the farm was discontinued the famous ryegrass crops were replaced by early potatoes. Finally the farm was sold.

Now it is possible that Mr. Kennedy's losses of three thousand a year for six years may have been occasioned by bad management and by bad farming, and not by the ex-

penses of his three hundred acres of pipes, but we heard nothing of bad farming as long as it was supposed to show a specimen of the liquid theory. But the question is, Can anyone show that Mr. Kennedy ever made a profit? and if he did not make a profit, his example, with which our farmers have been so long taunted, is not worth anything. It is also possible that Mr. Telfer made a profit by his farm, and lost money only by his mercantile transactions. But I am otherwise informed. At any rate it will not be difficult to prove how the profits really stand, because full accounts must have been rendered to Mr. Telfer's creditors in bankruptcy. Anyone who will take the trouble to inquire among the Ayrshire farmers will find the opinion universal that Mr. Telfer ruined himself by growing extraordinary crops at a loss. If Mr. Rawlinson can prove the contrary, so much the better for the liquid manure theory. But, at any rate, with Scotch evidence that I had before me, I was justified in protesting against Mr. Mechi quoting, as examples of success and profits, Myremill and Cunning-park.

Another speaker, who followed Mr. Rawlinson, also accused me of misquoting Mr. Lawes in order to misrepresent him, "making him (Mr. Lawes) to say what he did not say." Let the following extract from Mr. Lawes paper in the *Journal* of the Society, March 9, 1855, p. 277, show whether I am exact or not. Mr. Lawes said "For corn crops an enormous supply of liquid manure is certainly not well suited. The influence of season fixes an easily reached limit to the produce of grain, which cannot much exceed £12 or £14 per acre. For market-gardens liquid sewage does seem well suited."

Mr. Chadwick, on that occasion, understood, as I did and do, that Mr. Lawes would not use liquid sewage for corn crops, for he said, "Mr. Lawes had spoken of sewage as best suited for grass lands. Now there was no warranty for this limitation. Sewer manure had been applied to cereals and every species of garden production with complete success." And two years later, Mr. Chadwick backed up his assertion by quoting Rugby and "three years' increasing crops, last year at the rate of 50 bushels an acre, by the use of sewage alone." But the readers of the *Journal* will remember that the Rugby example proved even more mythic and delusive than Myremill and Cunning-park, for the Scotch farms did get great crops of grass, while at Rugby the ten-acre plot tried with wheat failed utterly!

These reckless assertions and wild exaggerations of value and profit by liquid manure theorists are very much to be regretted, because there is no doubt it would be better in many instances, even if at some loss, to turn liquid sewage on chalk, sand, and gravelly soil, than to poison our trout streams and mill streams. But there is no chance of persuading towns to incur the needful expense as long as they are told that farmers ought to give great rents for a liquid which they only require a few times in the year.

In the rare contingency of such a dry season as 1859, liquid sewage, or plain soft water, might be invaluable, while in an average damp season it would be a perfect nuisance.

In this climate an artificial sun at about £5 an acre would pay the patentee better than an artificial rain-fall.

I am, &c., S. SIDNEY.

Central Farmers' Club, Bridge-street, Blackfriars.

THE ART TREATMENT OF GRANITIC SURFACES.

Sir,—I am much gratified by the kind expressions of Sir Gardner Wilkinson, in his letter read after my paper on the 14th, on the treatment of granite, and I am desirous to return to him, through your *Journal*, my best acknowledgments for it. I fully agree with Sir Gardner, that, "in the treatment of granite for monumental and ornamental purposes, we ought to be satisfied with no mere copy;" "that we require it to be original and English, and that no imitation of Egyptian work will satisfy or accord with English requirements and taste." I believe that my views, as expressed in my paper, show how fully I agree with Sir Gardner on this point, as I expressly separated the adoption of the incised method of the Egyptians in treating granite from the emblems they used, suggesting instead a national decoration by means of wholly new subjects, special to our own time and country, for this purpose. This agreement with the views of Sir Gardner Wilkinson and Mr. Bonomi, whose letter follows his, shows how fortunate I am in thus treating a subject founded on, although not servilely copying, Egyptian work, in accordance with two of our greatest authorities on this subject.

In the treatment of the obelisk as a feature of monumental art, I hope also that I am equally in accordance with the views of Sir Gardner, as I assuredly conceive that we should not copy Egyptian obelisks; but, on the other hand, gift the feature with a treatment analogous to that which the Greeks would have done had they adopted it, as I explained last May, in the Society's rooms. As a mere feature of art, I conceive, of course, that the tall and pointed monolith, one phase of which the Egyptians adopted, is the common heritage of art, as finding its prototype in our "Needles, at the Isle of Wight," perhaps as celebrated as Cleopatra's needle, and in various of such natural formations and mountain "spicula" in our islands, or elsewhere.

The Egyptians, no doubt, arranged these features in pairs, "as vertical lines to contrast with the long horizontal character of their temples, where their effect was admirable," but this was by no means the only way in which the ancients employed them. Nebuchadnezzar, as Mr. Bonomi points out, put up one by itself on "the plain of Dura," and Semiramis did the same thing in her great city, in regard to one of greater height than any in Egypt, viz., one of 125 feet high, which she obtained in the mountains of Armenia, at least, so says Diodorus, and erected in a highway, as "a marvel to the world"; and this was also put up by itself. Jacob also put up one in Bethel, whence various of the solitary erect stones of record are said to have received the name of "Baituloi." Other nations also set them up, as the Assyrians, Phœnicians and Indians. Indeed, nothing can be more natural than to set up such features as marks and records; and, where permanence is the great object, as is likely to be the case, that they should be monoliths, and that records should be engraven on them, of which there are various ancient instances besides those of Egypt. Indeed, with all due deference, I am desirous to call attention to the fact that these features were, and are, far from being exclusively Egyptian.

I certainly conceive that their "pyramidia," or pointed tops, had better never be interfered with, as their form affords the best finial that can be invented. As regards the bases, assuredly they should be composed so as to harmonise with the surmounting form, but I see no reason for restriction beyond that. As to the treatment of the obelisk itself, (I use this name for the sake of brevity, as the recognised one) I conceive it capable of a great variety of treatment beyond what it has ever yet received. I see no reason why, for instance, the obelisk should not be fluted as well as the pillar; and on the occasion of reading my paper I exhibited two obelisks with a facial floral treatment, of a character which I believe is novel.

One great advantage which an obelisk possesses for monumental purposes is that it is complete in itself; that it is not like a column, a part of a building, removed from an edifice; also that it is not a feature of support, like a column, which wants something to carry, which has led to "mast-heading our admirals," and placing a portrait statue so high that its features cannot be distinguished. The use of obelisks would never lead to this. In their case the statue of the hero would be placed on a pedestal in front of the base of the obelisk, where it could be seen, while it would be his deeds alone which would be chronicled high in air on the granite shaft behind him.

But then such an obelisk should not be an Egyptian obelisk any more than it should be Egyptian granite. It

should be British granite and a British obelisk. I believe there is quite as wide a field open for novelty in obelisks as there ever was in columns. Perhaps we might have a better name, for when we speak of obelisks we immediately think of Egyptian obelisks, for which there is no necessity. After all, obelisk is not a very dignified name. The term is not Egyptian, but Greek. Obeliscon means a little spit! "A commodity of good names," as our great poet says, "is wanted" in this case, or, at least, of one good name, among the advantages of which would be the getting rid of the idea of such a feature of art being necessarily Egyptian, for which I beg to submit there is no just reason whatever.

I am, &c., JOHN BELL.

Kensington.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Geographical, 8½. 1. Dr. Livingstone, "On Lakes Nyinyesi, or Nyassi, and Shirwa, Eastern Africa." 2. Baron de Bode, "Sketch of the hilly Daghestan, with the Lesghi tribes of the Eastern Chain of the Caucasus."
Medical, 8½. Clinical Discussion.

Tues. .....Royal Inst., 3. Professor Owen, "On Fossil Reptiles."
Civil Engineers, 8. Hon. John Wethered, "On Combined Steam."
Medical and Chirurg., 8½.
Zoological, 9. Mr. T. H. Stewart, "On the Anatomy of the Stomach of the Red Potamochere." Mr. J. Petherick, "On the Habits of *Balæniceps rex*." Dr. Crisp, "On the Blood-corpuscles of the Gigantic Salamander," and other papers.

Wed. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. Robert Barclay, "On the Prevention of Forgery, arising from the Alteration and Falsification of Bankers' Cheques, Notes, &c.; with a Description of a Method of Manufacturing Writing Paper having the property of rendering Common Writing Ink Unalterable by Time or Fraud."
Geological, 8. Mr. C. Moore, "On the so-called Wealden Beds and Reptiliferous Sandstones of Elgin." Mr. J. Lamont, "Notes about Spitzbergen in 1859."
Archæological Assoc., 8½.

Thurs. ...Royal Inst., 3. Professor Tyndall, "On Light."
Royal Society Club, 6.
Antiquaries, 8.
Artists and Amateurs, 8.
Royal, 8½.

Fri. .....United Service Inst., 3. Col. MacDougall, "The Military Character of General Sir Charles Napier."
London Inst., 7. Professor Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Chemical, 8. Anniversary.
Royal Inst., 8. Dr. Odling, "On Acids and Salts."

Sat. .....Royal Inst., 3. Dr. Lankester, "On the Relation of the Animal Kingdom to the Industry of Man."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

First Session, 1859.

235. Army—Return.

Delivered on March 2nd, 1860.

51. Patriotic Fund—Return.
103. The Serpentine—Return.
109. Court of Chancery (Suitors' Fund)—Return.
114. East India, &c. (Transmission of Letters, &c.)—Return.
50. Bills—County Prisons (Ireland).
56. „ Ecclesiastical Vestments.

Delivered on March 3rd and 5th, 1860.

38. Duchy of Lancaster—Account.
107. Navy (Civilians)—Return.
108. Court of Chancery—Return.
115. Dublin Port—Account.
118. Channel Squadron—Return.
122. Portpatrick and Donaghadee Harbours, &c.—Return.
53. Bills—Coroners (No 2).
57. „ Representation of the People.
58. „ Representation of the People (Ireland).
Savoy and Nice—Correspondence respecting the proposed Annexation to France.

Delivered on Saturday, p.m.

124. Poor Rates—Return.

Delivered on March 6th 1860.

104. Annuity Tax (Edinburgh)—Return.
122. Paper Duty—Report of the Commissioners of Inland Revenue.
129. Electors, &c., (Cities and Boroughs)—Return.
130. Electors, Populations, &c. (Cities and Boroughs)—Return.
131. Population, Rating, &c. (Counties)—Return.
132. Parliamentary Boroughs, &c.—Return.
6. Election Expenses, &c.—Abstract of Return.
70. Local Acts (40. London and North Western Railway (No. 3)—41. Portsmouth New Railways, or Tramways, and Piers)—Admiralty Reports.
Superior Courts of Law at Westminster (Process, &c., of Pleading)—3rd Report of Commissioners.

Delivered on March 7th, 1860.

89. East Indin (Disturbances in Tinnevelly)—Return.
120. Mails (Canada and United States)—Return.
76. Local Acts (36. Vale of Clwyd Railway Extension—Foryd Bridge and Railway—37. Letterkenny Railway—38. Carricktergus and Larne Railway—39. North Eastern Railway (Blayden and Conside Branches)—42. Milford Haven Railway and Dock—43. Montrose and Bervie Railway—44. Hayling Railways and Harbour—45. Conway, Llanrwst, and Bettws-y-Coed Railway)—Admiralty Reports.
Savoy and Nice—Despatch for Lord Cowley.

Delivered on March 8th, 1860.

125. Durham Diocese—Return.
85. Harbour, &c., Bills (8. May River Navigation—9. Watchet Harbour)—Board of Trade Reports.
59. Bills—Representation of the People (Scotland).
32. „ Bleaching and Dyeing Works.
60. Indictable Offences (Metropolitan District).
Civil Service Commissioners—5th Report.

Delivered on March 9th, 1860.

61. Bills—Paper Duty Repeal.
65. „ Universtities (Scotland) Act Amendment.
15. Railway and Canal Bills (139. Great Northern and Western of Ireland—Kilrush and Kilkee Railway and Poulnasherry Embankment—Ulster Railway and Corporation of Belfast—140. Isle of White (Eastern Section)—141. Portsmouth New Railways, &c.—142. Manchester and Milford—143. Sirhowy Tramroad—144. Vale of Clwyd (Extension)—145. West Dorset—146. West Hartlepool Harbour and Railway)—Board of Trade Reports.

First Session, 1859.

208. (A IX)—Poor Rates and Pauperism—Return.

Delivered on March 10th and 12th, 1860.

119. St. George's-in-the-East—Return.
121. Weymouth and Melcombe Regis Election—Minutes of Evidence.
136. Income Tax—Return.
32. Bill—Customs.
Italy—Further Correspondence (Part 2).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 16th*, 1860.]

Dated 2nd February, 1860.

268. W. Ingham and W. Hinchliffe, Armley, Yorkshire—Imp. in apparatus for applying steam and other vapours, gases, or fluids, to the production of motive power, and which may also be used for a pump or gas exhauster, or other similar purpose.

Dated 7th February, 1860.

322. P. Chartroule, 29, Boulevart St. Martin, Paris—Iodine inhaling means and apparatus for medical purposes.

Dated 13th February, 1860.

394. W. Clark, 53, Chancery-lane—Imp. in apparatus used for stretching, drying, and finishing woven fabrics.

Dated 14th February, 1860.

404. J. Arnold, Leys, Tamworth, Staffordshire—Imp. in the treatment of sewage matters for the manufacture of manure and in the apparatus for the same.

Dated 22nd February, 1860.

472. F. H. Lemoine, 47, Howland-street, Fitzroy-square—Imp. in the manufacture of waterproof-papers and pasteboards of every description.

Dated 23rd February, 1860.

493. R. A. Brooman, 166, Fleet-street—An improved method of producing documents suitable for bank notes and other instruments of value, in order to prevent forgery thereof. (A com.)

Dated 25th February, 1860.

530. C. F. J. Fonrobert, Berlin—Imp. in gilding and silvering silk and other fibrous substances. (A com.)

Dated 28th February, 1860.

542. R. Walker, Eccleston, near Prescot, Lancashire—Imp. in apparatus for preventing accidents in winding from mines, which apparatus is also applicable for other similar purposes.
544. Z. Wright, Upper Wortley, near Leeds—Imp. in machinery or apparatus for the prevention of accidents in mine shafts by the breaking of the rope or chain, or disconnection of the drum from the engine, applicable also to other hoisting or lifting machinery or apparatus.
546. G. Weir, Glasgow—Imp. in regulating steam engines, and in regulating apparatus for steam engines and other prime movers.
550. C. Parish and J. Lang, Preston, Lancashire—Imp. in looms for weaving.

Dated 29th February, 1860.

552. P. F. Lynch and J. Tynan, Liverpool—Imp. in the construction of boats, and in the use or application of certain novel arrangements and apparatus thereto.
554. B. Hargreaves and J. Heaton, Habergham Eaves, near Burnley, Lancashire—Certain imp. in looms for weaving.
556. J. M. Bryden and W. C. Bryden, Edinburgh—Imp. in mountings for window blinds.
558. G. Ranken, Bathurst, Sydney, New South Wales—Imp. in paddle wheels.
562. W. E. Newton, 66, Chancery-lane—Improved machinery for making or forming the teeth of combs. (A com.)
564. R. H. Collyer, 8, Alpha-road, Saint John's-wood, Middlesex—Imp. in the manufacture of pulp and in preparing materials for the purpose, and in apparatuses employed therein, part of the invention being also applicable to preparing materials for fibrous and textile manufacturing purposes.

Dated 1st March, 1860.

565. P. C. D. Destas, 212, Rue de Reuilly, Paris—A new engine working by wind or water.
567. B. Britten, Sydenham-hill, Kent—Imp. in projectiles.
569. W. Clark, 53, Chancery-lane—Imp. in machinery for "sizing" raw silk or other threads, and for cleaning the same preparatory to the sizing operation. (A com.)
570. I. Bonnet and J. D. Heid, Brussels—Imp. in planing machines for files and other metal objects, straight, curved, or otherwise.
571. J. Milnes, Gloucester—An apparatus for exercising the joints and muscles of the human body.
572. J. Driver, Keighley, and J. Jessop, Bradford, Yorkshire—Imp. in means or apparatus used in washing, wringing, and mangling fabrics.
573. D. Chadwick, Salford, and H. Frost, Manchester—Imp. in apparatus for measuring water and other liquids.
574. J. McCulloch, San Francisco, U.S.—Imp. in the reduction of gold, silver, and copper ores.
575. J. Collins, 28, Bennett-street, Stamford-street—Improved outside blinds and awnings.
576. W. H. Nash, 3, Matson's-terrace, Kingsland-road—Imp. in steam engines.
577. J. M. Blashfield, Stamford—Imp. in burning pottery and china ware, and in kilns employed for such purposes.
578. H. Bessemer, Queen-street place, New Cannon-street—Imp. in machinery or apparatus employed in the manufacture of malleable iron and steel.
579. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in gas regulators or governors.

Dated 2nd March, 1860.

580. G. Edwards, 4, Park-road-villas, Battersea, Surrey—Imp. in caissons and foundations for bridges, piers, and other structures under water.
581. P. M. T. O. C. Albites, 34, Rue Vivienne, Paris—Imp. in photographic apparatus.
582. B. G. Babington, George-street, Hanover-square—Imp. in means or apparatus for protecting the throat and chest from atmospheric influences, and which may also be employed as a protection to the mouth.
583. R. d'Argy, Blois, France—Imp. in apparatus for raising water.
584. J. W. Lewis, Coventry—Imp. in looms for weaving ribbons.
585. R. A. Brooman, 166, Fleet-street—Imp. in the construction of naves or bosses for wheels. (A com.)

Dated 3rd March, 1860.

586. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of artificial fuel. (A com.)
587. J. Eccles, Blackburn, Lancashire—Imp. in machinery for the manufacture of bricks, tiles, pipes, and other articles formed of plastic materials.
588. X. Musty, 29, Boulevart Saint Martin, Paris—An improved apparatus for washing ores.
589. W. G. Ramsden, Liverpool—An improved boiler or apparatus for generating and super heating steam, or heating water and other fluids under pressure.
590. W. Bauer, Munich—Imp. in apparatus for diving and for raising and lowering bodies in water, parts of which imps. are also applicable to other useful purposes.
591. W. S. Hale, Queen-street, Cheapside—An improved candle lamp.
592. W. E. Gedge, 4, Wellington-street South, Strand—A liquid or novel preparation to be applied to wools. (A com.)
593. W. H. Muntz, Millbrook, Hants—Imp. in the construction of ferry boats.
595. E. Humphrys, Deptford, Kent—Imp. in marine boiler furnaces and in feeding the same.

Dated 5th March, 1860.

596. J. Broel, Manchester—Certain imp. in the manufacture of soap. (A com.)
597. J. Sidebottom, Broadbottom, near Mottram, Chester—Certain imp. in looms for weaving.
598. C. Price, Wolverhampton—Imp. in locks and latches.
599. R. Smith, 114, West-street, Glasgow—Imp. in the preparation and production of colour matter.
600. J. H. Johnson, 47, Lincoln's-inn-fields—An improved ruffle and sewing machine for producing the same, applicable also to ordinary stitching. (A com.)
603. R. A. Brooman, 166, Fleet street—Imp. in the manufacture of pipes for smoking. (A com.)
604. W. Bridges, Birmingham—Imp. in the manufacture of elastic bands.
605. J. Howard, Bedford—An imp. in the construction of horse rakes.
606. W. E. Newton, 66, Chancery-lane—Certain imp. in window sashes. (A com.)

Dated March 6th, 1860.

608. T. Cox, jun., and W. Holland, Birmingham—An imp. or imps. in the manufacture of the stretchers of umbrellas and parasols.
610. W. E. Gedge, 4, Wellington-street, South, Strand—An improved machine for drying fecula. (A com.)
612. W. E. Gedge, 4, Wellington-street, South, Strand—Imp. in latches. (A com.)
614. J. Walsh, Stedalt, Balbriggan, Ireland—Improved machinery for cutting, tearing, crushing, or otherwise preparing for various useful and economical purposes furze, or gorse, straw, bean-haulms, turnips, bark, flax, or any other vegetable substances.
616. W. Buxton, Staveley, Derbyshire—Imp. in safety cages for mines.
618. W. R. Jeune, 4, Flower-terrace, Campbell-road, Bow, Middlesex—Imp. in fire lighters.

Patents Sealed.

[*From Gazette, March 16th*, 1860.]

March 10th.

2121. S. N. Rodier.
2124. E. H. Taylor.
2129. J. Wright.
2132. H. J. Warmolont.
2133. R. A. Brooman.
2136. J. Court.
2139. W. Weild.
2142. A. Lamb.
2150. G. D. Robinson.
2152. R. Davison.
2160. C. J. Parry.
2179. J. Villet-Collignon and L. George.
2198. E. T. Simpson.
2199. M. L. J. Lavater.
2200. P. Robertson.
2220. W. Clark.
2273. W. Hopkins.
2284. G. Gibson and J. Gibson.
2292. J. H. Johnson.
2366. W. E. Newton.
2389. J. Gordon.
2722. W. E. Newton.
48. T. Bellamy.
68. A. S. Bolton & F. S. Bolton.
122. J. H. Johnson.

[*From Gazette, March 20th*, 1860.]

March 20th.

2138. A. Manbré.
2155. T. Field.
2163. J. J. Bourcart.
2166. J. Gedge.
2168. J. Coey.
2218. W. H. Buckland.
2270. G. Long and J. Archer.
30. A. V. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March 16th*, 1860.]

March 13th.

753. W. MacNaught.
793. W. Banks and J. Banks.
795. G. Perrott.

March 14th.

763. J. Wilkes, T. Wilkes, and G. Wilkes.

[*From Gazette, March 20th*, 1860.]

March 15th.

744. C. Askew, J. Askew, and H. Myers.
747. Sir F. C. Knowles.
754. W. M'Culloch and T. Kennedy.
757. J. Millar.

March 16th.

740. J. Moes.
775. W. G. Merrett.
824. S. Fox.

March 17th.

791. W. Moxon, J. Clayton, and S. Fearnley.

Patent on which the Stamp Duty of £50 was Paid within the Time prescribed by the Act, but which was not produced for Certification until the Day hereunder prefixed.

[*From Gazette, March 16th*, 1860.]

March 14th.

597. T. H. Jennens.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, March 16th*, 1860.]

March 13th.

646. J. Maudslay.

[*From Gazette, March 20th*, 1860.]

March 15th.

657. J. Livesey.

March 16th.

660. G. Johnson.
739. S. Fox.

Journal of the Society of Arts.

FRIDAY, MARCH 30, 1860.

EXHIBITION OF INVENTIONS.

The Twelfth Annual Exhibition of recent Inventions will be opened at the House of the Society, on Monday, the 9th of April next.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection.

Any persons having in their possession works by Sir William Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

EXAMINATIONS, 1860.—NOTICE TO LOCAL BOARDS.

The following circular has been issued :—

Society for the Encouragement of Arts, Manufactures, and Commerce,
John-street, Adelphi, London, W.C.,
16th March, 1860.

Dear Sir,—I am directed to draw your particular attention to Par. 11 of the Examination Programme, and to suggest that your Local Board should now make arrangements for holding the Previous Examination :—

"11.—The Previous Examinations must be held by the Local Boards sufficiently early in the year to allow the results to be communicated to the Council on or before the 10th of April, 1860, *i.e.*, four weeks before the 8th of May, the day fixed for the commencement of the Society's Final Examinations."

I shall be obliged by your informing me, *without delay*, whether you expect to have any candidates desiring to be examined in Music, as, if so, I will furnish you with a form of test to be used at the Previous Examinations, as mentioned in paragraph 86 of the Programme.

I am, dear Sir, yours faithfully,
P. LE NEVE FOSTER, *Secretary*.

SEVENTEENTH ORDINARY MEETING.

Wednesday, March 28, 1860.

The Seventeenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 28th instant, Thomson Hankey, Esq., M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Goode, William James.	Robertson, John.
Laing, Seton.	Shaw, Robert Ewart.
Lambert, Charles.	Solomon, Joseph Israel.

The Paper read was—

ON THE PREVENTION OF FORGERY, ARISING FROM THE ALTERATION AND FALSIFICATION OF BANKERS' CHEQUES, NOTES, &c., AND A DESCRIPTION OF A METHOD OF MANUFACTURING ORDINARY WRITING PAPER WITH CHEMICAL PROPERTIES, RENDERING COMMON WRITING INK UNALTERABLE BY TIME OR FRAUD.

By Robert Barclay.

The tendency of ordinary writing ink to fade and become illegible is well known to those who are conversant with ancient manuscripts, and is forced upon the notice of most of us when examining family documents, and letters dating a few years back. The serious annoyance resulting from it has led to many inquiries whether some more permanent writing medium might not with advantage be adopted.

It has been contended that a carbonaceous writing ink, as used by the Egyptians, Chinese, Greeks, and Romans, has exhibited a permanence which unquestionably has never been exceeded, and, therefore, that both theory and the experience of past ages point out the remedy for the evil complained of in modern times.

It is however found that the difficulty of holding in suspension particles of minutely-divided carbon, sufficient for the production of a good black, destroys the fluidity of the ink to an extent which almost precludes its use. Such an ink can also be washed from the surface of paper or parchment; and we should open a wide field for the falsification of manuscripts by its adoption. The only remedy for this evil hitherto proposed is the addition to the carbonaceous ink of corrosive acids or alkalis, which bite into the substance of the paper and carry with them the minutely divided carbon.

The latest development of these efforts is the use of dilute sulphuric acid and sugar with a little sulphate of indigo and gum as a writing ink. A hot iron is passed over the writing when dry, or it is held to the fire. The characters are converted into a jet black by the carbonization of the sugar. However great the ingenuity of this method may be to give security against erasure and the fading of the writing, I cannot but think that, in numerous cases, the dilute oil of vitriol concentrated by the heat would perforate the document.

The rapid and efficient execution of writing is an imperative necessity of the times in which we live, and if we consider for a moment the intensity of the black produced by the finest and lightest stroke of the pen, with our ordinary ink, and that our time is not wasted by being compelled to shake our ink bottles, we shall not desire to revert to the writing fluid of an earlier age, but must admit that which is in daily use to be admirably suited to our needs.

Black ink is not of the character of a pigment, but is strictly a dye, in combination with its appropriate mordant. It is a dye of the decoction of nutgalls mordanted with the peroxide of iron. As it exists upon paper it is a gallate of the peroxide of iron, containing a variable admixture of the gallate of the protoxide.

A permanent black dye has, from the earliest times down to the present day, been produced only through the intervention of an iron mordant, and it is this property which the persalts of iron possess of depositing the peroxide of iron and firmly attaching it to vegetable fabrics, which causes writing ink to adhere so firmly to paper that no amount of washing will destroy the characters.

There is, in my opinion, a fundamental error in these attempts to manufacture a carbon writing ink. Until a mordant is found for carbon, and it is applied in dyeing and calico printing, efforts to make it adhere and penetrate the fibre of paper will fail; since paper is also a cotton or linen fabric, and a method of applying carbon as an ink

will involve a discovery of vast importance to the calico printer.

In addition to the tendency of writing ink to fade by the chemistry of natural causes, a more serious objection is found in the fact that some of the simplest chemical substances enable us at will to destroy written characters. When it is considered that all our most important documents are of necessity written, the possibility of their alteration by persons whose interests can be served by such fraud is surely a question of national interest, and an evil which cannot be measured by the present frequency of such crime. The disposition of vast landed estates, and other property upon which depend the comfort and happiness of thousands of families hangs often upon the integrity of a few words. Our registers of births, deaths, and marriages, may be instanced.

It is of the utmost public importance not only that the writing may be legible after a lengthened period of years, but also that an alteration of the various copies which are kept should be physically impossible, since the moral impossibility of an alteration being made would depend upon circumstances over which we have no control.

The possibility of the fraudulent alteration by chemical means of various commercial documents, has been recognised for the last 30 or 40 years as an evil of a very serious character, and bankers being especially open to be thus defrauded, have with little exception adopted various scientific expedients in the paper and printing of their cheques, drafts, &c., to throw obstacles in the way of fraudulent tampering with and alteration of the writing placed upon them by the public.

I therefore propose to consider, in the first place, the various expedients which have been proposed and carried out into practice for the prevention of this description of forgery, several instances of which have occurred (one as lately as the spring of 1859, at one of the branches of the Bank of England, in which both the crossing was obliterated and the amount altered.) This is a danger already in a measure provided against by the public, and I shall endeavour to show that the expedients hitherto adopted with this view are imperfect, and that a complete scientific defence against the skilful chemical abstraction of writing is required and provided by the chemically prepared white writing paper which I am desirous to introduce to the notice of your Society and the public.

In the second place, I shall show that, by the incorporation of similar chemical substances in ordinary writing papers, we may so remove the fading tendency of common writing ink as to render it permanent to a great age. I shall also describe a method of rendering printed characters unalterable by any process whatever, and effectually preventing the mechanical erasure of writing. Before describing the remedies which have been proposed by others, it may be well to exhibit the wide range of substances which more or less perfectly obliterate writing ink under the three following heads, in the order of their practical efficiency :—

Bleaching Agents.	Acids and Acidulous Salts.	Alkalis.
Chlorinated Carbonate Soda	Binoxalate Potass	Potash
Solution of Bromine	Nitro Muriatic Acid	Soda
Do. Chloride Do.	Hydrochloric Acid	
Chloride of Lime	Oxalic Acid	
Bromide of Lime	Citric and Tartaric Acid	
Solution of Chlorine	Sulphurous and	
Chromic Acid	Sulphuric Acid	
Oxygenated Water		

I have often remarked that, even amongst persons possessing some knowledge of chemistry, an impression prevails that acids are the most ready and powerful dischargers of ink. The fact, however is, that bleaching liquids are vastly more effective, and their action is more elegant and perfect. Hence has resulted the erroneous conclusion that the obliteration or discharge of ink is a hazardous and doubtful process, and that, therefore, any special means of prevention are not imperatively demanded.

We have a list of 17 substances of the most diverse chemical properties, and it will be seen that the problem to be solved is one of considerable difficulty, because, if there is a single reagent on the list which will discharge and bleach writing ink, a method possessing, perhaps, the highest excellence in absolutely preventing the discharge of ink with one class of substances, is totally useless if attacked with another of an opposite class.

In 1817, Gabriel Tigere patented a process of manufacturing writing paper in such a manner that it would be extremely difficult, if not impossible, to extract or discharge any writing from such paper. He impregnated the sheets of paper, previously to being sized, in a solution of prussiate of potass, and afterwards sized them in the usual way.

In 1822, William Robson patented a method of preventing frauds upon banking cheques, bills of exchange, &c. He remarks :—" To point out the use and advantage of the same, I shall here observe that the great ease with which writing executed with common writing ink can be removed, discharged, or obliterated, by the application of oxalic or other acids, has placed a dangerous power in the hands of evil disposed persons, and the frauds practised upon the public, by altering bankers' cheques, bills of exchange, and various species of mercantile correspondence, plainly shews the absolute necessity of adopting some proper and efficient method to prevent so serious an evil." He proposes to rule with a ruling machine, or to print with a copper-plate, vegetable colours which are destroyed by chemical applications over the surface of the cheques, or where the writing is intended to be placed.

Extract of saffron is proposed, and extract of logwood is mentioned as suitable vegetable water colours to be employed.

This patent possesses considerable interest, since at the present time nearly all the cheques in use by bankers are secured by a vegetable tinting either on the surface or in the substance of the paper, and, therefore, though widely differing in the materials employed, are printed on the principle of Robson's patent.

In 1851, Mr. William Stones patented a method of manufacturing a safety paper for bankers' cheques, &c. He impregnates the paper in the sizing process with ferrocyanide of potassium, iodide of potassium, and starch.

In 1858, Mr. W. Herapath, the toxicologist, patented a method for the manufacture and treatment of paper for the prevention of forgery. This is precisely similar to that of Gabriel Tigere, in 1817, but the ferrid and sulphocyanides of potassium are included by Mr. Herapath. The principle of Robson's patent undoubtedly presents an obstacle to attempts to discharge writing ink. Its perfection may be exemplified by staining a sheet of white paper with ink so as to give the paper a light purple tinting. It is obvious that it is absolutely impossible to discharge writing placed on this paper without, at the same time, destroying a portion of the tinting.

Robson was a cheque printer, and his method being simple and eminently practical, entirely superseded the earlier method of Tigere.

Robson's principle, however, though suited perhaps to prevent ignorant and unskilful attempts to tamper with a cheque, is open to the serious and fatal objection that there is little difficulty in discharging the writing and retinting the engraved work or colour affected by the bleaching liquid.

Again, the number of vegetable colours affected by all the chemical substances which discharge writing ink, is, in practice, limited to a few, and the distinctive variety of colours required by bankers has introduced into circulation of late years tints possessing elements of great insecurity.

Tigere's method is founded on sounder chemical principles than the foregoing; it is quite impossible to discharge the writing by any acid or acidulous salt owing to the production of Prussian blue, but by immersing it in boiling water, to which a small portion of an alkali has been added, the entire amount of the soluble ferrocyanide con

stituting its security may be dissolved out with the size, and the writing readily discharged. Chloride of lime, or chlorinated carbonate of soda (the former at boiling point), completely evade the security of this paper.

A serious practical difficulty arises in the course of its manufacture, owing to the formation of Prussian blue during the sizing process, in which alum has been from the earliest of times found to be indispensable, and the unsightly greenish discolouration and specks which hence arise have, I believe, done more to prevent its adoption than any other cause.

In the paper used by those London banks whose cheques are printed on Tigere's patent, these defects are covered by a deep shade of Prussian blue.

Mr. Stones endeavours to overcome these difficulties by the use in addition to the ferrocyanide of potassium, of the iodide of potassium and starch. On the application of bleaching liquids containing chlorine, the blue compound, termed iodide of starch, is formed, and a stain on the surface of the paper is the result. This may be completely washed away by a weak alkali, and the security is destroyed.

The adhesive receipt stamps are printed in a vegetable colour with the view of rendering it impossible to discharge the ink and use the stamps under favourable circumstances a second time.

The foreign draft stamp exhausts the ingenuity of the systems of Robson and Tigere, for ensuring their destruction after being once used.

Here is an instance, in the adoption of Tigere's patent, of its utility being recognised by the government 30 years after its invention. The expediency of uniting this with the fugitive glycerine printing may, I think, be doubted, because bleaching agents will discharge ink in the lines of the writing, and the engraved work may be reproduced. I shall call attention to a far more serious defect, which arises from the enamelling of the stamp, at the close of this paper.

The revenue may also be defrauded by the extraction of the ink from bills of exchange with impressed stamps after they have been used.

This subject is of considerable importance, because none of these stamps come under the cognizance of any government department, and the public can hardly be expected to exercise vigilance.

I consider, however, that it is due to the Board of Inland Revenue to notice the intelligence which has directed the adoption of every scientific expedient which has assumed a practical shape to secure the revenue from being defrauded.

The constituent of my patent is the incorporation of an insoluble ferrocyanide, and an insoluble salt of manganese with the paper pulp. I have found the insoluble white ferrocyanide of manganese in a state of purity, the most suitable for my purpose. A special process is adopted for preventing waste and fixing the insoluble powder in the fibre of the paper, and the discolouration during the sizing process is prevented by the use of a mordant of the acetate of alumina, which perfectly fixes the size and prevents its decomposition; the paper is passed through the drying process with rapidity, and in this way the practical difficulties in the incorporation of a ferrocyanide are completely surrounded, and I obtain a pure white paper, which effectually obviates the objection to the use of tinted papers, and renders no change whatever in the appearance of paper to which the patent is applied.

This is a most important practical result, as any peculiarity of appearance involving a change is inconvenient, and is resisted both on valid practical grounds, and also on the simple principle of conservation, still I wish it to be clearly understood that, under my patent, any description or tint of paper can be produced.

The chemical principle of this paper is perfectly adapted to obviate the dangers arising from the wide range of ink discharging chemical substances.

By the application of acids the writing ink becomes fixed more firmly in the paper, and is converted into Prussian blue, mordanted with the alumina contained in the size. Chlorine and bromine have a still more powerful effect in causing the writing instantly to penetrate to the back of the paper, and to assume greater intensity than before, and the stains of the peroxyde of manganese also appear. Chloride of lime and chlorinated soda, and bromide of lime, produce the intense brown dye of the peroxyde of manganese, as calico-printers term it, manganese brown; if this is dissolved out it will be found that the writing will reappear, being not destroyed but merely obscured.

Alkalis and their carbonates, and oxygenated water, have a similar effect in producing manganese brown. Chromic acid causes the deposition of the green oxide of chromium, in addition to the manganese brown.

Every chemical substance which discharges the colour of Prussian blue produces manganese brown, and *vice versâ*. The chemist, therefore, is involved in an alternation of effects whichever class of chemicals is applied, and in the present state of our knowledge it is a net from whose meshes the utmost skill will not extricate him. As long as the insoluble material remains in the paper the writing cannot be destroyed. By dissolving out, and destroying the protective material from the substance of the paper, which in itself is a most hazardous operation, we may discharge a portion of the ink, but this involves still greater difficulties, since, when done, it is found to be totally inapplicable, as the stain, alternating according to the chemicals used, drives the operator to the edge of the document, and every portion of it is destroyed. Professor Brande, of the Mint; Dr. Miller, of King's College, and Mr. R. Warington, of Apothecaries Hall, will bear me out in saying that actual experiment will alone enable any person to appreciate the vast difficulties which present themselves in the effort to discharge a portion of the writing. These, though they employed the time, patience, and the resources of their well-known skill and ingenuity, they failed to overcome.

I have myself most fully followed up, by actual experiment, every idea, for evading the security of the paper, which has been suggested to me by scientific friends, and though some hundreds of experiments have been made with this view, I have not yet seen a single successful attempt to discharge a portion of writing placed upon this paper, without the production of stains or the destruction of the entire document.

These stains entirely prevent the possibility of restoring, by artistic skill, the appearance of a cheque or other document printed or written on this paper.

I produce specimens of the paper containing various amounts of the protective material.

In order to satisfy myself by actual experiment that the existing systems, even in their most perfect development, by which bankers' cheques are attempted to be secured, are unsafe, and capable of easy evasion, I collected those of the principal London firms which exhibit all those ingenious devices which have been often asserted to present insuperable difficulties to the forger. They have been fairly and properly filled up, and the methods by which the ink is extracted are described in the specimen-book and, considering the limited time which a person engaged in trade can bestow on such an investigation, and also that experiments have been repeated upon the same description of security, I think it will be admitted that I have endeavoured to substantiate my statements as to the insecurity of existing cheques.

The cheques of the London bankers may be thus classified:—

1. Tinted cheques, which are of imperfect security, and can be evaded without the process of re-tinting.

2. Tinted cheques exhibiting the perfection of Robson's principle, but which are evaded by bleaching the writing and restoring the tinting.

3. Cheques on Tigere's patent, evaded by bleaching liquids, and slightly re-tinted.

4. Cheques on plain paper, which present little diffi-

culty to any and every alteration which the convenience of a forger may require.

All these cheques are, however, open to a variety of manipulations, and I would call attention to the ease with which the writing may be bleached in the *lines of the letters or figures*, and the most elaborate, and at first sight, inimitable engraving may be re-produced by joining the lines of the engraved ground-work. It is in many cases necessary only to alter a very few letters to increase the amount of a cheque, but a larger portion of these engraved tablets may be reproduced by an artist's hand with certainty; it is merely a question of a little more time and labour.

Vegetable tinted paper may be retinted by a person accustomed to water-colour painting.

I consider the principle of obliging the forger to discharge in addition to the ink a vegetable colour, imperfect and founded on a false assumption, viz., that a colour which is bleached cannot be retinted. The reply to those who urge the difficulty of doing it, is simply that there is no occasion to destroy more than a very small portion of the tinting, and that this is not a question for a chemist but for an artist, and also that any person who is not an artist, if he will take the pains, may prove to himself that it is not a matter requiring much skill.

The principle of my paper is to oblige the forger permanently to dye a white paper, by an attempt to bleach the ink.

The difficulty of discharging the smallest portion of writing upon cheques printed on my paper, is precisely as great as if the largest portion is operated upon.

The origin of the variety of colours adopted by bankers, is the wish to have their cheques of a distinctive character.

In a town where there are three banks they almost invariably choose diverse colours. Colours are therefore applied for which it is impossible for a printer to supply, possessing the security needful for cheques.

This circumstance, and a general under-estimate of the ease with which writing can be discharged from paper, and the influence of unintelligent competition in the preparation of them, have combined to place the cheques of bankers throughout the kingdom in a position of greater insecurity at the present time than they have ever yet been. This, sooner or later, may become known to the fraudulent classes, and large sums of money may be lost, and bankers will find their vigilance completely counteracted.

By the adoption of the security which I propose, cheques of every shade and variety can be produced of equal security, and at a cost in no case exceeding that of cheques possessing no essential merit. The fact that the security resides in the paper itself, permits the greatest economy in the printing process. The electro block printing is peculiarly applicable to this paper, and when cheques in large numbers are required effects a reduction of cost. The Bank of England cheque is an instance of the extreme beauty which this method of printing is susceptible of.

Railway dividend warrants, and a vast variety of commercial documents, can thus be secured from alteration without any variation in appearance, and printed by the letter-press process at an insignificant additional cost.

The number of forgeries perpetrated by persons becoming possessed of cheque forms and imitating handwriting is *not* very small. There is less skill in the alteration of a cheque by chemical means, and the important element in a forgers, calculation would be that, bearing all the marks of a genuine document, the probability of its being paid is immeasurably greater.

The preference shown by many of our bankers for the best scientific expedients for the prevention of this description of forgery, has unquestionably had a tendency in checking the development of this description of fraud, but the diffusion of chemical knowledge, and the rapidity with which science is pressed into the service of the fraudulent classes, admonish us to exercise a salutary vigilance lest its resources applied to the purposes of fraud should not prove more powerful in attack than the means we are depending upon for our defence.

In connexion with the few specimens which I have shown of the evasion of the security of existing cheques, would not a professional forger, or the combined skill, scientific, graphic, and artistic, of several of these gentlemen who cultivate "High Art Crime" have achieved far more perfect results than a person like myself, closely occupied with business, and possessing neither artistic skill or that of imitative penmanship.

I would ask, is there any serious difficulty in a gang of forgers purchasing some hundreds of cheques which pass current as money, and skilfully altering them to a considerable amount and presenting them in the course of business for payment. Would not the fact of their bearing a genuine signature and appearance cause both the fraud and its authors to escape detection?

I may mention that a knowledge of chemistry is diffused very widely by photography and other practical applications of chemical science.

Two of the chemical substances used constantly in photography, bromine and the chloride of bromine, dissolved in water, discharge writing ink as I have before remarked with the utmost perfection, and several of the tinted cheque papers in common use are very slightly discoloured by the application of the solution of bromine. Photographic forgery, that is, the copying of the printing and writing, or the writing of a cheque by photography, is readily guarded against by printing upon my paper in yellow, or manufacturing it of that colour. Skilful erasure with a knife may be detected by viewing a cheque in varied lights, and the surface of the paper will betray it. I consider the engraved ground work so commonly introduced into cheques, almost worse than useless, as it effectually hides an erasure if reproduced. I am prepared to carry out the very simple remedy of running silk threads in the lines of the amount of a cheque in the body of the paper, similarly to the postage envelope, for any bank whose consumption is extensive.

Before leaving this part of my subject, I may be allowed perhaps to introduce a few remarks made by Mr. Gilbart, before the Banking Institute in 1853, and I cannot but believe that the sound practical views of a gentleman, who has conducted for a series of years the interests of a Banking Establishment known throughout the civilized world as a monument of the success of private enterprise in this country, will express the views of most, we may hope of all our bankers.

In former times when a man committed a robbery he went on the highway perhaps, with pistols in his hand, and although the person stopped might have very little opportunity of escaping, still he had a chance, he saw his assailant, and probably in an encounter might get free. But of late years the system of plunder has become different. Now a man, to rob, has only to write the name of his fellow man, or, by another species of forgery, to take out a number and put in another for a larger sum. I recommend you to guard against the misapplication of science in this way, by yourselves acquiring knowledge as to its operation.

"The necessity has of late become more urgent for gentlemen engaged in banking pursuits to be well informed in the discoveries of science, so as to protect themselves from the acts of men who employ the improvement of science in defrauding them.

"I am afraid that in the march of civilisation no scientific discovery can be made but such as might be taken advantage of by wicked men for the purposes of fraud. Then what you must do is,—to keep pace with science, and so make science defend you against science."

Had these admirable remarks of Mr. Gilbart been made since the alteration of the law relating to cheques, by which the public have been made responsible for what a banker alone can prevent, he might possibly have added, that a banker is morally bound to protect the public from loss by the alteration of the crossing of their cheques, and

to adopt the best scientific expedients to prevent the possibility of its occurrence.

A banker is now legally bound to make good to his customer any loss arising from the alteration of the amount of a cheque. The late Bill made the crossing of a cheque a material part of the cheque. But although now as much a part of the cheque as the amount, a banker is relieved from any responsibility for a loss arising from the alteration of the crossing, provided the cheque does not, at the time of presentment, *appear* to be crossed.

This inconsistency was pointed out by the *Times'* Monetary article, when the Bill was before the House of Commons, 13th July, 1858, which I may, perhaps, be allowed to quote.

"The Bill of the Attorney General for legalising the crossing of bankers' cheques is expected to come on tomorrow, Thursday, evening.

"Mr. Bovil has given notice of an amendment to make it worthless, namely, that bankers shall not be liable for paying such cheques in cases where the crossing shall have been erased with sufficient skill to prevent detection. But if bankers choose to employ proper paper for their cheques, they can prevent all danger on that score, and if they decline to do so they must bear the consequences, and not expect a useful public measure to be vitiated for their convenience. Never on any subject have the commercial community been more unanimous than upon this, and never has anything been opposed on narrower grounds.

"Not only have the bankers power to protect themselves by proper safeguards, but they can decline to receive any accounts except on a special understanding with their customers that they shall be guaranteed against any risk which by the new Bill may be imposed. They are aware, however, that their profits are so ample and their chances of loss are so trifling, that it would be preposterous to suggest such terms. It is remarkable, moreover, that the largest establishments in London, by whom, of course, the greatest risk would be incurred, seem disposed to support the Bill, or, at all events, not to obstruct it. The Bank of England, the London and Westminster Bank, and Mr. Glyn, are said to be fully prepared, for the sake of promoting the general convenience, to meet all the liability, such as it is, that the measure in its integrity is likely to throw upon them."

In the House of Lords, the Lord Chancellor stated, "that the occasion which gave rise to the Bill was that a person sent a crossed cheque through the post. The cheque was abstracted from the letter. The words crossed were obliterated—it was presented to the bankers having all the appearance of an uncrossed cheque, and the money was paid.

"An action was brought by the customer against the bankers, and the Court of Common Pleas first, and the Court of Exchequer afterwards, decided that the words of the Act of 1856, that the crossing should be a direction to the banker to pay only through a banker, were applicable not to the time of drawing, but only to the time of presentment, and that the crossing was no material part of the cheque. He had understood that there was some objection to giving the banker the protection of the fourth clause, which provided that bankers paying a cheque which did not plainly appear to be crossed or to have been obliterated should not incur any liability. The Lord Chancellor reasoned that a cheque which got into dishonest hands got there through the negligence or fault of the person who drew it. It was either lost through negligence, or entrusted to a person unworthy of confidence, or stolen.

"In the great majority of cases the banker could not protect himself, but the customer could, and, therefore, it would be a most unfair thing, when giving protection to crossed cheques, they withdrew the protection bankers now possessed in the event of a crossed cheque being presented to all appearance an uncrossed cheque, and in such a state as would defy any amount of vigilance to detect the fraud."

The *Times* remarks upon this:—"The Bill of Sir Fitzroy Kelly on bankers' cheques, was, in its original form, a simple measure, and not only fulfilled the wishes of the mercantile community, but also was in harmony with the general principles of the law of England.

"An amendment was proposed for the interests of the bankers, that if in any case it should turn out that the crossing had been dexterously obliterated no liability should attach to them.

"This was in a great degree to damage the entire measure because it has been recently shown that crossings can be so erased to escape ordinary observation, a Joint Stock Bank having availed itself of the plea to throw the loss from such a circumstance upon its customer.

"But anomalous as it was, the colleagues of the Attorney-General appear to have taken fright and to have threatened him with desertion, unless he would allow his measure to be defaced, and become a party to placing upon the statute book another discordant and unmeaning act.

"The amendment was, therefore, without a struggle accepted by the Government, and the banking class were conciliated at the same cost of principle as when a former ministry exempted them from responsibility in paying cheques with forged endorsements.

"But the 1,500 leading firms of London who had petitioned for this measure were not likely to remain quiescent, and there was some talk of endeavouring to restore it to a rational form.

"The Government consequently, after having been frightened by the bankers, were now, in their turn, frightened by the public, and under these circumstances Mr. Nichol, the member for Frome, obtained a virtual promise from the Attorney-General that the obnoxious clause sould be resisted in the Lords. Hence the bill was allowed to pass through the lower house.

"Last night it came on in the Lords, and the Government, instead of fulfilling their intimation, turned round and absolutely recommended the clause in the strongest way.

"It should always be borne in mind said the Lord Chancellor, that a cheque which got into dishonest hands got there through the negligence or fault of the person who drew it, and that in the great majority of the cases the banker could not protect himself but the customer could.

"The whole of this statement is directly at variance with fact. As to the drawer of a cheque being able to protect himself, if such were the case there would be no need to cross a cheque at all. Cheques are crossed to guard against those accidents which the Chancellor says cannot take place without negligence.

"But while the Chancellor says the holder of a cheque can protect himself, he contends that bankers can do notning for their own security, and that the recognised principles of law are to be set aside at their behoof.

"To this headlong and unguarded assertion the reply is,—

"1st. That bankers can make themselves perfectly safe by the adoption of a tinted paper, a precaution not in the power of their customers who use the cheques supplied to them.

"2nd. That the bankers, by resorting to a guarantee fund, may avert all danger, except such as would be utterly insignificant, but which, falling upon individuals (*query* holders of cheques or customers), might lead to ruin.

"Looking, therefore, at every feature of the case, it is not too much to say that a more paltry or objectionable piece of legislation was never witnessed, and the manner in which it has been carried out reflects discredit on all concerned."

The statement of *The Times*, that a banker can protect himself from the crossing of his cheques being altered or obliterated is in no way impugned by my experiments. It is surely a very serious matter that the public should be exposed to very severe losses merely because a banker (to use Mr. Gilbart's words) will not "keep pace with

science," and continues to use a cheque which is imperfect, and which can be palpably demonstrated to be so without the necessity of a forgery to prove it.

An instance came under my notice previous to the passing of this bill, when there was no probability of banks being exempted from this liability, in which bankers disused plain paper cheques, and inquired for the best security they could adopt to protect themselves, on the ground of the additional liability about to be imposed.

It will, I trust, be observed that I have expressed no opinion whether this liability should be in fairness borne by the public or by bankers. I have merely made use of the public discussion which took place upon this subject, to show that an instance of the chemical extraction of a crossing was the occasion of the alteration of the law. The law has decided that bankers shall be relieved from this liability, and it is clearly their obvious interest speedily to adopt means which will prevent instances of the alteration of crossings again occurring. Should public attention be again called to the subject, there can be little question that the protection now extended by the law will be withdrawn.

I have pleasure in mentioning instances where scientific advice has been taken in reference to the selection of cheques. Messrs. Coutts and Co., have repeatedly consulted Professor Brande and Dr. A. S. Taylor, in order that their cheques might present the greatest difficulty to a forger's operations which existing methods would allow.

The London and Westminster have displayed the same anxiety, expressed in Mr. Gilbart's address. Messrs. Barclay and Co., have also exhibited the same care, and many other banks have probably done the same. I would suggest that the opinion of an eminent artist, in addition to that of an eminent chemist, should be taken, since a chemist alone may come to an entirely incorrect conclusion on that part of the subject which relates to the reproduction of tints, which is out of his province.

I now propose to show that the same chemical principles which are applied to the prevention of artificial and fraudulent attempts to destroy written characters, apply also in obviating the fading of common writing ink by the effacing finger of time, and also to describe a method for the prevention of attempts to erase or abstract printed characters, forming a plan of printing of the most novel character, by which a partly printed and partly written document of importance may be rendered absolutely unalterable.

The art of dyeing furnishes us with that wealth of practical results which will powerfully aid us in finding the solution of any question connected with the chemistry of colours combined with that extensive experience which we require, and which centuries alone will give. Its history shows us that sombre colours can be attached to cotton and linen fibres almost exclusively by the peculiar power of chemical and mechanical combination with colouring substances, which the peroxide of iron possesses.

It therefore appears to me very doubtful if any material improvement in the permanency of our writing ink will result from the abandonment of the iron mordant used in its manufacture.

We cannot shut our eyes to the fact that the large amount of laborious investigation and chemical knowledge which have been devoted to this interesting and important subject have hitherto been without results, and that we cannot ensure the permanency of common ink with any degree of certainty even for a comparatively short period of time.

It is well known that Prussian blue has been proposed as a writing ink of the utmost attainable permanency. The only objections which have been suggested are, its lying upon the surface of the paper as a pigment; the necessity of dissolving it in an acid which affects the paper injuriously; and the fatal one that the public will not adopt a blue ink.

By incorporating in writing paper a proportion of an insoluble ferrocyanide, the extraordinary result is attained of writing, executed with *common writing ink*, becoming more firmly fixed in the paper and strengthening in intensity by exposure to all the influences which under ordinary circumstances cause writing to fade.

I conceive the sole causes of the fading of ink are damp, the oxygen and carbonic acid of the atmosphere, chlorine, and sulphurous acid. All these influences would develope Prussian blue, mordanted with alumina, in that portion of the writing which penetrates below the surface of the paper, and as the gallic acid on the surface gradually decomposed, the writing would still remain legible and distinct.

There is a strong objection to the ferrocyanide of potassium for impregnating paper to be thus used, owing to its solubility, and its residing only in the size and not in the paper fabric.

No objection would, I think, arise from using the ferrocyanide of manganese for this purpose. I consider, however, that it would not be possible to urge an objection to the use of the insoluble ferrocyanide of zinc in the paper pulp, and if in any documents to which it was applied absolute security against fraudulent alteration was required, a small quantity of the insoluble phosphate of manganese might be added.

These powders would be perfectly harmless to the substance of the paper, and would probably preserve it from the attacks of insects. Writing would, without any alteration in the nature of our ink, remain perfectly permanent on this paper to a great age, and the slight amount of damp to which records and manuscripts are almost inevitably subjected, would intensify instead of obliterate the writing.

Prussian blue is the most permanent compound of the oxide of iron with which we are acquainted. The most powerful acids—sulphuric, nitric, muriatic, &c., do not affect it; chlorine and bromine exercise no bleaching power upon it; chloride of lime hardly affects it, except at boiling point.

Alkalis alone destroy it. It is also bleached when exposed while wet to sunlight.

We shall find, whenever Prussian-blue is described as a fugitive colour, it is subjected to damp and sunlight combined, or to alkalis or alkaline liquids.

These influences in the nature of things are such as manuscripts are never subject to.

It will be seen that the whole question of the endurance of writing on my paper to a great age turns upon the permanence under all the circumstances to which manuscripts are subject, of the Prussian blue characters developed in the substance of the paper in proportion as the writing fades by the decomposition of the gallic acid of the ink.

I therefore trust a short account of the discovery of the Prussian blue, and the practical experience we possess of its stability, may not be out of place. The experience of calico printers, linen and cotton dyers, and dyers of woollen fabrics that are washed, is absolutely useless, and would mislead us, because though, from the extreme beauty of Prussian blue, and having no substitute, they are compelled to make use of it, directly such fabrics are placed in the hands of the washerwoman, with her soap, soda, and hot water, and are hung while wet in the sun to dry, the colour is chemically destroyed by the only methods with which we are acquainted for accomplishing it.

The testimony of oil and water-colour painters must also be rejected, because their colours are invariably subjected to the influences of damp and sunlight.

I therefore confine our attention to those cases in which Prussian blue either as pigment or a dye is NOT exposed to alkaline influences, or that of sunlight while damp, and we shall find that it has a character for extreme stability and permancy of colour.

This beautiful blue was discovered and first made in the year 1704. Stahl, in his 300 chemical and physical experimental researches (Chymica Experimenta et Physica), No. 231, published at Berlin, in 1731, relates how the discovery of this blue was made.

He says:—

"A colour maker, of the name of Diesbach, who was making a cochineal lake called Florentine lake, mixed the decoction of cochineal with alum and a little sulphate of iron. The colour he struck with an alkali, and being once short of it, he was given by Dipple, a chemist, in whose laboratory he was working, salt of tartar, with which this chemist had distilled many times—an animal oil. The lake, which by the usual alkali would have been thrown down a red, became first purple, then blueish, then a most beautiful blue or gentian colour.

Diesbach was aware of the way in which the salt of tartar had been previously treated.

Dipple, to whom he communicated the intelligence of this strange appearance, knew at once it must proceed from the peculiarity of this salt of tartar he had given him, and investigated the result, and he was soon able to give this quality in a simple manner to another salt. These researches were attended with happy results, and from this time forward the discovery of Prussian blue was established.

This blue was first shown in the Exhibition of the Academy of Berlin, in the year 1710, without any description of the proceeding by which it could be manufactured. Many chemists endeavoured to discover the secret.

In the year 1724, Mr. Woodward, F.R.S., published the process in the *Philosophical Transactions*.

Four ounces of saltpetre, four ounces of salt of tartar, and four ounces of ox blood, are mixed and calcined over a fire. While hot, four pounds of water are added, and it is allowed to settle half-an-hour; two ounces of green vitrol are added, and the precipitate is washed with muriatic acid.

Mr. John Brown, F.R.S., repeated his experiment, and ascertained that the blue was due to the iron; he also in his experiments most certainly discovered and made the ferrocyanides of copper, tin, lead, and silver.

In 1775 I find these remarks upon the stability of Prussian blue, by Dr. J. G. Krünitz. "It is excellent in both oil and water-colours, and of such lasting permanency, that even aquafortis does not destroy the colour." This may be taken to be the experience of seventy-one years.

It will be seen that the practical experience of our own times of manufacturers of this colour, of silk dyers, of woollen manufacturers whose goods are not subject to washing, and of coloured-paper makers, entirely bears me out in the views I have advanced of its very great permanency.

Mr. James King, of the Hurlet and Campsie Alum Company, Glasgow (among the largest manufacturers of Prussian blue in the kingdom):—"We perfectly agree with you in your views as to the permanency of Prussian blue when not exposed to the action of sunlight and damp.

"Unfortunately, we have not in our Glasgow warehouse any very old specimens.

"Having some years ago collected together specimens of blue which had accumulated during the previous 30 years, we then found the whole in good condition, the colours being apparently as deep as when first manufactured, and the whole being quite saleable.

"In regard to your inquiry as to the effect of damp on Prussian blue, we have seen it often become mouldy from this cause, but even then the colours did not appear to be impaired in depth. We have observed, in the case of a finely bronzed or coppery blue, that the lustre is injured in brilliancy by damp, though its strength is not lessened. We enclose sample of blues made in 1846, fourteen years ago."

Mr. John Berger, of the firm of Berger and Sons, writes me:—"As far as my experience goes, I should say, age has no tendency in any way to deteriorate or weaken the properties of Prussian blue."

Messrs. John Crossley and Sons, the celebrated carpet manufacturers of Halifax, write:—"These blues stand sunlight very well, and we are not aware of any influence (besides that of alkaline liquids and soap) to which fabrics are likely to be exposed which would cause them to fade. We know a carpet which has been in use six years, in which the colours dyed with prussiate stand out very prominently, from their retaining fully their intensity, while the other colours have not stood so well. We have no doubt the blue shades would have been as good at the expiration of double this period."

Mr. Thomas Dickens, of Spring Vale Silk Mills, Middleton, near Manchester, writes:—"The action of hot soap and water, and the solution of strong alkalies, this blue will not resist, but acids hot or cold will not injure the colours. In general estimation Prussian blue is one of the most permanent of dyed colours on silk. I enclose two samples, dyed about six years or seven years since with red prussiate, they have the whole time since been much exposed to the air."

Mr. H. Pearson, of Spitalfields, silk dyer, has informed me that he has dyed these blues on silk for above thirty years, and regards them as colours of very great stability.

Messrs. Howe and Co., of Coventry, have very kindly furnished me with a specimen of silk dyed with Prussian blue in 1854, and also a most beautiful shaded specimen card of the blues obtained from red prussiate, dyed in 1850.

Messrs. Hands, Son, and Co., of Coventry, have also kindly furnished me with a specimen of the blue obtained from the red prussiate, dyed in 1847 or 1848. The red prussiate blue is generally termed Napoleon blue, but it is also dyed with yellow prussiate.

All these gentlemen state the fact of its extreme stability. Owing to the brilliancy of this blue, it is more generally used than that obtained from the yellow prussiate.

Mr. H. Allnutt, of the firm of Allnutt and Sons, makers of coloured papers, at Maidstone, whose experience and skill in the manufacture of tinted paper is unequalled in this country, writes me:—

"It must be more than 35 years I have made papers coloured with Prussian blue. After our samples, kept for the purpose of comparing with future makers, have become very old, they have been destroyed.

"I enclose you two specimens which have been made nearly 20 years; there appears no symptom of fading, and the colour corresponds with papers lately made."

Messrs. Allnutt, it should be explained, keep specimens of every parcel of paper they manufacture, which are carefully numbered. They reproduce any tint with astonishing accuracy, and the value of their remark that the colour corresponds with paper of the same number, lately made, is very great.

Prussian blue has been manufactured now for 160 years. I have given the character for stability it possessed 71 years after its discovery, and the experience of men practically conversant with its properties for 35 years, and we must bear in mind that probably it has not been employed as a dye longer than about 40 years.

I have shown that damp alone does not injure the intensity of its colour, and that exposure to the air and sun *while dry* do not impair its brilliancy. Colours liable to alter with age generally show a tendency to fade in a year or two, and if a colour lasts only six or seven years exposed to the light and air, we may infer its durability for a lengthened period. From the practical experience of men conversant with the properties of this colour for thirty years, we cannot err in the conclusion that this colour is unalterable, under the circumstances I have mentioned, to a great age.

I do not contend that documents written upon paper prepared according to the method I propose will remain permanent only under favourable conditions, but that under the most disadvantageous circumstances, whether avoidable or unavoidable, to which written documents may be subjected, the chemical principles brought into play act in a similar way to the compensation-balance of a watch, and that common writing is thus intensified and fixed by the very causes under which its colour fades and becomes illegible, and that the Prussian blue characters thus de-

veloped are of great and lasting permanency. Practical evidence of a more complete and striking character might, I do not doubt, be adduced. I trust, however, that which I have collected may be deemed sufficient to warrant a trial of paper thus prepared for some of our public Government records. This solution of the question is simple, economical, and practical, and, I believe, founded on sound scientific principles.

I produce specimens of copying paper prepared in this manner. The prevention of the fading of copies taken with common copying ink has been recognised to be of the highest importance, since their liability to fade is greater than that of any written documents.

The insoluble ferrocyanides are a very extraordinary class of substances, and have not it appears received much attention from chemists. I have found them in a state of purity under ordinary circumstances substances of considerable stability; if exposed to the rays of the sun while damp or wet they have the same tendency to decompose as Prussian blue.

I have here a small piece of the ferrocyanide of manganese, which has been exposed for a whole year in a small hole in my garden wall, enjoying a south aspect and sunlight, and in spite of the vicisitudes of weather it has kept its colour perfectly.

The ferrocyanide of copper has great stability, and I would point out to chemists that the most minute portion of a salt of copper will discolour a ferrocyanide—since ferrocyanogen will unite with copper, even in preference to iron, for which its powerful affinity is well-known; and I would suggest that the descriptions given of certain ferrocyanides have probably been erroneous from this cause.

I produce a specimen of the ferrocyanides of zinc which I have prepared, and which is included in my patent.

Also the ferrocyanide of lead, and paper manufactured from it.

Also from the ferrocyanide of tin.

Also from the ferrocyanide of copper.

It is clear that even printed documents are not secure from fraudulent alterations.

As an instance of black printing-ink being obliterated, I would mention the postage-stamps, which are strongly suspected of having the cancelling stamp removed; it was stated lately in the *Times* that they are sold under cost. I have been lately shown a railway ticket from which the short limit of the journey stipulated for had been expunged, and a journey of 150 miles was actually obtained in this easy way, and this is not the only case that has occurred.

There are several chemicals which will dissolve the oil attaching black printing to the surface of paper, and a grey shadow of the firm and solid letters remains, which a very trifling amount of erasure will remove entirely.

I would mention caustic potass and benzole in both cases to produce a successful result. I think skill in the application is required.

The danger arising from the application of benzole or similar liquids, in order to remove the cancelling of the postage stamp, could be absolutely guarded against by printing them on my paper, and cancelling with muriate of iron or sulphate of copper.

Erasure by some means of printed characters on bank notes has also taken place. This I have ascertained to be a fact.

I propose to prevent the possibility of such a procedure by printing on my paper with acidulated muriate of iron, or a weak caustic alkali, or a salt of copper, mixed with the requisite proportions of a suitable thickening material. The characters will by this process be dyed through the substance of the paper, in Prussian blue, or manganese brown, or prussiate of copper. Erasure obviously cannot remove such characters, and I believe no portion of a document so printed could be altered without the destruction of the whole.

By writing in common ink slightly acidulated, it will penetrate to the back of a cheque, bank note, or any document, such as a foreign bill, which is liable to pass as money on the security of first class names; writing may thus be absolutely secured from alteration by mechanical erasure or chemical obliteration.

I produce a specimen written upon with an ink containing iron, which produces an agreeable variety of writing.

Country bankers' bills on London may be thus secured.

I produce a specimen of a bank-note; and there are many other cases in which an absolutely unalterable document is a most important attainment.

And now, having concluded this paper, I feel very strongly it may be urged that if a person is determined to commit forgery, he will do it. That my invention may prove to be defective, and that, in that case, its security will be no better than the expedients hitherto carried out; and, as a consequence, that I have, to the public detriment, done much to instruct the public forger in his depredations.

To explain my views, I may state, that I consider forgery as a misapplied Art, in which both skill and science are employed. The prevention of forgery involves the question,—Is not the scientific and artistic skill of men who use it honestly immeasurably in advance of those who use it dishonestly?

Our only security is in keeping in advance of the fraudulent classes in intelligence, and in the prompt adoption of every new aid Science and Art will give us. Our bankers have at their call an amount of ingenuity immeasurably greater than a gang of forgers can command.

Our course is, therefore, to solicit, rather than to repress, discussion, and not to underrate the danger. I do not say that we are to imagine dangers, but that we are exposed to the *greatest of all dangers*, when it is proved that frauds of a certain kind have taken place and we despise them because not sufficiently extensive.

I do not state that there never may be a way discovered of evading the security of my paper—but that in the present state of science of chemistry it reduces the chance of a successful forgery to a point which is equivalent to absolute protection.

I am confirmed in this view by the judgment of the eminent chemists who have examined my paper.

Few persons can conceive the amount of labour which the investigation and practical carrying out of this simple application of chemical science has cost me.

We must also feel that all forgers are not determined to commit forgery, and that the moral courage of a highly-cultivated and talented man may in a moment of pressure fail, and if by the exercise of a little fore-thought in so trifling a matter as the selection of a cheque or bank-note, a Banker can remove temptation from his way, and save him from ruin, is it not worthy of his personal attention?

DISCUSSION.

Mr. Herapath (Bristol) said, that as he had been alluded to by name in Mr. Barclay's paper, he might be allowed to commence the discussion. So far as he had been able to hear Mr. Barclay's paper, he did not understand that he had mentioned the patent of Mr. Stevenson. He thought that, as Mr. Barclay had closely criticised other patents, he was equally open to criticism for omitting all mention of that of David Stevenson, dated 1837, No. 7,313. This patent was for the very same thing as Mr. Barclay's. Stevenson claimed the use of the ferrocyanide of manganese, and he (Mr. Herapath) held in his hand a dividend warrant of the Bristol and Exeter Railway Company, on which appeared the following notice:—Printed on R. Barclay's patent indelible paper for the prevention of forgery." This he (Mr. Herapath) had analysed, and he pledged himself that the only protective substance found in it were ferrocyanic acid and oxide of manganese; and yet Mr. Barclay had claimed that as his own, while, in reality, it was Stevenson's paper

and Stevenson's patent. Stevenson's patent had expired in 1851, when, of course, it became public property, and they knew that if any patent had real merit in it at the time of its expiration, and the public had become aware of its value, it was generally adopted, but in Stevenson's case it had fallen into disuse, and he therefore thought it might fairly be presumed that Mr. Barclay's, which was identical with it, was of no value. Mr. Herapath concluded by reading from the specification of Stevenson's patent the following extract:—"The chemical preparation which I have used with success for preparing writing paper, and giving it the property aforesaid, is a solution of manganese prepared with a solution of prussiate of potass in a liquid form, and mixed with the pulp whereof the writing paper is to be made. So as that the metallic preparation cannot fail to be incorporated with, or equally diffused throughout the substance of the paper."

Mr. H. N. Nissen said, he had attended the meeting for the purpose of hearing what Mr. Barclay might have to say upon the subject of cheque-paper, and he could not help thinking that he (Mr. Barclay) would have acted more prudently if he had withheld a large portion of the information he had given that evening, and if he had hesitated to make statements which must have the effect of producing in the mind of the banking community, and of the public at large, a feeling of insecurity. He thought Mr. Barclay had raised a great number of apparitions, for the purpose of laying them again, more especially when he drew attention to the circumstance of receipt—and bill—and foreign stamps—being liable to the possibility of having the cancelling marks taken out and the stamps again used. He (Mr. Nissen) did not suppose it was at all likely that any one would attempt to remove the stamp from his receipt, and destroy the cancellation for the purpose of using it again. The same observation applied to bill stamps. He thought Mr. Barclay would have been better advised if he had taken more pains to ascertain the security of his own paper before he put it forth to the world that every other kind of paper was insecure. He (Mr. Nissen) had come prepared to show the insecurity of Mr. Barclay's paper, and he would exhibit to the meeting specimens of Mr. Barclay's paper, from which the ink had been completely discharged, and the extraction of the ink writing from those papers had been effected in two or three minutes, and in most cases not the slightest stain had been left upon the paper. For that purpose he required no special apparatus; no long list of discharging chemicals. He would leave those specimens for the inspection of the meeting, and he should be happy to find that Mr. Barclay could prove that his paper afforded greater security against frauds than the other descriptions of paper generally used.

Mr. Coe said, notwithstanding the pains which Mr. Barclay had taken in the preparation of this paper, he was sorry to be obliged to differ from him as to the advantages to be derived from the remedy he proposed, inasmuch as he (Mr. Coe) asserted that it was not at all required. He felt assured that the evil did not exist. He was sorry Mr. Barclay had not referred to the statistics of the number of forgeries effected, either upon cheques or bank-notes. He (Mr. Coe) had taken some pains to ascertain the feeling of the London bankers upon the subject. He began with the Bank of England, whose experience with regard to altered cheques was so small that they could scarcely call to mind a case in which a cheque had been tampered with by chemical means, and in the case of Glyn's and the London and Westminster Banks, he found their experience was precisely the same. With these facts before them, it appeared to him that it was not fair to the public to raise phantoms calculated to create so much distrust in their minds. The plan adopted by the Bank of England was that of a simple, plain, white cheque, without any preparation whatever, and that had been found to give all the security needed. With regard to the other banks it was no doubt true they had adapted various devices. He had been asked how it was then that they did not adapt plain paper. He presumed it was owing to the cheque printers having persuaded the bankers that they must have something distinctive to secure them from danger. He thought the public should be made to understand that they possessed within themselves the best means of protection; and that was by locking up their cheque-books. The great majority of frauds had been proved to have been obsolute forgeries effected on cheques improperly obtained. And he gave as an illustration a case which had occurred a week or two since, at the Old Bailey sessions. These cases occurred in the majority of instances from the carlessness of persons in leaving their cheque-books in places accessible to other parties. With regard to forged notes, he believed there never had been an instance in which a note of the Bank of England had been altered by chemical means from one amount to another. In conclusion he would state that experiments he had made with Mr. Barclay's paper showed that the writing could be completely obliterated from it.

Mr. J. A. Franklin remarked that the subject of obliterating the cancellation of expensive bill stamps was one of great importance. He begged to ask whether any means had been devised of cancelling those stamps in such a manner as effectually to prevent the possibility of their being restored to their original appearance, and used again for commercial purposes?

Mr. Fox, in allusion to the specimens of the results of the experiments upon Mr. Barclay's paper, produced by M. Nissen and handed round the meeting, pointed out that the writing had not been obliterated without making some alteration in the general character of the surface of the paper, palpable to the senses. He would put it to those who had examined these specimens, whether, if brought to the test of bright daylight, it would not be palpable to the eye that the paper had been tampered with? There was, in his opinion, a manifest difference between that portion of the paper which had been subjected to chemical operation and that which had not.

Mr. Nissen remarked that in the specimens produced the writing had not been thoroughly extracted, for the reason that a sceptical person might fancy that there had never been any writing upon the paper.

Mr. Fox added that in some of the specimens there was to him an observable difference between the portion of the paper to which Mr. Nissen's chemicals had been applied and the rest of the paper.

Mr. Apsley Pellatt said he understood the author of the paper to base his argument mainly upon the question of law with respect to crossed cheques. One speaker had said that the alteration of cheques seldom occurred, but the instance which had occurred appeared to have brought about an alteration of the law. With regard to the process of extracting the writing from the paper of Mr. Barclay, and the assertion that it could be so done as not to be apparent, he (Mr. Pellatt) would say, judging from the specimens he had seen, it had more the appearance of erasure by mechanical means; and if practised upon a crossed cheque, the eye of the banker's clerk would be at once attracted by it, and he would not pay the cheque. If that were so, then there was some value in the paper which Mr. Barclay had described. He (Mr. Pellatt) had had the honour of being associated with the Chairman in the House of Commons, and he ventured to introduce a bill into the House bearing upon that subject. At that time there had been legal decisions in the Courts, by which the security of crossed cheques had been put in jeopardy. He thought Mr. Barclay was entitled to their thanks, for, although there might be doubt in the minds of some persons as to whom the merit of these chemical preparations was due, all must acknowledge that they were indebted to Mr. Barclay for having brought forward the subject in so excellent a paper.

Dr. Miller could corroborate all that had been stated by Mr. Barclay. So far as he had made experiments

with Mr. Barclay's paper, the ink was discharged, but though he had succeeded in that, he was unable to do so without producing stains in the paper, which made it apparent that the writing had been effaced. He, however, had never succeeded in extracting the ink so completely as was shown by the specimens exhibited by Mr. Nissen.

Mr. Garraway inquired whether the writing upon the paper experimented upon by Mr. Nissen was written with ordinary ink.

Mr. Nissen replied that the ink used was that prepared according to the method given by Professor Brande.

Mr. Barclay, in reply said, Mr. Herapath had not succeeded in establishing the identity of the lapsed patent taken out twenty-three years ago with his. He had also omitted to allude to the distinction in the methods of manufacturing the paper on which depended its practical success or failure. The paper manufactured strictly in accordance with the directions of the lapsed patent, would not give any security to a banker. He begged to remind Mr. Coe that he had not ventured to deny that a cheque of the Bank of England was actually paid at one of their branches, as lately as the spring of last year, in which both the crossing and the amount were altered by chemical means. In reply to Mr. Nissen, who had denied that the introduction of paper as prepared by Mr. Barclay's process, gave any additional security, he would state that the fact was notorious to chemists, that it did give very great security, and that so far from his (Mr. Barclay's) having introduced it to the notice of bankers without due examination, it had undergone four very severe examinations, by gentlemen in whose chemical knowledge, skill, and integrity the banking community had confidence. He was inclined to think that the course he had taken, of publicly stating that the security of existing cheques was defective in both a scientific and practical point of view, and supporting his views by actual experiment accurately described, with specimens from every London bank, showing the extraction of amounts, crossings, &c., would show bankers that he had not studied the subject superficially, and would therefore be approved. Like Gabriel Tigere he might have thrown away the labour and expense the invention had cost him, and allowed its merits to be overlooked, to the detriment of the banking interest. Other cheque printers would, after a short period, adopt it as they had Tigere's, as a special and occult preparation of their own, and take credit to themselves in pressing upon bankers the efficiency of their cheques. The specimens produced by Mr. Nissen, of the extraction of a portion of writing from the new paper, were such as would be immediately detected by any bank clerk. The portions of writing operated upon were not by any means wholly obliterated, and that was admitted by Mr. Nissen himself. By resizing and restoring the original glazing of the paper, they could not fail to be noticed. They were also not written in a firm hand, and the writing ink had not penetrated the paper. Various proportions of the protective material could be incorporated in paper, and the specimens produced by Mr. Nissen were not strongly prepared. That strength was adopted as sufficient, an experiment having been conducted in the laboratory of King's College, in which writing newly executed on paper so prepared was not destroyed until an hour and three quarters had elapsed, and stains then were clearly visible. He would again call attention to the actual statements made in his paper. Owing to the paper having been brought on to be read at an earlier period than had been anticipated, he had not been able to lay the subject privately before the bankers previously, as he had intended.

The Chairman said it was now his duty, as well a his pleasure, to propose that the thanks of the meeting be given to Mr. Barclay for the paper he had been kind enough to read, but before doing so, he would make a few remarks upon one or two points which had occurred to him in the course of the discussion. He thought that even some of those who might object to some of Mr. Barclay's views must agree with him (the Chairman), that a free discussion like that which they had had must tend to some good end. He thought if those who possessed scientific knowledge were not a little jealous of their own inventions, there would not be that stimulus to bring forward the results they had accomplished, no doubt for their own benefit in the first instance, but from which the public in the end must derive an undoubted advantage. He felt assured that both Mr. Nissen and Mr. Herapath would agree with him, that open and free discussion, however tenacious gentlemen might be of their own views, must lead to increased knowledge on the part of the public. He certainly felt that, as one of the public, he had to thank the gentlemen who had taken part in the discussion, as well as Mr. Barclay, for the information they had afforded him. With regard to what had fallen from Mr. Coe, who considered there was no necessity for any special process whatever, and that all security was obtained by taking proper care of cheque-books, he (the Chairman) fully appreciated those remarks; still he thought they must all feel that that ought not to prevent their well considering any suggestion for improvements which might be offered to the public. He knew Mr. Coe well enough to be able to say that that gentleman never threw aside any suggestions for improvement without well considering their bearing. If Mr. Barclay's patent was not original, and if it were not quite so serviceable as he, Mr. Barclay, might think it, still his paper did well in reminding both the public and bankers that they were liable at all times to the risk of erasures and obliterations on cheques; and he was sure every gentleman present connected with banking must feel that the utmost vigilance was always necessary to provide that no acts of that kind should escape the attention of the banker's clerk. It was the duty of all who stood in the position of principals of banking-houses, to take care that every endeavour was used to prevent the occurrence of those risks. He for one confessed that he rather shared Mr. Coe's feeling, that there was no very great risk from the use of the cheque ordinarily in use. He had found from his own experience, and from his association with persons still more practical than himself, that the more simple the cheque was—the plainer it was—the less attempt there was to make it inimitable—the less likely it was to be imitated. That was the principle which, for many years past, had been adopted in the Bank of England. That was the principle with regard to their bank-notes as well as their cheques; but those who had the management of that establishment from time to time were never unwilling to listen to suggestions, and they were always thankful to receive the opinions of gentlemen of science, and give the subject the most ample consideration. He would conclude by asking them to join him in offering to Mr. Barclay their best thanks for the paper he had read, and for the information it had been the means of eliciting.

A vote of thanks was then passed.

The paper was illustrated by numerous experiments upon various patent and other papers in ordinary use.

The Secretary announced that on Wednesday evening next there would be NO MEETING; and that on Wednesday evening, the 11th of April, a paper by Mr. Edwin Goddard, "On Stoneware," would be read.

The following letter has been received by the Secretary since the meeting:—

There are four points of importance entering into the consideration of the security of documents from forgery:—Peculiarities in the fibre or texture of the paper, chemical preparations introduced into the pulp, water-marks in the paper, the style and character of the engraving printed on the papers. It is principally to the second of these

elements of security that attention is directed in the paper read by Mr. Barclay.

As far as I am aware, one of the first persons who suggested the introduction of chemical ingredients, with a view to prevent or detect alterations in the written portions of cheques, was the late Mr. Robson, whose London Directory was so well known before the volume compiled by the post-office officials drove it out of the field. This ingenious but unfortunate gentleman reasoned thus, If I write upon paper the pulp of which has been mixed with dilute ink, the application of any re-agent to destroy the written ink must necessarily destroy the colour of the adjacent tissue; hence, by adding a salt of iron and galls to the pulp he obtained the dye or tint in paper known as Robson's patent, still used by many bankers, and a very valuable paper it is.

Subsequently many other chemicals, chiefly vegetable colouring matters, of subdued tone, have been employed, their efficacy depending upon the facility with which they are destroyed by re-agents calculated to break up and dissolve the constituents of writing ink.

Upon this principle is based Mr. Baildon's process for securing bank drafts. After the value is inserted in the body of the documents in the usual manner, he writes the amount across the face, in an ink capable of discharging the colour of the paper.

Hence, for a successful forgery, two alterations are necessary, the black ink, and the white, if I may so term it. The preceding are all cases of tinted papers, being blanched on the application of chemicals to remove the ink. I believe I was the first to attack the converse proposition, to cause a white paper to exhibit a colour when tampered with; and the plan I suggested was to introduce starch into the pulp, and iodide of potassium and ferrocyanide of potassium into the size. On the application of any re-agent to remove the ink, the iodine is released and discolours the starch throughout the paper. It is not for me to express an opinion on its merits or faults; suffice that I am not aware of any case since its introduction, of a cheque printed on the paper having been altered to a higher amount and paid by a banker. As for it or any other paper possessing absolute security against the experiments of experts, my experience has taught me to avoid assuming the position of a quack doctor, "I am the man, and wisdom shall die with me."

Following this track, Mr. Barclay presents his paper, into which a whole laboratory of chemicals seems introduced, whether with more success than others remains to be proved. From the difficulty experienced by several persons in obtaining specimens, experiments have not been very fully made. So many Excelsiors, in the eyes of their parents, having proved to be only ordinary mortals after all, I shall be scarcely judged harsh in cautioning our friend not to expect a cold-hearted world to smile with the same roseate complacency upon his offspring as he does himself.

But here the serious question arises—Are these papers of that great practical value which at first sight might be supposed? Regard to truth compels me to admit they are not.

They remind me of those fanciful Chinese forts of which we read, very terrible and threatening towards the road the enemy is expected to advance, but very exposed on the other sides. Now these outer barbarians, the fraudulent, will not come by the path we prescribe, and expose themselves to the concentrated fire of chemical inventors, but ever and anon they touch us on the shoulder, and exclaim, "Here we are," and by very unscientific means. How, then, are frauds accomplished? Scarcely ever by chemical means, but in one of the following ways:—

1st. Some few by the simple school-boy process of scratching out the sum written in a cheque, and inserting a higher amount, more to the taste of the forger.

2nd. By transferring the printed part of a genuine cheque, and copying the writing of some known customer of the bank. By this mode an unlimited supply of cheques is obtainable, the only difficulty being in procuring suitable paper. Against this particular form of forgery Messrs. Glynn and Appel's process specially provides. By introducing phosphate of copper and a tenacious soap, transfer seems rendered impracticable.

3rd. But by far the largest proportion of frauds—I believe nineteen-twentieths of the whole—are effected by direct thefts of cheques, and these thefts occur in three modes. By obtaining cheque books on false orders. As these are most frequently written by discharged clerks, it would seem that the bankers have it in their power to diminish this class of frauds, by requiring the request for a new blank cheque-book to specify the last number of cheque in the previous book delivered to the customer.

Another mode is that of parties having access to cheque-books, fraudulently abstracting individual cheques. Against these thefts the public can materially aid in protecting bankers by feeling a moral responsibility to take care of their cheque-books, as it is evident that a cheque, genuine in all its printed characters, is *primâ facie* evidence to the bank clerk of its authenticity.

The last mode I shall mention is that of purloining cheques during process of preparation. Instances of the two former occurred before the Police-courts during the present week, and a case of the last description so recently as February in the present year.

The introduction of a water-mark is to some degree advantageous, by raising a difficulty in the way of one class of forgers, and in other cases limiting the field of fraud; no respectable manufacturer would deliver such a paper but to the bank or the authorised person, and only the manufacturer, the printer, the bank, or its customer should have possession of the paper, but ordinary tinted or white papers are so much in use for other purposes that they are readily obtainable by the fraudulent. W. STONES.

INDIAN WOODS THAT HAVE BEEN TRIED FOR ENGRAVING.

The following letter, from Dr. Alexander, has been addressed to the *Madras Daily Times*:—

Sir,—It may interest the public, both in Madras and Calcutta, to know that the results of the experiments commenced in the School of Arts at Madras, in 1850, to improve the illustration of the literature of India, attracted considerable attention in London, Edinburgh, and Glasgow, where specimens of the woods and of the engravings upon them were exhibited. For several years the attempts were very feeble and indifferent, although much on a par with the early efforts at illustration in England about sixty years ago. Rewards were offered for the best kinds of wood produced, and the following were the results:—

The *Guwa Psidium pyriferum, Tam.*, Coay Marum, was found to be close grained and moderately hard, with a thin bark and pretty uniform texture of both the outer and inner parts of the wood, when cut across the grain. It cut easily and cleanly, like firm cheese, and gave delicate lines, but being a little softer than boxwood it did not stand the pressure of printing, though it yielded very good impressions with a burnisher. The art of printing from woodcuts being in its infancy for illustrating literature in India, many of the early impressions were spoilt from too heavy pressure. For four or five years the Guava was used, and answered well for bold engraving, or for cutting blocks for large letters; attempts to cut letters upon it for a Tamil alphabet proved a failure, though the large Tamil and English alphabets succeeded very well, and were useful for several purposes, as printing large school and diagram letters, stamping on cloth and clay to get letters or numbers for use in schools. The Guava-wood was found to vary very much in texture, the large trees yielding a soft coarse wood, while the small wood, from hilly districts, was hard and fine in the grain. Samples that had been sent to England and tried for en-

graving were pronounced to be too soft, and inferior to English boxwood.

The next wood which was tried was the Satinwood of Ceylon, *Chloroxylon Swietenia, Tam.*, Vummaay. This proved to be hard but uneven in the grain, coarse in the pores, and, like many woods of a large size, harder and denser in the centre than near the bark. Under the graver it was found to splinter, and not to cut sweetly or turn over in curls as it ought to do. This wood was condemned as unsuited for wood engraving, both in Madras and England.

One of the next woods tried was the Palay, *Wright Tinctoria, Tam.* The native name is a very vague one, being applied to a number of woods that have a milky juice. The wood, however, is better known to the public as one from which native toys are frequently turned. It is a pale nearly white wood, close and uniform in the grain but too soft to stand printing. It cuts smoothly, but does not bear delicate cross hatching. It was pronounced unfit or wood engraving in England, though well suited for furning, carving, and in-laying with darker woods. A kind of indigo is obtained from the leaves of this tree.

Veppaley, or *Wrightia autidysenterica*, was also tried, found to be very hard in the centre, but soft in the outer portions, and liable to the attacks of insects. On examining this wood under the microscope, it gave promise of being suitable, from the closeness of texture and the polish left by the chisel in cutting it across the grain, but the uneven quality and the softness of the outer parts showed that it was not fit for engraving. Its chief use is for posts and rice-beaters.

The next wood which was tried was Sandal. *Santalum album, Tam.* Chandanum. This proved to be the nearest approach to the boxwood in working quality, hardness, and durability under pressure. This is a moderate-sized wood, with thin bark, which is usually a criterion of fine, even grain; it cuts smoothly, the chips curl well under the graver, and the oily nature of the wood seems to preserve it from splitting when wet. There are considerable differences in sandalwood, according to the locality from which it is procured, the small dark-coloured wood, of five inches diameter, grown on dry rocky soil, being the best. Many hundred engravings have been executed upon this wood, and it has been found occasionally to equal boxwood, though it is not quite so hard. It is an elastic wood, that hardens on exposure to the air, and stands a good deal of rough usage in the press; some blocks have yielded upwards of 20,000 impressions without being worn out. The large pale sandalwood is not so good as the small dark kinds. This wood was not tried in England, as its price was thought to be too dear, but on comparing it with boxwood, which sells in England for one penny the square inch, it was found to be cheaper in India than boxwood in England, though it is ten or twelve times the price of any of the other woods that were tried.

The Beyr fruit, *Zizyphus jujuba, Tam.*, Elenedei, gave good promise under the microscope, but proved to be a soft, spongy, light wood, that did not stand cross hatching or pressure. It is used for native sandals.

The wood of the Wild Orange, *Citrus aurantum, Tam.* Kitechel, bears a strong resemblance in appearance to box in working qualities, and is often as hard, but, like the sandalwood, the small old trees from hilly districts yield the best wood for engraving. It has a very thin bark, a bright yellow colour, and very uniform and close texture. The cultivated or garden orange is a coarse wood, with a very uneven texture, produced in some cases by a curious mode of propagating the trees, viz., by splitting down the parent stem and planting every piece that has a root attached; a barbarous and primitive mode of culture, but thought by the natives to improve the fruit.

It was reported that a kind of boxwood was common in the gardens about Madras, but on procuring a specimen of the flower and fruit of the tree for examination, it proved to be a species of China Orange, the *Murraya exotica*, with a very small fragrant fruit, little larger than a pea. On trying the wood for engraving, it proved to be, like the wood of many of the Aurantiaceæ or orange family, hard and close in the grain near the centre, but softer near the bark. The cross section of this tree is very irregular, being deeply indented, from the same mode of propagation as is followed with some of the garden orange trees. The result of this is that both the wood and bark of the tree are impaired, though the flowers and fruit are not. The flowers of this plant is used by bride's maids in favour as the true orange blossom which it resembles.

A wood that disappointed the expectations that had been formed of it from the first trial was coffee, *Coffea Arabica, Tam.*, Capie cottai. The first piece of this that was sent to the School of Arts was very hard, uniform, and close in the grain, but small. Some pieces of old trees, about 6 inches in diameter, were afterwards procured, but they proved to be soft, uneven in grain, and not fit for engraving, though the wood is well adapted for ornamental carving or inlaying. We should be glad to hear more about this wood, and to receive other specimens of young and old wood cut when fresh. The specimens sent us were old trees that were past bearing, and that had been pulled up, left on the ground for a few weeks, and then dried near the cook room fire for some days—a great mistake, as woods for engraving ought not to be too dry. This wood works beautifully on the turner's lathe, and cuts very sharply under the chisel, gouge, or graver; it is deserving of more attention for ornamental carving and inlaying. It harmonises well in colour with the orange and with the wood of the Inga dulcis or Corookapoolee. A near approach in colour and grain to walnut, but too coarse for engraving, though fit for gunstocks and cabinet work.

The only other woods tried for engraving were a very close-grained, fine, and uniform wood which was sent from the Neilgherries, under the name of iron wood, used for turning and for making walking sticks. It worked well under the graver and on the turning lathe, but the piece sent was too small to print from. And a piece of *Fustic Maclura Tinctoria*, that had been grown in the Horticultural Gardens at Madras, but this proved to be too soft and coarse for engraving, though a rich coloured, bright yellow wood, suited for inlaying.

About two years ago, it was reported that true boxwood was discovered in the N. W. Provinces, and a log of it was kindly procured for the Madras School of Arts by Captain Maclagan, of the Roorkee College, and forwarded to Calcutta for despatch to Madras; but it seems to have been appropriated for use in the School of Arts in Calcutta, where a prize of 500 rupees was offered for the best substitutes of English boxwood fit for engraving. We do not yet know if the prize has been awarded, but we heard from a friend who had lately visited the School of Arts in Madras and Calcutta, that a good deal of boxwood has been sent to the latter school, and our log is one of those probably. We should think the prize of 500 rupees too large for such a discovery in Madras, as we have collected all the above-named woods and used some of them for engraving and illustrating scientific and educational books, reports, and many of the advertisements in the Madras newspapers, and all have been the result of a reward of 10 rupees offered to Captain Puckle, who sent us the best collection of woods, but liberally handed over by him to the natives who collected the specimens. We have to deplore the loss of the services of our best wood engravers in Madras. Mr. Garrick, who was at the head of this department, has been tempted away from us to Calcutta with the offer of a high salary. Mr. J. Durate. Mr. Sharleib, and many others who used to render us valuable aid, have obtained more remunerative employment for their talents than we could afford to give, and we are reduced to one intelligent deaf and dumb native lad, who promises as well as any of the above-named.

We have still got a good staff of engravers and etchers upon copper; this style of work was pointed out to us in

England as one in which the natives of India were calculated to excel, as it admits of a free and flowing kind of line which cannot be easily imitated in wood engraving. We wish our former teachers and pupils every success in after life, and should be glad to see them trying to aid in the extension of a taste for the fine arts, or for illustrating literature in Southern India. A good many lads began to learn wood engraving in Madras, but few of them had the perseverance to carry it on, chiefly, I believe, on account of its difficulty, and the time and labour requiring to be expended on its study.

ALEX. HUNTER, M.D.

Home Correspondence.

DECAY OF BUILDING STONES.

Sir,—I am happy to see, by the result of Wednesday evening, the 14th inst., that public opinion will before long abolish the practice of rearing public buildings with rotten, perishable materials, and with it the crowded system of expensive and useless ornamentation, badly imitated from the darkest and most barbarous monkish ages.

Minute sculptured or painted ornaments on public buildings must inevitably be worse than useless, for at the distance they must be viewed for effect, the ornamentation takes the appearance of a mass of dirt thrown on to the face of the building, especially in the metropolis; and he is no architect who cannot design a building that shall be light, elegant, and beautiful, without having recourse to any sculptured or other decoration whatever.

If, again, sculptured ornament be rendered imperative by a barbarous fashion, where are the artists to be found to execute the work? Stone-cutters and statuaries are mere tradesmen, not artists. Where is there in London an example of architectural or monumental sculpture, that any real artist would look at twice, if at all? All our equestrian bronzes are mere brass-founders' productions, and might have been obtained at far less cost, and of much more artistic execution, by transmitting an order to one of the great foundries of the Midland or Northern counties.

What exchequer could stand the expense of a Chantrey or a Marochetti, for the sculptured ornaments of a public building? Yet no art is admissible as art, that is much inferior to that displayed in the monument of the two children in Lichfield Cathedral.

If, however, granite and such hard stones only are to be used as will give a shower of sparks under the pick or chisel, a great revolution must take place in the operations of the stone-cutters.

In the South of Europe, where such stones only are used for building purposes, no band of stone-cutters work without the attendance of a smith and forge, the smith being generally one of their own body, who, after work hours, draws out their picks and chisels; for they never waste good steal by grinding, and never work with blunt tools.

The most useful tool, however, for rough work is a soft iron double-headed maul, of various weights, but always heavy. Instead of being faced with steel the two ends of the maul are pierced with a pyramidal cavity, in which any number of picks are inserted, of this shape , square in section, made of the best steel, and both ends equally available for work. Owing to the weight of the maul very slight blows are required, so that the steel picks wear well, and yet the granite is worked down with astonishing rapidity.

The picks are knocked out and changed in a moment by the blow of a small hammer.

But if granite is to be used on a large scale why should we not imitate the seal engraver's machine for all finishing purposes. Corundum, which can be obtained in any quantity, will be the substitute for the diamond powder of the seal engraver to arm the soft steel tools, revolving by the aid of steam at enormous high speeds.

The general form of such machines already have their type in the block, wood, carving, and planing machinery actually at work in every part of the country.

The disfigurement of the Pompeian and Byzantine Courts in the Palace at Sydenham, is most justly attributed by Mr. Wentworth Scott to the very bad materials always used by our builders, even when they covenant to, and through gross ignorance, believe they do supply the best that can be procured. But it ought to be well understood that the builder's "reservation" means the best that can be got out of the foundations dug for the work they may be upon.

As the subject is of primary importance, it may be useful to describe the materials and mode of using them adopted in building the original Pompeii, for they are precisely the same now as 2,000 or 3,000 years ago.

The solid walls are generally built of three materials, namely:—

1. Tufo, a volcanic production, that never effloresces.
2. Hard stones, that will give a shower of sparks when struck with the pick.
3. Bricks, such as I have already described in a former letter, which of course are indestructible.

The mortar is made from the common buff-coloured lime of the country, quite as abundant now as formerly. It is made from a peculiar boulder stone, washed down by the mountain torrents. This buff-coloured lime is to be found in many parts of this kingdom, but is avoided by the builders as they would Satan himself, because it will not carry near so much sand as the wretched limes in common use.

The mortar, if not intended for sea-works, is made up with coarse washed sand, that can generally be found in the rivers.

This mortar makes so powerful a cement that large quantities of water are dashed over every course of brick or stone as it is laid, in order to ensure a perfect set.

The same mortar is used for the outside stucco, as well as for the first coat inside, especially near the ground, as it fears no damp.

The second and third coats, inside work for the best apartments, always consist of fine white lime and white marble powder, which may be obtained from "Massa di Carara" or other marble quarries in any quantities. The exquisite finish this stucco is capable of receiving is superior to polished ivory, and of course infinitely more durable.

Knowing the badness of their lime mortar, builders and contractors often recommend the use of Roman and other cements, upon the use of which they are allowed to make exorbitant charges. It is true that these cements are quick and hard setting, but they have many faults, which ought to prohibit their use except under ground, where indeed buff lime is far preferable, and more of the so-called cements will adhere to the soft materials they are intended to hide. The builders also complain that they will not carry one quarter of the sand they used to do.

All these cements were wholly unknown to the ancients, who had no patent offices, or patent companies formed to establish expensive manufactories of substitutes for, but far inferior to, nature's simple materials when properly used, which have been the sole cause of the preservation of the Pompeian decorations down to our times.

To give an idea of the accuracy and strength of Italian bricklayer's work, I may state that it is a common practice to turn a groined flattish vault for the floor of a ball-room, say 35 feet by 60 feet span, without a centre of any kind, of brick on edge, and those bricks only 1½ inch thick. The spandrils are spurred up with four-inch work on all sides, but the true floor rests upon the crown of the vault. It is called turning a vault "*alla volterrana*," instead of "*volta reale*," as when the bricks are used flatways.—I am, &c., HENRY W. REVELEY.

Poole, March 23rd.

ON ARSENICAL CRUSTS.

Sir,—Without wishing in any way to detract from the merits of Dr. Guy's interesting paper, I must demur to

the proposed employment of flat discs of glass for receiving arsenical crusts. Except with very high magnifying powers (which are rendered unnecessary by adopting a process which I shall presently describe,) a glass tube of half-an-inch diameter offers equal facilities for examination under the microscope. Indeed, for small crystals, even a quarter-inch objective (magnifying 500 diameters) can be so employed, with the slight drawback of some extra focussing being needed. On the other hand, the rapid sublimation required in Dr. Guy's method must involve the loss of part of the arsenical vapour at the mouth of the tube, which is only loosely covered by the flat glass, and another portion, being very dense, will remain in the tube itself, whilst that which reaches the disc will be deposited on it in a nearly amorphous condition. No wonder that such "mists" should frequently require objectives of one-eighth inch to develop any crystallic character, and even then a few imperfect triangular facets afford but unsatisfactory evidence of octohedralism, when we consider what weighty issues are in a measure dependent on the making out that feature. It is, however, in the power of the operator to obtain crystals of arsenious acid as perfect as he can those of alum an inch or two in diameter, and by acting on the same principle, namely, by obtaining a very gradual formation during slow cooling. The following is the *modus operandi*, as described by me in Table I. of my "Compendium of Qualitative Analysis." Drive the substance entirely off the lower half of the tube, which is made very hot by waving it about in the flame. Then re-vaporise the sublimate, holding the tube (which should be closed by a loosely-fitting cork) as upright as possible. The dense vapour sinks to the bottom, and will give large and regular crystals as the glass slowly cools. These crystals glitter in the sun like diamonds, and exhibit the same play of colours; they are from one one-hundred-and-fiftieth to one two-hundredth of an inch in diameter, and under an inch objective form splendid specimens for the micro-crystallographer. Here and there we find octohedra absolutely perfect, but they are more frequently truncated; all the angles, however, being beautifully sharp. The majority are transparent, but some are only translucent, or even opaque. By reflected light (using a bull's-eye condenser) they appear, in consequence of their adamantine lustre, like diamonds lying in high relief on a black ground; but their complete shape is most strikingly displayed by a combination of strong reflected and feebler transmitted rays of various degrees of obliquity. A tube of half-an-inch diameter, under a one-inch objective, presents nearly the entire field in focus, and the perfect crystals appear from one-half to three-quarters of an inch in diameter.

I will describe an actual experiment just made by this method. I accurately weighed out a grain of pure arsenious acid on a balance sensible to the thousandth of a grain. I dissolved this in water, and made up to a known bulk. By means of a graduated pipette I took a thousandth part of this, containing of course one one-thousandth of a grain of arsenious acid, and evaporated it to dryness on a bit of curved glass. The latter, with the slight residue adhering to it, was then cut up and placed in a corked tube, four inches long by four-tenths of an inch in diameter. On igniting the fragments, a feeble sublimate appeared halfway up the tube, which, under a quarter-inch objective, was seen to consist of granules, evidently crystalline, but of indeterminable shape, and not more than one ten-thousandth of an inch in size. Re-sublimed by my method, these gave a few crystals, which were sought out by the inch objective, and then examined under the quarter-inch. They were beautifully perfect in shape, and about one twelve-hundredth of an inch in diameter. This would yield the strongest presumptive evidence of the nature of the substance in question, but I can by no means agree with one of the speakers at the meeting, who considered that we might afford to neglect applying the liquid tests to a solution of the sublimate. Each reaction must stand for what it is worth, but the concurrence of all furnishes irrefragable proof. The above quantity seems to be about the smallest that would yield any definite result in a tube of the size named; but unless more than a thousandth of a grain of arsenious acid were obtained by Reinsch's test, I for one should be extremely loath to assert that it had been criminally administered.

I am, &c.,

FREDERICK W. GRIFFIN, Ph.D.

Bristol School of Chemistry, March 26, 1860.

THE PAPER DUTY.

Sir,—As it appears to me and many others that a very one-sided view of the effect of the repeal of the paper duty has been taken, I would wish to press on the public, through you, the following practical considerations. There is abundance of available fibre in the common furze, not fit for linen or cordage, easily extracted, and easily blanched. There is an excellent material, of similar kind, with a long staple, in the common broom. Cannot the enormous quantity of land laid waste by railways be profitably cropped with furze and broom, which would embellish those dreary lines? The crop could be sown by any clever gardener, regularly cut at very little expense, be carried on by railway to retting ponds and mills for making "half-stuff," that is to say, half-made paper, and thence transferred by those same railways to the paper manufacturer himself. The railway companies would thus receive some rental for their land, and a prodigious quantity of good material, provided at a cost not greater than that of converting filthy cotton waste into paper, would be available for the paper market. Another refuse material which promises well is the bine or stem of the hop after the hops are picked. Surely it would pay to construct mills in the neighbourhood of the hop gardens of Kent and Worcestershire. The true worth of all such articles can only be ascertained by actually manufacturing them, but the worst holds out a better prospect of fitness than the straw that was converted into the paper we are now writing on, which would have been regarded at one time as the most intractable of substances. As to materials of exotic origin, there is the husk of maize cobs—that is to say, the thin leaves which protect the ear of Indian corn, and the refuse fibre of sugar-cane mills; surely they may be procured from an easy distance, and might come home as dunnage. Their quantity is inexhaustible. We may also mention the wool of the silk cotton tree of tropical America, within a few days' sail of Liverpool—a substance only employed in stuffing pillows and mattresses, or blown away like the tree cotton of Canadian poplars. This is a short-stapled article, *ferœ naturâ*, as they say, demanding no cultivation, and whose market value is nil. Its price is the cost of collection and freight. It is ready made matter, bleached easily when bleaching is necessary. Cannot this, or the fleecy down of countless tropical Asclepiads, be compelled to obey the commands of the paper-maker, armed as he is with size and whitening? I do not pronounce a positive opinion as to the value of any one plant in particular, but I am persuaded that commerce will easily bring all such substances under trial, and until they have been made the subject of fair experiment I must withhold assent to the doctrine that nothing will make good paper except old rags. It is equally incredible that our machine makers are unable to provide mechanical contrivances capable of reducing the most obstinate fibre into pulp; it is equally incredible that merchants should be unable to procure worthless substances at as low a price as rags; and it is not less inconceivable that chemists cannot provide bleaching materials at a far lower price than they now bear in the market.

If anything could be added to the force of the above facts, it is this—that no doubt whatever can exist as to one effect of the repeal of the paper duty, being an enormous increase in the demand for labour. The articles, even of trifling value which would be made when this excise is removed are countless. Boxes, wrappers, and an infinite number of similar articles would be provided by the great

shopkeepers, in which to enclose the fancy goods they sell, and all such articles would be made, not by the able-bodied part of the population, but by women, children, and infirm men incapable of much exertion. I therefore think that on the ground of humanity alone, the repeal of the paper duties ought to be considered one of the first duties of an enlightened Government.—I am, sir, yours, &c.,

JOHN LINDLEY, F.H.S.

Acton-green, W., March 28.

Proceedings of Institutions.

London and South-Western Literary and Scientific Institution.—At the tenth annual general meeting of the members of this Institution, held at Brunswick House, Wandsworth-road, on Thursday, the 16th February, 1860, Mr. Hayes Kidd in the chair, the report of the Committee and statement of accounts for the year ending 31st Debember, 1859, were read. At the termination of the last winter season (1858–9) the Committee did not feel themselves justified in providing for any summer course of lectures. They reserved the funds then in hand, and by means of this economy were enabled to devote a much larger amount to liabilities connected with the library, printing, &c. The Committee consider it their first duty (after defraying the current expenses of the Institution) to meet the obligations arising from the past; and they hope during the present year to be enabled to relieve the Institution from every incumbrance of this kind. The increase of the library is an object which the Committee have ever had at heart, and it now contains more than 2,000 volumes. During the past year, the French, German, and Gymnastic classes were set on foot on the self-supporting principle. The French and German classes had been discontinued during the previous autumn, in consequence of the master, M. de Reiffenberg, leaving England. In the spring, however, they were again commenced, under the superintendence of an equally experienced and efficient master, Mr. Smale. A Gymnastic class was organised, but not being sufficiently numerous to recompence the master for his attendance, it has been discontinued. The only class now supported by the Institution is the Mechanical Drawing class. This class, however, is not so much an appendage to the Institute as an integral and constituent part of it. It is a class expressly designed to instruct the sons of the Company's servants in mechanical science, and thus to prepare them for efficient service when the time arrives that they themselves shall enter as artizans into the Company's works. In the day and evening schools attached to this Institute for the education of the children of the Company's servants, the attendance both of boys and girls has been greater this year than heretofore; the number of pupils entered to the schools during the year being respectively 144 of the former and 86 of the latter. To these numbers must be added 24 adults, making a total of 254 scholars. During the last quarter of the past year, a Vocal Music class has been established. During the past year a large accession of new members has been enrolled, and at the present time the number is considerably larger than it has been at any former period since the Institution was first founded. The total number for the quarter ending 31st December last was 301. The number has progressively increased from the first establishment of the Institute up to the present time. The balance-sheet shows that the receipts are about the same as those of last year, but there is a diminution in the expenditure (inclusive even of the outstanding accounts before alluded to) of £7 14s. 9d. The Committee have great satisfaction in stating that, in reply to their invitation, Mr. Tite, M.P., has consented to become a Vice-President of the Institution. The Committee have also the pleasure to acknowledge a donation of ten guineas from that gentleman. Several votes of thanks were passed, and the election of officers for the ensuing year took place.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Entomological, 8½. Dr. Routh, "On some of the Disadvantages of Employing Fallen Women as Wet Nurses."
Tues. .....Civil Engineers, 8. Discussion on Mr. Wethered's paper "On Combined Steam."
Pathological, 8.
Photographic, 8.
Wed. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Pharmaceutical, 8.
Thurs. ...Linnæan, 8. 1. Prof. Bell, "On a new genus of Crustacea." 2. "Notes on Ants," communicated by Mr. Paterson, of Belfast. 3. Mr. Bentham, "Notes on *Ternstrœmiaceæ*."
Chemical, 8.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on March 6th, 1860.

117. Savings' Banks—Return.
133. Queen Anne's Bounty—Account.
134. Fines and Penalties (Ireland)—Abstract of Accounts.
142. Light Dues—Return.
105. Probate Court—Return.
66. Bills—Isle of Man Harbours.
67. ,, Public Improvements (Amended).
71. ,, Court of Chancery.

Delivered on March 14th, 1860.

137. Exports (France)—Return.
138. Royal Gunpowder Mills (Waltham Abbey, &c.)—Returns.
139. Militia—Returns.
144. Gloucester City and Wakefield Election Commissions—Return.
127. Great Yarmouth Election—Minutes of Evidence.
68. Bill—Bankrupt Law (Scotland) Amendment.
Italy—Further Correspondence (Part 3).

Delivered on March 15th, 1860.

128. Counties and Boroughs (Ireland)—Returns.
140. Military Savings' Banks—Return.
69. Bills—Titles to Land (Scotland) Act (1858) Amendment.
72. ,, Inclosure.
73. ,, Refreshment Houses and Wine Licenses.

Delivered on March 16th, 1860.

145. Bankruptcy—Return.
149. Refreshment Houses and Wine Licenses—Copy of Memorial of the Licensed Victuallers.
France (Relaxations in Treaty of Navigation)—French Decree, 10th May, 1854.

First Session, 1859.

208. (D) Poor Rates and Pauperism—Return (D).

Delivered on March 17th and 19th, 1860.

135. Imports—Return.
126. Carlisle Election—Minutes of Evidence.
116. East India (Salaries, &c.)—Return.
85. Harbour, &c., Bills (10. Mersey Docks and Harbour Board)—Board of Trade Report.
76. Local Acts (46. Kilrush and Kilkee Railway and Poulmasherry Embankment—47. Moy River Navigation—48. Llyfni Vale Railway and Harbour—49. Blyth Harbour and Dock—50. Newcastle-upon-Tyne and Derwent Valley Railway—51. Watchet Harbour—52. Isle of Wight (Eastern Section) Railway—53. Putney and Battersea Bridges—54. Athenry and Ennis Junction Railway—55. Land Loan and Improvement—56. Mersey Docks and Harbour Board)—Admiralty Reports.
74. Bill—Ecclesiastical Commission, &c.
China—Further Correspondence with Mr. Bruce.
Marine Engines—Amended Report.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 23rd*, 1860.]

Dated 13th February, 1860.

389. T. Shedden, Ardgartan-house, Argyle, N.B.—Imp. in the manufacture of cartridge cases for fire-arms, and in the arrangement of primers therefor.

Dated 21st February, 1860.

468. R. J. Derham, 46, Redcliff-street, Bristol—Imp. in butter churns.

Dated 25th February, 1860.

523. J. E. Boyd, Hither-green, Lewisham, Kent—Imp. in and transmitting motive power from certain parts to certain other parts of lawn mowing, grass cutting, and other agricultural, horticultural, and farming machines.

Dated 29th February, 1860.

561. J. K. Smythies, 27, Kensington-park-gardens—A flying engine.

Dated 5th March, 1860.

591. W. N. Wilson, 144, High Holborn, and J. Pitt, Cleckheaton, Yorkshire—Imp. in apparatus for sewing machines.

Dated 6th March, 1860.

607. E. Field, 10, Hart-street, Bloomsbury—Imp. in the manufacture of railway tyres.
609. J. Leeming, Bradford, Yorkshire—Imp. in looms for weaving.
611. W. E. Gedge, 4, Wellington-street South, Strand—Improved machinery or apparatus for washing fecula. (A com.)
613. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in the manufacture of lasts and boot trees. (A com.)
615. P. Hugon, Paris—Imp. in obtaining and applying motive power.
617. R. Pitt, Bath—Imp. in the manufacture of leather, and in machinery for that purpose.

Dated 7th March, 1860.

619. G. Walcott, 24, Abchurch-lane, London—An improved receptacle or receptacles for generating gas.
620. J. Arnot, Birmingham—A new or improved spindle for door and other knobs.
621. E. T. Hughes, 123, Chancery-lane—A hydro-dynamical reacting rotary steam engine. (A com.)
623. C. A. Chapuis, 29, Boulevart St. Martin, Paris—A new or improved process in manufacturing and ornamenting ceramic products chemically.
624. A. Paget, Loughborough—Imp. in knitting machinery.
625. J. Imray, 65, Bridge-road, Lambeth, and J. Copeland, 12, Marlborough-place, Kennington—Imp. in steam and other hammers and anvils.
626. W. Beardmore, Deptford, and W. Rigby, Glasgow—Imp. in steam engines.

Dated 8th March, 1860.

628. W. Goddard, Park-hall, Staffordshire—An imp. in railway chairs.
629. T. Veal, Willenhall, Staffordshire—Imp. in curry combs.
631. G. H. Birkbeck, 34 Southampton-buildings, Chancery-lane—Imp. in floating docks. (A com.)
633. J. Bell, Manchester, and W. Curtis, Salford—Imp. in steam engines.
634. Capt. W. Palliser, Comragh, Waterford—Imp. in breech loading rifles and other guns, and in cartridges to be used with such like fire-arms, also in shot used with rifled guns.
635. G. Shearman, Haggerston, Middlesex—Imp. in water gas meters.
636. Lieut.-Col. G. Spiller, R.A., 15, Upper Southwick-street—Imp. in knapsacks.
637. J. Napier, Glasgow—Imp. in steam engines.

Dated 9th March, 1860.

638. J. Lister and J. Lees, Oldham—Imp. in the construction of oil cans.
639. W. Richards, Nottingham—Cleansing, rinsing, or scouring lace, hosiery, or other articles, whether made of silk, cotton, or other material from extraneous matter.
640. C. Sheldon, Saint George's-place, Great Hampton-row, Birmingham—Certain imps. in ornamenting spurs, and other metal portions of saddlery and harness furniture, and which said improvements are also applicable for ornamenting other fancy articles made of wrought or cast metal.
641. C. F. Bielefeld, Gower-street, Middlesex—Imp. in the manufacture of wads for guns, and in cases for containing the charge of powder for the same.
642. J. Sawyer, London—Imp. in the construction of furnaces for steam boilers and other purposes.
643. W. Clay, Liverpool—Imp. in the manufacture of gun barrels, cannon, and other ordnance.
644. W. E. Newton, 66, Chancery lane—An improved mode of attaching tools to handles. (A com.)
645. T. Smith, Manchester—Imp. in machinery or apparatus for ornamenting woven fabrics.

Dated 10th March, 1860.

647. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved means of blasting rocks. (A com.)
648. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved mechanical damask loom. (A com.)
649. J. S. Ottley, 10, Eversholt-street, Oakley-square, Middlesex—An improved indicator for the withdrawal of liquids from casks or other liquids.
650. J. H. Young, 66, Great College-street, Camden-town, London Imp. in setting up (composing) and distributing types.
651. J. Rae, New-Cross, Kent—Imp. in constructing iron ships, part of which improvements is applicable to the rivetting of boiler plates and others.
652. F. Ullmer, Castle-street, Holborn—An imp. in printing machines.
653. T. Morris, Birmingham—Imp. in voltaic batteries and in vats used in depositing metals by electricity.
654. F. A. Pope and E. F. Cook, and R. F. Woodward, Birmingham—Imp. in connecting brooms and brushes to their sticks or handles.
655. J. Pilling, Colne, Lancaster—Imp. in brakes or apparatus for stopping looms when the shuttle is caught in the warp, which is applicable to all looms with a break applied to them.
657. W. Tuxford, 106, Upper Thames-street, and G. W. Hills, Mortlake, Surrey—Imp. in furnaces.

Dated 12th March, 1860.

659. J. B. Howell, Sheffield—Imp. in tubes for boilers.
660. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in steam boilers and engines. (A com.)
661. J. Langman, Stonehouse—An improved cartridge and method of manufacturing the same.
662. A. V. Newton, 66, Chancery-lane—Imp. in steam engines. (A com.)
663. T. W. Ashby and T. Yorke, Stamford—Imp. in the construction of haymaking machines.
664. W. E. Newton, 66, Chancery-lane—Improved machinery for making hat bodies. (A com.)

Dated 13th March, 1860.

667. S. Smith and P. Hathaway—Imp. in the manufacture of chains and other similar articles.
669. M. Miller and J. Kemp, Mount-street, Nottingham—Imp. in water and steam guages for steam boilers.

Dated 14th April, 1860.

675. M. Henry, 84, Fleet-street—Imp. in the construction of artificial hands, feet, and limbs, and parts thereof. (A com.)
677. J. Sim, Aberdeen—Imp. in measuring and registering the flow or discharge of liquids.
679. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in cleaning rice, and the machinery or apparatus employed therein. (A com.)
681. W. T. Cheetham, Rochdale—Imp. in cocks or taps.
683. A. V. Newton, 66, Chancery-lane—An improved construction of nail plate feeder. (A com.)

Invention with Complete Specification Filed.

673. C. Batiste, Toulouse, France—An improved wood grooving machine.—14th March, 1860.

Patents Sealed.

[*From Gazette, March 23rd*, 1860.]

March 23rd.
2165. A. R. Le Mire Normandy.
2167. C. Lambert.
2174. J. Fernihough.
2177. D. White.
2185. J. S. Parfitt.
2195. W. H. Phillips.
2203. G. G. Page and C. Lungley.
2205. W. Johnson.
2255. J. Shields.
2291. W. Irlam.
2295. J. Childs.
2329. T. B. Daft.
2347. T. Robinson.
2357. J. Harcourt.
2393. C. Cowper.
2399. J. R. Palmer.
2675. F. Scheithauer.
2847. W. R. Crocker.
2901. R. S. Howden & E. Thresh.
183. I. L. Bell.

[*From Gazette, March 27th*, 1860.]

March 27th.
2194. E. S. Cathels and S. Splatt.
2196. J. F. Stanford.
2204. T. Allan.
2206. E. H. Bentall.
2210. R. Oxland.
2212. T. Guibal.
2223. Hon. W. E. Cochrane.
2226. W. Parkin and J. Bates.
2228. A. S. Stocker.
2266. J. Webster.
2321. Z. Nuttall.
2464. A. B. Mitchell.
2706. B. Samuelson and W. Manwaring.
94. A. B. Mitchell.
205. M. O. Dammann.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March 28rd*, 1860.]

March 19th.
776. T. S. Adshead & A. Holden.
790. W. Seaton.
863. W. Ross.
871. J. J. Russell.

March 20th.
799. J. E. Cole.
834. R. Sims.

March 21st.
807. R. Dolby and E. T. Dolby

[*From Gazette, March 27th*, 1860.]

March 22nd.
827. W. H. Collins.
838. R. Cassels and T. Morton.

March 23rd.
825. T. Lawes.
828. T. Lawes.
845. W. T. Clark.
945. R. Birkin, jun., and T. I. Birkin.

March 24th.
841. J. W. Wilson.
870. L. E. Deplanque.
912. F. A. Laurecisque.
1160. W. Clark.
23. M. L. J. Lavater.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, March 27th*, 1860.]

March 24th.
775. G. F. Wilson and J. F. Lee.
776. G. F. Wilson.
783. G. F. Wilson.
785. G. F. Wilson.

Journal of the Society of Arts.

FRIDAY, APRIL 6, 1860.

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection.

Any persons having in their possession works by Sir William Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition will be opened on Monday next, the 9th instant, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, having their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

A sheet of tickets is issued with this copy of the *Journal* to every member. Additional tickets may be had on application to the Secretary of the Society.

THE PRODUCTION OF PHOTOGRAPHIC IMAGES ON PLATES OF GLASS OR PORCELAIN, BY THE ACTION OF LIGHT, ENABLING THEM TO BE PERMANENTLY FIXED BY BEING BURNT IN WITH CERAMIC COLOURS.

By John Wyard.*

The plates of glass, or porcelain, or other substance, on which the pictures are to be produced, may be glazed prior to the application of the sensitive mixture, or otherwise this glaze or flux may be carried over the finished picture before burning. The first preparation of the plates after cleaning consists in the application of the following sensitive mixture:—

I make separate solutions of gum arabic and gelatine.

Gum Arabic	72 grains.
Sat. Sol. Bichromate of Potass	½ oz. by measure.

Dissolve without heat.

Gelatine (Bell's)	15 grains.
Water	1 oz. by measure.
Sat. Sol. Bichromate	1 dr. by measure.

Dissolve in a water bath. When cool add the sol. bichromate. Shake well and filter.

Take of the solution of—

Gum Arabic	11 parts.
Solution of Gelatine	5 ,,
Water Distilled	5 ,,

To every dram of this mixture add 9 or 10 drops of honey syrup, formed by mixing equal parts in volume of honey and water, and filtering.

This mixture must be heated gently in a water bath, well shaken, and filtered through fine muslin.

The substance on which the picture is to be produced, opal glass, porcelain, ordinary kelp, or plate glass, is slightly warmed by a fire, and a sufficient quantity of the above sensitive mixture poured on, in the same manner as collodion, drained off, and gradually dried before a fire. The film must be very even. A vigorous positive picture, either from a collodion negative, paper, or albumen, or even an engraving, must be placed in contact with the sensitive surface, and the whole exposed to light—sunlight if possible. The exact amount of exposure is a matter of great importance, from six to ten minutes in good sunshine is in most cases sufficient.

When removed from the light a negative image should be visible, the action of the light darkening and hardening the sensitive layer to a much greater degree when using the above mixture than when using plain gelatine. The sunned parts are harder, and the unsunned softer, than is the case with gelatine alone. The advantage I take of this hardening effect of light on the film of the above will be apparent in the next stage of the process.

I produce a positive image in ceramic colour on the plate. This is effected by carrying over the surface of the plate the colour in a fine state of division, by means of a pad of cotton wool, well charged with the required colour. Its successful application requires some experience. The surface of the plate should be beaten gently and equally, not rubbed. The cotton should be occasionally breathed on, and re-charged with colour. The colour will be found gradually to adhere to the unsunned parts of the film, and its application should be continued until the picture is considered sufficiently powerful. Almost any amount of vigour may be obtained.

The picture is produced by the parts not exposed to light taking the colour, and those portions exposed refusing to take it. The original negative image will now be almost lost to appearance by the superior density of the applied colour, forming the positive picture, but there remains in the sensitive coating the changed and unchanged bichromate, which it is necessary to remove.

To effect this I apply alcohol to which has been added dilute acid in the proportion of 6 drops of the dilute acid to the dram of alcohol.

The dilute acid contains 5 minims of ordinary nitric acid to the dram of water. A bath of this may be used, or, if the subject is on a flat surface, the liquid can be poured on. While on the plate evaporation of the alcohol takes place; this would be equivalent to adding too much dilute acid to the alcohol, which would damage the film, therefore, in pouring on and off the liquid, care must be taken to keep up the proportion by adding a little pure alcohol occasionally.

When the brown colour of the changed bichromate disapears the acid spirit must be poured off, and pure alcohol poured on and off; this must be repeated once or twice with fresh quantities, it being necessary to remove every trace of the acid and water.

The picture must be dried very rapidly, and is now

* The paper was accompanied with three specimen plates, which will be exhibited in the Exhibition of Inventions which opens on Monday next. Ed. S. of A. Journal.

ready for burning, provided the recipient has been previously covered with a flux or glaze, if not the flux may be applied over the picture in the following manner. Pour on a solution of Canada balsam in Sp. turpentine. Dry the plate by heat until the turpentine is entirely evaporated.

Prepare the flux, which may consist of borax and glass, or borax, glass, and lead, by grinding it on a slab with water, and drying. Apply this (the flux) equally and evenly, by means of a pad of cotton tied up in very soft and flexible leather.

With respect to the colours used, they are ground on a slab with water, and dried.

The red picture is obtained by peroxide of iron, prepared by calcining the sulphate, and washing the mass with successive lots of boiling water; the dark brown by oxide of manganese.

Home Correspondence.

MR. ALD. MECHI'S LIVE STOCK ACCOUNT.

Sir,—A desire having been expressed by several very intelligent agriculturists to see the particulars of my live stock account, and knowing that their motive is not a captious one, but a desire for comparative facts on this important part of farming, I cheerfully accede to their request. This balance-sheet will prove what I have so long and so often said, that live stock are necessary evils—that they entail an immediate loss for a prospective benefit. You cannot do without them; on the contrary, the more you have of them, up to a certain point, the more profit you will make by farming. This appears paradoxical, but it is, nevertheless, quite true. The quantity of manure you make bears an exact relation to the quantity of meat you produce; and we know that if you are to sell off your farm abundant and frequent crops of cereals and other exhausting crops, you must apply plenty of manure. Taking the country on an average, there is not half enough meat made per acre; and yet this accounts, in part, for the miserable crops we see.

My Scotch friends were particularly angry with me for calling live stock necessary evils, but I would illustrate my argument by stating that no man who had not a farm could feed a lot of animals with profit if he had to buy, and pay market price for their food. I know, by long and large experience, that pigs pay better for purchased food than any other stock—and even they will by no means "clear their teeth;" and if you charge attendance, shelter, and casualties, they will show a loss of 10 per cent., or more, with the best management. I have seen a great many balance-sheets of pig feeding from village tradesmen, labourers, and others, who were knowing hands at this business, and in almost every instance there was a loss.

In making out my live stock balance-sheet I always carefully take stock at beginning and end of the year, and the balance represents the quanity of meat produced. The market value of lean stock at the end of 1858 and 1859 being pretty equal, makes this balance-sheet extremely accurate, as an average one. Twenty-nine acres of fine root and green corps are consumed, besides the aftermath of 18 acres. A good deal of straw is also consumed, for which I make no charge, as I take no credit for it. But if I charge the green and root crops and the horse and the manual labour, casualties, mill power, &c., there will be a loss of £172.

This statement in no way affects my general balance-sheet.

I consider this a fair average year of my general stock management. It is certainly infinitely more favourable than could be obtained under ordinary management, by those who allow their cattle to wander about the fields late in the season, without shelter, and who do not soil their green crops. In my case the animals are all comfortably housed, the food cut up, steamed, &c., on the most approved plan, the corn, &c; ground for pigs, or crushed for horses at my own mill, the green clover and tares passed through the chaff cutter, cut straw chaff given to the sheep, as detailed in my book on farming. Had I used linseed cake instead of rape cake my account would have been less satisfactory. Strange to say, farmers tell me their animals will not eat rape cake. I have used 100 tons, and never saw a bullock or sheep that would not eat it, and thrive upon it.

I adhere strictly to Mr. Horsfall's practice, as detailed in the Royal Agricultural Society's Journal—vol. xvii. p. 260, vol. xviii. p. 150—in the mode of feeding my cows and cattle.

I am often astonished at the miscalculation which permits large farmers to send to the mill their corn for stock, when they might grind it at home so much cheaper. In fact no farm of 200 acres ought to be without mill stones, and all the other necessary attachments to steam power.

We must, as agriculturalists, prepare for great changes in our economical arrangements, with a view to the more profitable results.

This has been done in threshing. Let the principle be carried out.

In my general balance-sheet I make no charge for horse keep, nor do I take credit for what they consume. The six consume about fifty quarters of oats annually, being allowed two bushels (70 lbs.) each weekly, during eight months.

They get no hay, except for three weeks in October. Their oats are crushed and mixed with fine cut straw, and green food passed through the chaff-cutter. From October to May they get mangold wurzel, which are carefully cleaned, and placed whole in the manger.

They seldom or ever are turned out. The stables are properly ventilated. Their condition is excellent. They clear or consume about 10 acres of green and root crops, and 5 acres of oat crops, annually, or something less than 2½ acres per horse annually.

The ordinary clearance in this neighbourhood is quite 5 acres per horse annually.

I still continue of opinion that sparred floors are an advantage, as they economise straw for food, and the animals thrive upon them. Probably we shall find it best to substitute iron grating or trellis-work, upon iron girders, as being, in the long run, cheaper than wooden spars.

I have an impression that they might be advantageously used for horses. In fact, Mr. Young, the great livery stable keeper at Leeds, has always used them—they save him so much in the purchase of straw; 13-14ths of animal manure being urine, one can easily understand that much less straw is required on the boards.

It has long been the custom in Essex to fat calves on boarded floors, with openings to let the urine pass between them. It is said they die of a better colour, and the same remark applies to pigs.

With respect to horses, it is my intention carefully to try them with rape cake instead of corn. It is much cheaper, and its elements, both as food and as manure, are more valuable than those of corn. Everybody now knows the value of decorticated cotton-seed cake for feeding purposes, and ultimately for manure.

In conclusion, I am satisfied that the same principles apply to animals as to ourselves. Warmth, dryness, and shelter in cold weather, and plenty of air and shade in hot weather, are sought alike by both.

If you will provide a brush, in the shape of a cut haulm wall, animals will groom themselves; but, if they have not that, a little artificial grooming will be as acceptable to our bullocks as to our horses. How would our carriage horses thrive without the removal from their skins of the dust and crusted exhalations?

If I am asked which stock I should prefer, I would say it is very desirable to rear good stock—where the farms

are suitable. But we must remember that the manure from breeding and suckling and young animals is of very little value, compared with those of full-grown fattening animals; therefore we must make up for this by very high feeding and artificials, or we shall grow small crops of corn.

When our farmers know more of the chemistry of agriculture—and some are studying it—they will feel the force and truth of Baron Liebig's remark, page 173 of his work on Modern Agriculture, where he says:—

"A practical agriculturist. Albrecht Block, is reported to have said:—'A farmer can afford to sell and permanently alienate only that portion of the produce of his farm which has been supplied by the atmosphere—a field from which nothing is abstracted can only increase, not decrease in productive power.' If we express the same idea in another form, viz., 'A farmer may sell and permanently alienate all the portion of the produce of his farm which has been supplied by the atmosphere—a field from which something is permanently taken away cannot possibly increase, or even continue equal in productive power,' the axiom thus enunciated is simply a natural law. In this opinion of this truly experienced man, to whom future agriculture will surely raise a monument, is at once expressed the whole foundation and groundwork of rational farming, and all the knowledge that the science of nature can teach the practical farmer. Every act of the farmer which violates the laws of nature must justly be branded as an act of spoliation."

A great deal of my live stock has been purchased full grown pigs, fattened to hogs, by barley ground into meal. Nothing pays so well as rape-cake given to sheep and bullocks. The late Mr. Pusey knew this; and I should recommend young farmers to cover their land with sheep eating rape-cake or decorticated cotton-seed-cake. The result, in the succeeding corn-crops, must be profitable. My sheep eat more cake as they increase in fatness: they begin with ¼ lb. daily, and finish with 1½ lb. daily. It is desirable to give them hay instead of cake for a few days before they are killed.

I would recommend every farmer who can afford it, to make at least £4 to £5 worth of meat per acre. To do this he will have to purchase food equal to £3 per acre. Supposing you lose 7½ per cent. by this purchase, or 4s. 6d. per acre, your gain, in the succeeding corn and other crops, will be, at least, £1 per acre.

I say nothing about the breeding question. A man, having first-rate powers of observation in regard to stock, is sure to do well in such matters.—I am, &c.,

J. J. MECHI.

Tiptree, March 30th, 1830.

LIVE STOCK.

Dr.	£	s.	d.
Lean Stock purchased	545	0	0
Purchased food—Barley and Rape Cake, £3 per acre on 170 acres	510	0	0
Horse and manual labour, carting and cutting up roots and green crops, preparing food, &c.	104	0	0
Steam engine grinding corn, breaking cake, shaff cutting, &c.	22	0	0
Casualties, 1s. per acre	8	10	0
Sundry other expences	10	0	0
10 acres Mangold Wurzel (cost £10 per acre)	100	0	0
6½ acres Swedes (cost £9 per acre)	58	10	0
About 12 acres of green crops	60	0	0
22 acres aftermath, Clover and Grass	33	0	0
	£1,451	0	0
Cr.			
Meat, Wool, Dairy produce, and Poultry sold	1,279	0	0
Apparent approximate loss	172	0	0
To which, in fact, should be added the interest on the buildings affording them shelter, and wear and tear of troughs, implements, &c., used in feeding; also the value of much straw used as food.			
	£1,451	0	0

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Medical, 8½ Discussion on Dr. Routh's Paper, "On Some of the Disadvantages of Employing Fallen Women as Wet Nurses."
Tues. .....Syro-Egyptian, 7. Anniversary.
Medical and Chirurg., 8½
Wed. .....Literary Fund, 3.
Archæological Assoc., 4. Anniversary.
London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. Edwin Goddard, "On Stoneware."
Graphic, 8.
Microscopical, 8.
Royal Soc. Literature, 8½.
Thurs. ...Philological, 8.
Fri.....Archæological Inst., 5.
Astronomical, 8.
Sat. .....Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on March 20th, 1860.

15. Railway and Canal Bills (147. Grand Canal—Midland—Great Western of Ireland—and Great Southern and Western—148. Hungerford Market and Charing-cross Bridge—149. South London (No. 3) Railway—Board of Trade Reports.
150. Paper—Returns.
154. Church Rates—Lords' Report.
Church Estates Commissioners—9th General Report.
Ecclesiastical Commissioners for England—12th General Report.
Affairs of Naples—Correspondence.
Treaties of Commerce, &c.

Delivered on March 21st, 1860.

82. (1) Bankruptcy—Returns.
143 Ecclesiastical Commission (Ireland)—Return.
147. Poor Law Commission (Ireland)—Return.
151. Army Prize Money—Account.
75. Bill—Bankruptcy and Insolvency.
Miscellaneous Statistics of the United Kingdom (Part 2).

Delivered on March 22nd, 1860.

101. Works and Public Buildings—Abstract Accounts.
155. Counties and Boroughs (Scotland)—Returns.
76. Bills—Common Lodging Houses (Ireland).
77. „ Professional Oaths Abolition.

Second Session, 1859.

138. Health of the Royal Navy—Statistical Report.
182. Gold Coast—Copy of Correspondence.

Delivered on March 23rd, 1860.

148. Wexford Harbour—Copy of Mr. Coode's Report, &c.
158. St. George's-in-the-East—Return.

Delivered on March 24th and 26th, 1860.

141. Education—Return.
163. Railway and Canal Bills—3rd Report from General Committee
167. St. George's-in-the-East—Further Return.
84. (2) Trade and Navigation Accounts (29th February, 1860).
15. Railway and Canal Bills (150. Dorset Central Railway—Extension of Time, &c.)—Board of Trade Report.
70. Bills—Herring Fisheries (Scotland).
79. „ Attorneys, Solicitors, Proctors, and Certificated Conveyancers.
81. „ Pawnbrokers' Act Amendment.
82. Benefit Societies Rules Amendment.

Delivered on 27th March, 1860.

152. The Serpentine, &c.—Return.
153. British Museum—Return.
78. Bill—Gas (Metropolis).

Delivered on March 28th, 1860.

159. Portpatrick Harbour—Return.
166. Court of Chancery (Ireland)—Return.
146. Cambridge University—Copy of Statutes.
83. Bills—Companies (1860).
85. Bills—Income Tax.
„ Stamp Duties.
Shipping—Return.
Topographical Department, War Office—Report.

Delivered on March 29th, 1860.

172. Immigrants and Liberated Africans—Return.
172. Committee of Selection—Fourth Report.

Delivered on March 30th, 1860.

188. Railway and Council Bills—4th Report from the General Committee.

Delivered on March 31st, 1860.

171. Barracks—Return.
173. Medical Education and Registration—Account.
175. Licensed Beer Retailers—Memorial.
49. Bills—Admiralty Court Jurisdiction.
84. „ Mines Regulation and Inspection (Amended).
Switzerland and Savoy—(Mémoire sur les Rapports entre la Suisse et la Savoie Neutralisée)—Return.

Delivered on April 3rd, 1860.

165. Highland Roads and Bridges—46th Report of Commissioners.
184. Queen's University (Ireland)—Returns.
185. Dulwich College—Return.
80. Bills—Jews' Act Amendment.
88. „ Emblemets, &c. (Ireland).
Italy „ Further Correspondence—Part 4.
Japan „ Correspondence.
Merchant Shipping—Copy of Mr. Lindsay's Letter on Belligerent Rights.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March 30th*, 1860.]

Dated 5th March, 1860.

602. T. W. Ashby and J. Coulson, Stamford—Imp. in thrashing machines, part of which is applicable to cranks.

Dated 7th March, 1860.

622. E. Billington, Manchester—Imp. in machinery for combing cotton, wool, flax, tow, silk waste, and other fibrous substances.

Dated 10th March, 1860.

646. J. Luis, No. 1B, Welbeck-street, Cavendish square—An improved calcareous varnish for coating wood, metals, paper, ships, and other substances. (A com.)
656. M. J. E. Jullienne, 29, Boulevart St. Martin, Paris—An improved bath belt, to be applied in the bathing vessels and in electrical apparatus connected therewith.

Dated 13th March, 1860.

665. M. Mangles, 6, Abchurch-yard, Cannon-street—A new mode of applying gases so as to effect the purifying and bleaching oils and fats, purifying, disinfecting, and deodorizing fœcal and decomposing matter and the gaseous products of decomposition, decomposing deleterious gases, purifying and decolouring soap, preparing flax and other fibres, treating blood, night soil, bones, and other substances, whether solid, liquid, or gaseous.
666. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in apparatus for washing or dressing ores and analogous substances. (A com.)
668. J. Wright, 42, Bridge-street, Blackfriars—An improved method, means, and process of treating wood, so that it becomes so changed as to be well adapted for uses for which it is naturally unfit. (A com.)
670. A. V. Newton, 66, Chancery-lane—An improved construction of churn. (A com.)

Dated 14th March, 1860.

678. J. Sim, Aberdeen—Imp. in meters or apparatus for measuring fluids.
680. I. Horton and I. Kendrick, Southwark—Imp. in steam boilers.
682. J. A. Hopkinson, Huddersfield, Yorkshire, and A. Ridings, Bolton-le-Moors, Lancashire—Imp. in steam boilers and engines, and in apparatus connected therewith.

Dated 15th March, 1860.

685. T. Wilson, Birmingham—Imp. in breech loading fire arms.
686. C. H. Shearman, South Belgravia—Imp. in steam engines.
687. M. Henry, 84, Fleet-street—Imp. in twisting fibrous materials, and in apparatus employed therein. (A com.)
688. W. M. Pattison, Frelighsburgh, Missisquoi, Canada—Imp. in fountain pens and fountain penholders.
689. J. Shields, Perth, and A. Shields, Cromwell-park, Perth—Imp. in jacquard looms or machinery for weaving.
690. B. Lauth, Manchester—Imp. in machinery or apparatus for rolling railroad rails, bars, beams, and other such articles. (A com.)
692. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved metallic window sash. (A com.)
693. G. Sturrock, Chatham, Kent—Imp. in revolving fire arms.

Dated 16th March, 1860.

696. R. B. Sayer, Newport, Monmouthshire—Imp. in parts of the permanent way of railways.
697 W. Hudson, Burnley, Lancashire, and C. Catlow—Certain imps. in power-looms for weaving.
699. W. Wield, Manchester—Imp. in machinery for winding yarn or thread on to bobbins, spools, or other similar surfaces.
700. J. Laird, Port Glasgow, Renfrew, N.B.—Imp. in effecting the exhaustion of steam engine condensers.
701. G. A. Huddart and J. D. E. Huddart, Brynkir, Caernarvon—Imp. in obtaining and applying motive power.
702. W. Wood, Monkhill, near Pontefract, Yorkshire—Imp. in the manufacture of fibrous yarns and fabrics of cotton, flax, wool, or other material.
708. T. Richardson, Newcastle-on-Tyne—Imp. in treating organic and other substances, containing phosphate of lime.
705. J. Reynolds, jun., 57, New Compton-street, Soho—Imp. in the manufacture of wire or metal netting and in machinery employed therein.

Dated 17th March, 1860.

707. E. Cope, W. Cope, and W. G. Ward, New Basford, near Nottingham—Imp. in the manufacture of fabrics in lace machinery, and in the means or apparatus employed therein.
709. R. Briggs, Birmingham—A new or improved washing machine.
710. P. Brotherhood, Chippenham—An improved method of generating steam in locomotive, stationary, marine, or any other form of steam boiler.
711. W. Clark, 53, Chancery-lane—Imp. in the application of paper to filtering fluids. (A com.)
712. T. Richardson, Newcastle-on-Tyne, and M. Prentice, Stowmarket—Imp. in the manufacture of hydrated oxides and salts of iron and salts of the fixed alkalies.
713. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for controlling refractory horses.

Dated 19th March, 1860.

715. J. Ellis, W. Winterbottom, and J. Bradock, Droylsden, Lancaster—Certain imp. in or applicable to steam engines.
717. W. Clark, 53, Chancery-lane—Imp. in tanning hides. (A com.)
719. J. H. Heal, Tottenham court road—Imp. in spring mattresses

Dated 20th March, 1860.

721. J. Williamson and F. Williamson, Griffe Mill, near Keighley, Yorkshire—Imp. in looms for weaving.
723. J. Aspell, E. Booth, and J. Hurst, Middleton, Lancashire—Bertain imp. in power looms for weaving.
725. T. Law, Uppingham, Rutland—Imp. in reaping and mowing machines.
727. E. Finch, Chepstow—Imp. in constructing railway switches and crossings.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

731. J. A. Herbert, Guildford, Surrey—Manufacturing of oxychloride of lead. (A com.)
763. G. K. Snow, Watertown, Massachusetts, U.S.—Imp. having reference to bookbinding, and the folding and pasting of sheets of paper therefor.—23rd March, 1860.

PATENTS SEALED.

[*From Gazette, March 30th*, 1860.]

March 30th.
2148. H. A. Jowett
2234. J. Wright.
2235. E. Morewood.
2237. L. H. I. Lemaire.
2244. S. R. English.
2246. W. Backett.
2250. G. Davies.
2260. T. H. Dodd.
2261. J. Scott.
2271. G. A. Smith.
2280. A. Hind and J. Lowenthal.
2378. A. W. Williamson.
2404. J. Hodgson.
2430. R. Seager.
2437. W. A. Matthews.
2735. T. R. Russell.
2814. J. R. Breckon & R Dixon.
2858. L. S. Magnus and W. Sinnock.
130. W. W. Hewitson and B. Walker.

[*From Gazette April 3rd*, 1860.]

April 3rd.
2239. G. F. Greiner.
2250. T. Cook.
2274. E. O'Connell.
2216. W. Brookes.
2290. W. Dawson & T. Singleton.
2300. T. Knowles, J. Knowles, and A. Rigg.
2301. G. White.
2367. W. E. Newton.
2431. W. E. Newton.
2493. R. De Bary.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March 30th*, 1860.]

March 28th.
894. R. A. Wright and L. J. Fouché.

[*From Gazette, April 3rd*, 1860.]

March 29th.
907. A. V. Newton.
March 30th.
930. A. Paget.
1045. C. Barlow.
March 31st.
891. J. Graham.
911. G. Lowry.
929. E. Joy.
932. T. Whitehead.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, April 3rd*, 1860.]

March 28th.
757. J. Bernard.

CATALOGUE

OF THE

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

BEING A COLLECTION OF ARTICLES RECENTLY INVENTED, PATENTED, OR REGISTERED, EXHIBITED AT THE SOCIETY OF ARTS, ADELPHI, DURING THE SPRING OF 1860.

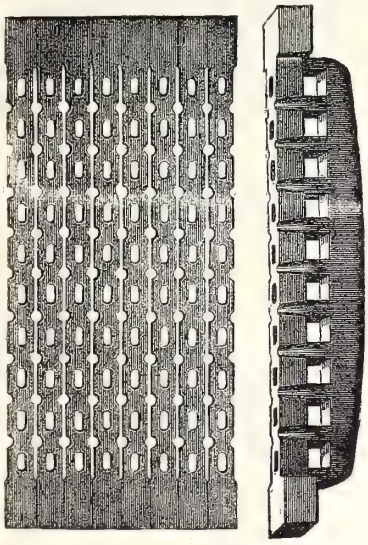
N.B.—The Council wish it to be understood that they are not responsible for any of the statements contained in this Catalogue.

ENGINEERING, MINING, RAILWAY MECHANISM, &c.

(*For the remainder of the Articles in this Section, see Drawings.*)

1. Patent Argand Fire Bars; Martin and Purdie, 3, Cannon-street Chambers, E.C.

These fire-bars have perforations through them, and grooves at their sides, in order to introduce an efficient supply of Atmospheric Air.

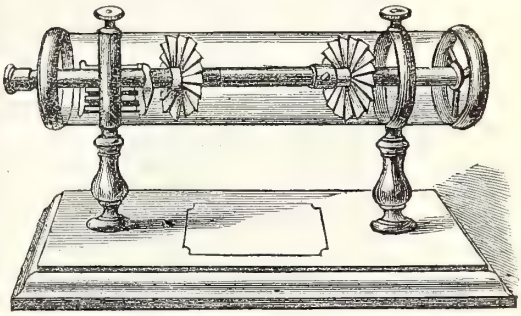


2. Patent Pendulous Fire-Bars; John Lee Stevens, 1, Fish-street-hill, E.C.

The pendulous action peculiar to these fire-bars is produced by their form and by their suspension at points of vibration above their centres of gravity; they are, therefore, free to swing on their pivots as motion is given to them by the oscillation of locomotives or the rolling of steamers, thus preventing the formation of clinkers; and in stationary furnaces they afford unusual facility for cleaning the fires

3. Patent Steam Generator and Smoke Consumer; Howell, Hick and Hargreaves, Sheffield.

This contrivance consists in placing one, two, or more circular fans at convenient distances, according to the length and diameter of the boiler, upon a bar of iron and steel placed longitudinally in the centre of the tube; the draft of



the chimney causes the fans to rotate freely, completely mixing the gases as they pass through the tube, and making the heat in the centre of the tube and at the surface uniform. By the mechanical mixing of the gases more complete combustion ensues, and an important saving of fuel is effected.

4. Barran's Patent Marine Boiler; Gardiner and Mackintosh, Railway Foundry, New Cross, S.E.

This is a cylindrical vertical boiler, with the ordinary exterior fire-box shell, and water space around the interior fire-box shell. The interior fire-box is cylindrical, with two or more deep conical rings or water spaces let into the crown. These rings taper downwards, and are 2 feet deep or more, and sufficiently large to allow the

water to circulate freely; they are concentric, with spaces between them tapering upwards, which spaces afford a large amount of heating surface to the direct action of the fire. The boiler is economical, easily cleansed, occupies a small space, and is adapted for salt water. In applying this form of boiler for marine purposes, two, three, or four boilers may be used, placed side by side, and connected to one main steam chamber, around which all the surplus heated products of combustion pass direct to the uptake, by which means the steam will be superheated. This boiler may be worked at 100 pounds pressure to the square inch.

5. Giffard's Patent Self-Acting Water Injector; Sharp, Stewart, and Co., Atlas Works, Manchester.

This apparatus is intended for supplying water to steam boilers, whether stationary, locomotive, agricultural, or marine, or to cisterns in elevated positions, and furnishes "a head of water." It does away with the necessity for pumps for feeding boilers, and the various movements for working them in all classes of engines; it is an adjunct to the boiler, and entirely independent of the engine, and is put in operation by simply opening connexions with the boiler; and, having no parts in motion, it is not liable to wear, nor otherwise to get out of order. The apparatus is small, and can be placed in any position, vertical, horizontal, or otherwise, near to, or at a distance from the boiler, and at any reasonable height above the level of the feed-water. It is connected with the boiler by two pipes, one leading from the steam space, and the other conducted to the lowest convenient point of the water space; it will operate with steam at any usual pressure, and it will supply itself from the hot well of a condenser, or from any ordinary apparatus for increasing the temperature of the feed-water. (See Drawing, No. 299A.)

6. Patent Continuous Motion Cut-off Valve for Steam Engines; James Ferrabee and Co., Phœnix Iron Works, Stroud, Gloucester, and 76A, Holborn, W.C.

This model represents a continuous motion cut-off valve, by which the supply of steam to the cylinder may be altered or regulated by the attendant when the engine is in motion. By this arrangement an engineman can adapt the supply of steam at full pressure to the duty of the engine.

7. Patent Continuous Motion Equilibrium Valve; James Ferrabee and Co.

This model represents a continuous motion cut-off equilibrium valve by which the time of the cut-off is altered by the rising or falling of the governor balls, and the supply of steam to the cylinder regulated without the intervention of a throttle-valve. By this arrangement the exact quantity of steam required for the work on the engine is supplied at the full pressure of steam in the boiler.

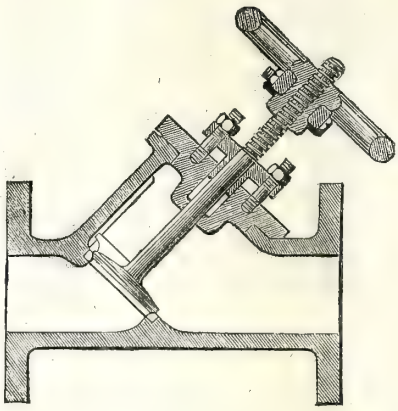
8. Marine Governor for Screw Engines; A. Stewart Harrison, 133, Upper Thames-street, E.C.

In this invention a sufficient length of gas tubing is carried along under one of the decks, and for a certain height up the foremast, and the end fitted with a sliding conical reservoir; the other end of the tube is connected, in the engine-room, with a cylinder (3 for the largest class of vessel) containing a piston of sufficient weight to close the throttle valve of the engine to which it is attached. Mercury being poured into the foremost end, the piston is supported by the pressure of the column of mercury while the vessel is horizontal; on the rising of the stern of the vessel, lifting the screw wholly or partially out of the water, the throttle is closed by the ascent of mercury in the foremost tube and consequent descent of the piston; on the horizontal position being again assumed, the full force of the steam is again allowed to pass, the valve being open. A modification of this plan is adapted to laying down submarine cables. With proper connections it may be made to take the strain off the "cable brakes," when the sudden heaving up of the stern requires the cable to run out with the greatest freedom.

9. Patent Valves for Steam Engines; W. P. Wilkins, Ipswich.

These valves are circular discs, and are intended to be moved continually in the same direction, at the normal condition of expansion the valve being stationary. The valve revolves but once to ten revolutions of the crankshaft, friction and liability to abrasion being thereby much reduced. The piston is provided with projections, which pass into the steam passages, nearly up to the valve fans, and thereby prevent the usual loss of steam. This cause of loss being obviated, the passages may be made larger than usual. The exhaust passages, radiating from the same centre, and being further therefrom, present a larger area.—(See drawing, No. 294.)

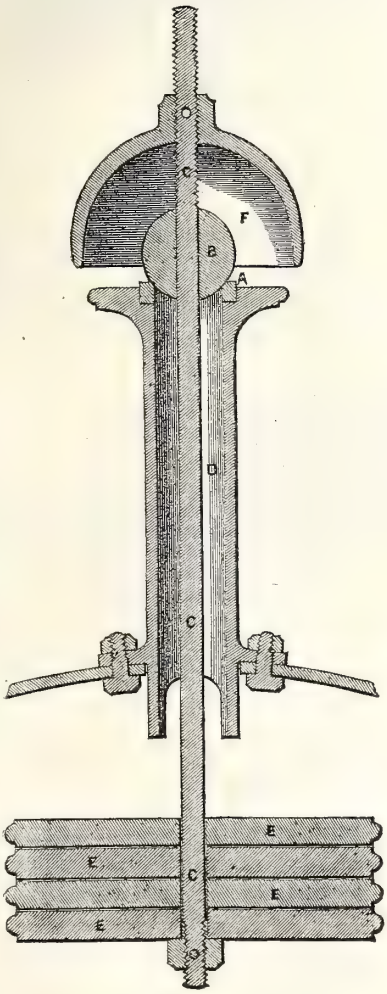
10. Improved Stop Valve for Steam or other Fluids; W. P. Wilkins.



The peculiarity of this valve is that it presents a free, straight, uninterrupted course for the passing fluid.—(See Drawing, No. 295.)

11. Patent Spherical Seated, Internal-Loaded Safety Valve; Guest and Chrimes, Rotherham, Yorkshire.

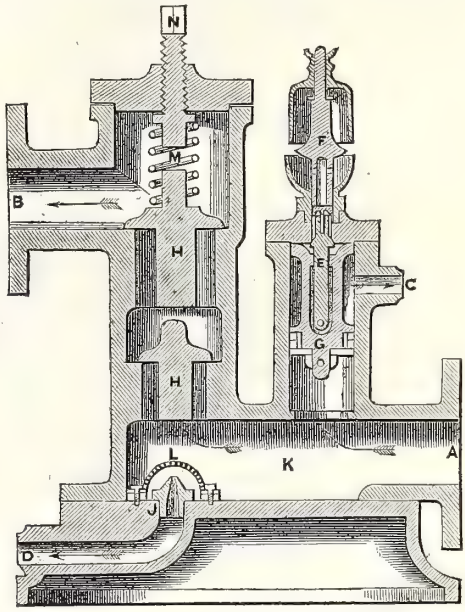
In this valve there is a hood or bell, against the under side of which the steam, escaping from below, strikes, and, by its force, lifts the valve completely out of its seat; or, in other words, the valve rises its full diameter above its seat, thus allowing a discharge equal to the area of the pipe (minus the rod). The inventor states, that a valve of the above construction, of 2 inches diameter, will discharge more steam in a given time than any two 3-inch valves of the ordinary construction now in use; and while the two 3-inch valves may allow the steam to increase in the boiler, according to circumstances, from 5lbs. to 10lbs. above the loaded weight of the valve, this valve will not allow of any increase whatever. It discharges in proportion to its area, and not its circumference; being weighted inside the boiler, it cannot be easily tampered with by the attendant without the knowledge or consent of the proprietor. This valve being of comparatively small diameter, it is not necessary to cut large holes in boilers to fix it. A is a spherical valve



seat, of gun-metal, B is a cast-iron ball valve, free to move in the seat with any motion of steam in the boiler. C is a wrought-iron rod, attached to valve B and hood F. D is a pipe, bolted to boiler for conveying steam to valve. E adjusting weights attached to valve-rod. C, inside boiler. F is a cast-iron hood or bell, attached to valve B by rod C.—(See drawing, No. 297.)

12. Patent Pump Alarum; Guest and Chrimes.

The object of this apparatus is to give immediate alarm to the engine-man in attendance on steam boilers when any cessation of the feeding action of the pump takes place. This alarum is fitted in the feed-pipe leading to the boiler, and is composed of two cylinders, one of which contains two valves, to prevent the return of the water from the boiler to the underside of the piston; they are merely back valves. The other contains a small piston, which is pressed up by the force of the water from the pump below, and thus keeps a small whistle valve closed above it as long as the pump continues feeding and sustains the pressure upon the underside of the piston, but as soon as this pressure ceases, the steam which is admitted above the piston presses the same down, and thus opens the small whistle valve above mentioned, and, allowing the steam to escape, sounds the whistle in connection therewith. In the wood-cut, A is the pipe connecting to engine-pump; B, pipe connecting to boiler; C, pipe connecting to engine-cylinder; D, waste pipe connecting to hot well; E, valve leading to whistle; F, whistle; G, piston; H H, valves to prevent the return of water from boiler;

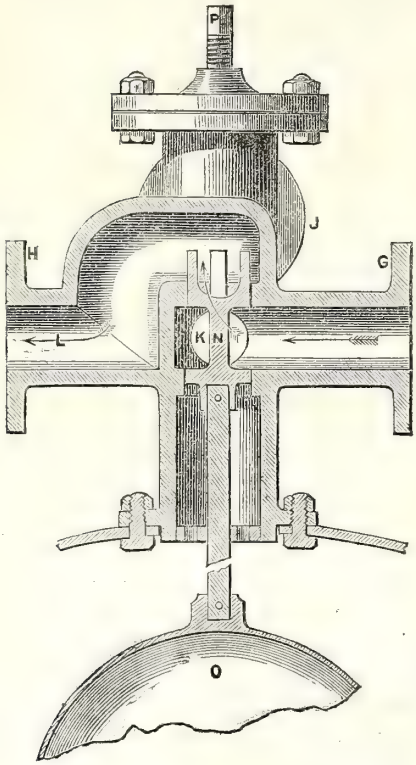


J, dribble valve, to take pressure from pump chamber, K; K, pump chamber; L, strainer, to prevent dirt getting into dribble valve; M, spiral spring to back valves; N, adjusting screw to regulate pressure of spring. (See Drawing, No. 296).

13. Patent Self-Acting Water Feed; Guest and Chrimes.

This apparatus may be used in connection with the pump alarum, or separately. On first filling the boiler the float will be at the lowest point, thus leaving a full open water way from the

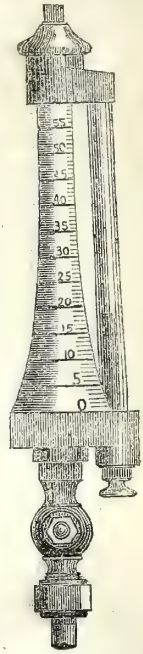
pump to the boiler, but as soon as the water has risen to its proper height the float will also have risen to its highest position, and with it the float-rod and valve, which has, by its action, closed the water-way into the boiler, while the pressure increasing from the pump opens the waste water valve, which allows the water to return to the



hot-well or tank. By this arrangement the valve will be only open sufficiently to allow water to pass equal to the consumption in the boiler. In the wood-cut, G is the flanch connecting to pump of engine; H, flanch connecting to waste or return pipe; K passage for return to waste water; L, passage for water into boiler; N, equilibrium valve, to regulate height of water in boiler; O, float attached to equilibrium valve for opening and closing same with the rise and fall of water in boiler; P, adjusting screw, for regulating the spring according to the pressure required in the boiler. (See Drawing, No. 298).

14. Improved Pressure Gauge; Alexander Allan, Perth.

Pressure by this gauge is indicated by the more or less compressed or expanded condition of a measured quantity of atmospheric air. The gauge consists of a hollow pillar of brass (or other material), of a differential internal capacity. This chamber is connected, by passages at top and bottom, to a glass tube. The quantity of air within the gauge is acted upon or compressed by cold water (or condensed steam) contained in a bent pipe. This pipe is attached at one end to the gauge; at the other to the boiler, or vessel containing the pressure to be indicated, which is exhibited by the height of the water-line, as seen in the glass tube opposite the graduated index on the pillar. The novelty and utility of this invention consist in its simplicity, the durability of



its parts, its extreme sensitiveness, and the facility of its adjustment, as the air, which acts as an elastic spring within it, can be renewed and replaced at pleasure; and it is less influenced by changes of temperature than gauges with metallic springs. (See Drawing No. 299.)

15. Patent Metallic Spring Steam Pressure Gauge; George Allcroft, 220, Upper Thames-street, E.C.

The improvement in this gauge consists in using corrugated plates or discs of tempered steel, which are fixed at their circumferences to a cylindrical chamber, into which the steam or other fluid presses. The pressure of the steam acts on the plates, with a tendency to press them outwards, when they act on a bell-crank lever, the other end of the lever being attached by a connecting rod to a toothed quadrant, the teeth of which gear into a pinion, on the axis of which the pointing hand is fixed. In order to keep the hand steady, and always bring it back to the starting place, a coiled spring is attached at one end to the quadrant, and by the other is fixed to the frame of the instrument.

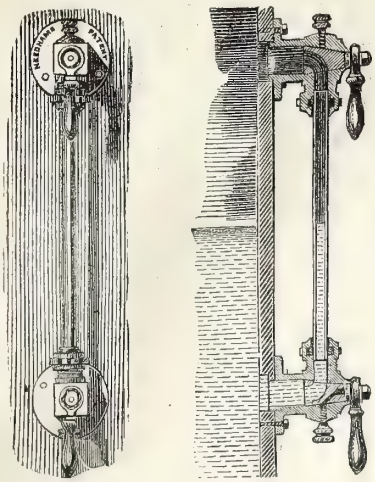
16. Improved Gauge Cock; George Allcroft.

The advantage of this cock consists in the seat being of soft metal, which renders it easily repaired.

17. Patent Improved Glass Tube Water Gauge; R. Needham, Engineer, Wharf-street, Ashton-under-Lyne.

In this gauge the area of the passages is sixteen times larger than those of the ordinary gauge, and the agitation of the water is communicated

to the glass, so that it is always free from dirt or silt. By removing the thumb-screw at the bottom, and turning the handle half round, the



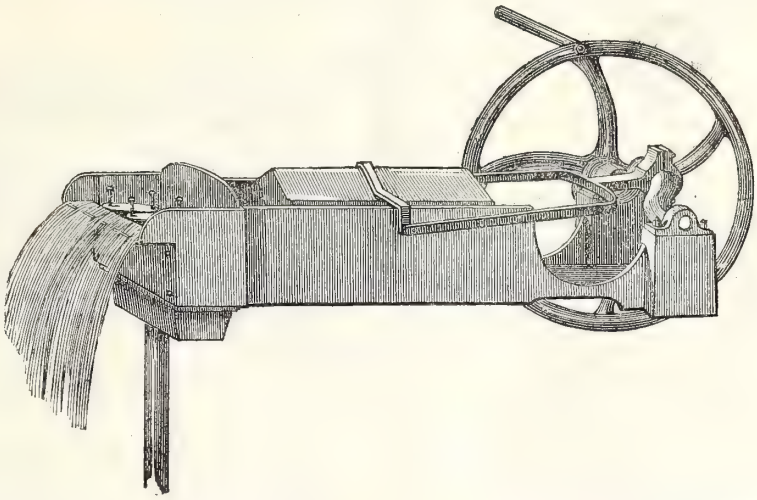
passage can be blown through without blowing through the glass. By removing the thumb-screw at the top, and screwing in the Steam Engine Indicator, then turning the handle half round, the accuracy of the steam gauge and safety valve is at once tested.

18. Improved Iron Cock for Water-Cisterns, &c.; W. T. Gidney, East Dereham, Norfolk.

19. Patent Bitumenized Pipes; Paul Joske and Alexander Young, 67, Mark-lane, E.C.

This invention is due to Mons. Jaloureau, of Paris. These pipes are stated to possess great strength and durability, and are not liable to oxidation. They are only one-fifth the weight, and half the price, of iron pipes. These bitumenised pipes have resisted the pressure of 250 lbs. to the square inch, equal to 570 feet head of water, without exhibiting any symptom of leakage. They are also found to resist outward pressure to such an extent as to be safe under the heaviest embankment, and irregular pressure. They are likewise found to resist all acids in ordinary use. They are also non-conductors of electricity. These pipes are made in lengths of 6 feet, fitted with iron flanged sockets, which are screwed together.

20. Hawksley's Patent Pump for Ship's use, Drainage, and ordinary purposes; Y. L. Norton, 38, Belle Sauvage-yard, Ludgate-hill, E.C.



In this pump the working surfaces are self-adjusting, no packing of any kind being required. The working part can easily be got at, without moving any nuts or bolts.

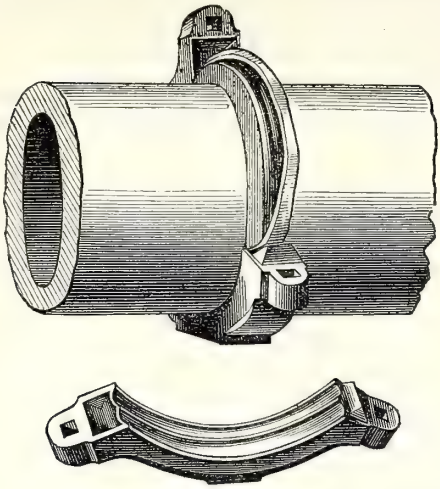
21. Patent Ferruginous Cement Packing; William Warne and Co., 9, Gresham-street West, E.C.

This packing is applicable to steam, water, air and gas joints of all descriptions, in place of iron cement, sheet lead, red and white lead, &c. It is indestructible either by fire, steam, water, or gas. For all permanent joints (elastic before its application) it can be made to set perfectly hard; while for all other joints, it can be made sufficiently elastic to answer all the purposes of india rubber or other packing.

22. Patent Elastic Pipe-Joint for Gas, Water, and Steam; T. S. Truss, 53, Gracechurch-street, E.C.

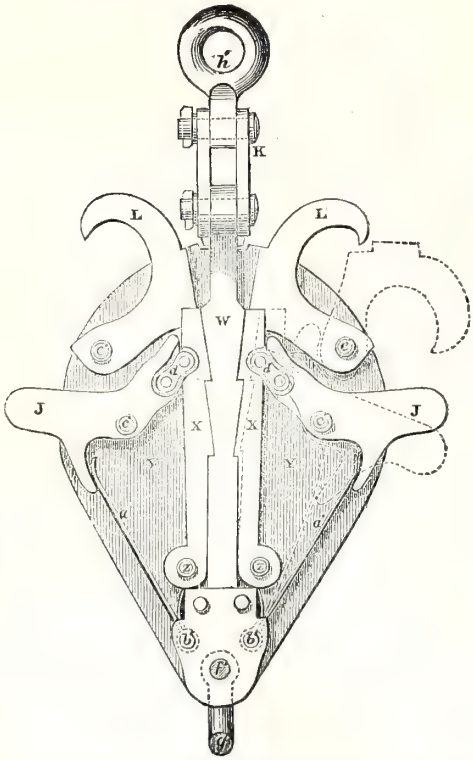
This invention consists in a combination of the principles of the wedge and screw, so applied by means of a strap, as to obtain equal direct pressure upon the surface of flanges surrounding the ends of pipes, the parts of which are so arranged as to become the more secure as pressure is increased, thus forming a perfect joint capable of deflection at pleasure without impairing it. Mains connected on this principle are stated to

be strongest at the joints. The packing prevents any contact of metals, and the difficulties caused



by expansion and contraction are surmounted. The joint may be made by an ordinary labourer, and readily disconnected.—(See drawing, No. 304).

23. Prevention of Accidents from over-winding in the Shafts of Mines; Samuel Bailey, Wood-green, Wednesbury.



Between the pit's mouth and the pulley over which the winding-rope passes there is provided a cross bar, in the centre of which is a ring, which surrounds the rope. While the starting and the stopping of the engine is properly attended to, the winding-rope being attached to *h*, and the cage suspended from *g*, the lowering and drawing goes on as if no safety apparatus were attached; but when, from negligence of the winder, the cage proceeds onward towards the pulley, the arms *J J* strike with force against the lower side of the ring already referred to, and draw back the bars *X X*, by which the bolt *W* is kept in position, throw the hooks *L L* over the ring, and leave the cage suspended by these hooks; whilst the bolt *W* and shackle *K* are left free to pass over the pulley. The arms *J J* are levers, *c c* being the fulcra, *d d* flat chain-links, by which the bars *X X* are drawn back; *e e* are the pivots on which the hooks turn when acted upon by the points of the levers *J J*; *a a* are springs passing round strong pins *b b*, and which serve to keep the arms *J J* and the bars *X X* in position when not acted upon by the pressure of the ring; and *Z Z* are the pivots on which the bars *X X* turn. A flat plate of iron has been removed in this woodcut to render the interior construction visible. Any kind of stop may be used to act upon the levers by which the cage is disconnected from the winding-rope, and as the hooks are in most cases sufficient to prevent the cage from descending, auxiliary stops are sometimes provided.

24. Miners' Safety Lamp; R. Jones, Fiar View, Upper Tulse-hill, Brixton, S.E.

The security of this lamp consists in the impossibility of opening it without extinguishing the flame.

25. Miners' Safety Lamp; Charles Henry Waring, Neath, Glamorganshire.

This lamp is constructed in such a manner that it cannot be opened without extinguishing the light. This object is attained by arranging an extinguisher on a wire passing through a tube in the oil chamber, (as the ordinary *pricker* is passsed through), which extinguisher, or parts connected with it, on being drawn down over the light, extinguishes it, and presses upon a spring which releases a bolt and allows the gauze to be removed. It can be applied to any form of lamp.

26. Elastic Wheel; M. Davis, 5, Lyon's-inn, Strand, W.C.

This wheel is a combination of cork and hollow iron. Spoke-holes are bored in a wooden nave of the usual kind. Previously to driving in the spokes—which are formed of iron tube—flat pieces of metal are inserted in the spoke-holes, to prevent the thin edges of the spoke cutting into the nave. A rim of hollow iron is attached to the other ends of the spokes; this is filled with cork, and over it an iron tyre is driven red hot. On cooling it shrinks, and falls about an eighth of an inch below the two edges of the hollow rim. To prevent the tyre settling unequally on its cork bed, stops are placed at intervening spaces within the recess of the rim, thus obtaining uniformity in the margin of the tyre.

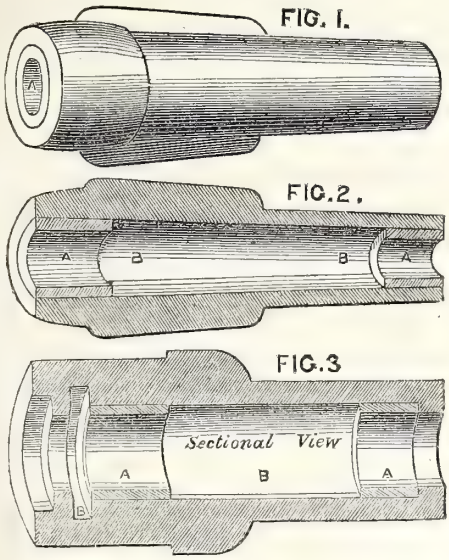
27. Hollow Axle, with Gun Metal Box; M. Davis, 5, Lyon's-inn, Strand.

This axle is a strong iron tube, with a cork in-

serted in each end. A hole is formed on the top, to admit a supply of oil, which flows through other holes at the bottom within each axle arm. The spring bearings are in halves and notched, similarly to gas-pliers. When the spring flaps are bolted together they firmly grip the axle. The box outwardly is of the usual iron form. Two short gun-metal cylinders that fit the axle arm, are driven into the iron box, cold, whilst it is red hot; it shrinks around the gun-metal, making the whole equal to a solid gun-metal box. The gun-metal cylinders are not one-half the length of the iron box, but are short enough to allow a vacancy in the centre of the outer casing to retain the oil. The axle arms are tinned. The nut that keeps the wheel on the axle has a cap of metal on its end, to prevent the cork in the axle being disturbed.

28. Patent Steel Axle Box; E. Partridge, 14, Park-street, Stourbridge.

The principal improvement consists in forming steel conical bushes, or bearings, in the ends of cast-iron boxes, by casting the iron on to two conical steel collars, prepared and shaped to fit the different axles to which the boxes have to be fitted. The two steel collars or bushes take the entire bearings of the axle, and the space left between the collars inside the box forms a grease or lubricating chamber. Fig. 1 is a form of axle-box made of cast iron. In each end of this box, prepared steel bearings or bushings



A A, are cast in to receive the wear of the axle-arm, and by the manner in which this is done it is impossible for them to get loose. Fig. 2 is a sectional view of Fig. 1. A A show the manner of laying in the bearings or bushes. From B to B is a lubricating oil chamber. Each end of the box being perfectly parallel, the usual lashing of the wheels, which causes the axle-arm to break, is prevented.

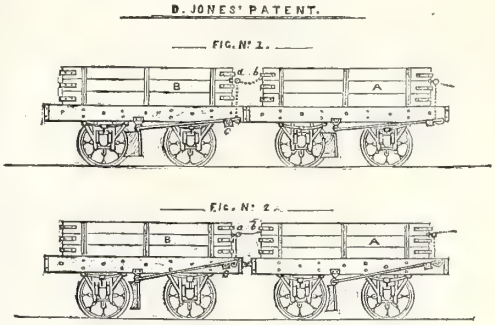
29. Spencer and Corlett's Combined Patent Buffer for Railway Waggons, Carriages, &c.; John Spencer and Sons, Newburn Steel Works, near Newcastle-on-Tyne.

This buffer consists of Spencer's patent ribbed volute spring, and Corlett's patent case; this case is so constructed that by a projecting part round the end of the plunger, which fits into the recess of the cylinder, it is prevented from getting out, thereby doing away with the through bolt. The ribbed volute is an improvement upon the spring known as "Baillie's volute spring," and the improvement consists in forming the coils with ribs or projections upon them for the purpose of strengthening the coils and preventing them from pressing or rubbing their whole surface upon each other when the spring is being compressed. These ribs or projections may be formed upon the coils in any position or direction.

30. Spencer's Patent Ribbed End Laminated Spring; John Spencer and Sons.

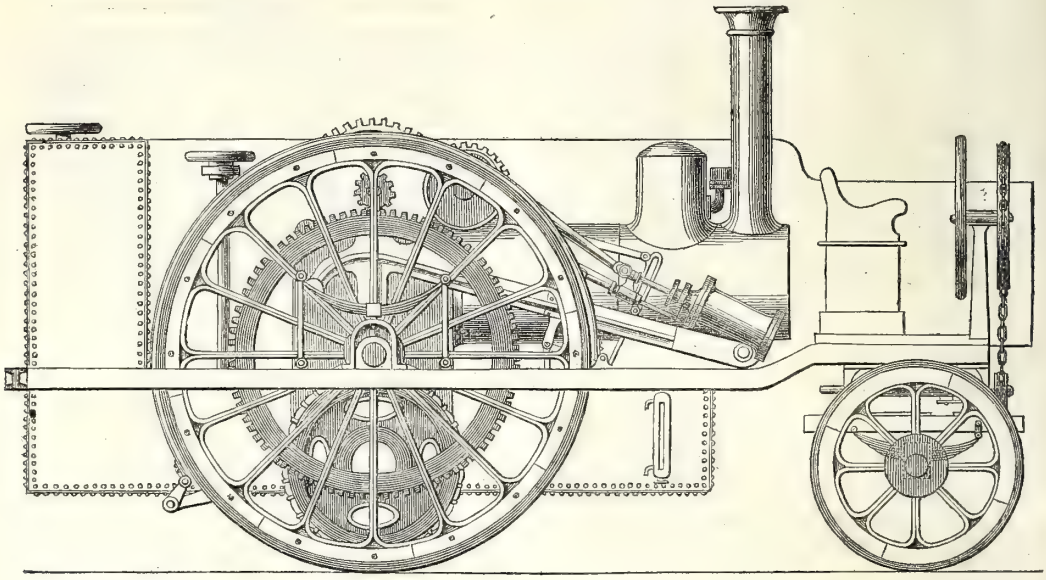
This improvement relates to springs of the ordinary construction or laminated springs, and consists in dispensing with the slits and their accompanying studs or ribs at present used in the construction of these springs. This object is accomplished by forming at the ends of the plates small hollow ribs or projections, the under side or cavity formed in making these ribs upon the upper plates, fitting upon the ribs or projections upon the under plates, or vice versa.

31. Patent Self-acting Railway Brake; David Jones, Rumney Railway, Machen, near Newport, Monmouthshire.



This invention consists principally in connecting the brake lever of one truck or carriage with the after part of the preceding truck or carriage, in such a manner that as soon as the relative speed of the trucks or carriages is varied, and they consequently approach each other, the chain between each truck or carriage gets slack, and the lever falls and applies the brake on the wheels. If the weight of the lever be not sufficient to apply the brake with the requisite force, a weight may be attached to it, or to the chain. When the carriages are disconnected, or the brake is not required to be self-acting, the end of the chain may be hooked on to a staple on its own truck, so as to hold up its brake lever.—(See drawing, No. 306.

32. Longstaff and Pullan's Patent Traction Engine; Gardiner and Mackintosh, Railway Foundry, New Cross, S.E.



In this engine the steam cylinders and driving gear are mounted on a vibrating frame or platform. The boiler is mounted on the same frame, but separate from the cylinders and driving gear. In order to keep the boiler in a horizontal position when going up hill, so as to maintain the water level therein, it is mounted on adjustable trunnions, which may be elevated or lowered by means of screws. The steering is effected by parallel screws, which are worked by a hand wheel. This engine is light, simple in construction, and well-adapted for agricultural purposes.

33. Improved Locomotive Traction Engine; John Giles, 8, Cannon-street, E.C.

The improvements consist in the use of certain means by which the weight of the engine is kept in constant suspension (while in action) at a point oblique to that part of the driving-wheel in contact with the earth; this is effected by placing a lever (furnished with a bearing at each end) between the axle of the driving-wheel and the axle of the pinion which conveys the driving power, the pinion being placed at a point on the engine forward of the axle of the driving-wheel and obliquely to its resting point on the earth; the axle being at the same time relieved from all absolute or rigid fixture. By these means the weight of the engine (when in action) is transferred from the axle of the driving-wheel to a point between it and the circumference (as in fig. 1), (See drawing, No. 306A.), or (as in fig. 2), the axle is converted into a pivot joint connecting two levers placed between the point of contact and the point of suspension, the lower lever being constituted by that portion of the driving-wheel between the axle and the earth. The use of this simple addition (the connecting lever) gives an adhesive power to the wheel, on which a tractive effort of 2,000 lbs. can be exerted for every ton weight of the engine.

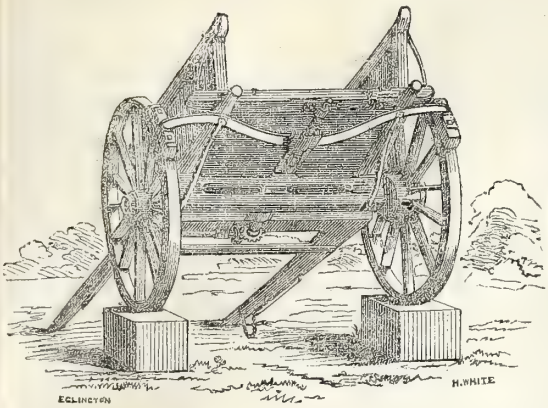
34. Patent Apparatus for Facilitating the Draught of Carriages; Matthew Leahy, 4, Orsett-terrace, Gloucester-gardens, Hyde-park, W.

The object of this apparatus is to enable any description of carriage to carry with it a moveable railway, lay it down on the road or ground always in advance of the "bearing wheels," take it up again as soon as it is rolled over, and thus give to the carriage or waggon nearly the same facility of motion as if it were placed on a fixed iron tramway. This is effected by placing eccentric "disc-wheels" at both sides of each bearing-wheel, and of the same or larger diameters, from the upper half of the peripheries of which endless chains of short lengths of "bridge-rails" are suspended and pass under the bearing-wheels. The disc-wheels revolve freely on their centres, independent of the bearing-wheels, but these centres are higher than those of the bearing-wheels. The object of the eccentricity of the "disc-wheels" is to prevent the endless chain of rails from coming in contact with the peripheries of the bearing-wheels, except underneath, at the actual bearing point, by which means a great portion of the strain on the joints of the rails, and the friction attendant upon the working of the rails round the wheels as the whole advances are prevented.

35. Patent Self-acting Carriage Brake; J. Biers, Jun., 38, Rochester-road, Kentish-town, N.W.

This invention consists in giving to the fore-carriage (by means of a slot or slots, in ordinary vehicles, and sliding socket and jointed hook for

artillery) a longitudinal as well as the present rotary motion.



36. Patent Double-locking Carriage; Charles Seton, Edinburgh.

The features of novelty in this invention consist, first, in connecting together the axles on which the wheels are placed, by which the fore-wheels of four-wheel vehicles, instead of being smaller than the hind wheels, as is at present the case, may be of the same size. Secondly, in causing the hind wheels to move sideways with the fore-wheels in the act of turning, instead of the fore-wheels turning only. This is effected by employing two rods, crossing each other diagonally, the ends being respectively fixed to each of the axles, so that they shall operate as tension rods, to pull the hind axle in an opposite direction to the fore axle, thus compelling all the wheels to move in the arc of a circle.

37. Improved Method of Working Junction Signals on Railways; Saxby and Co., Railway Station, Brighton.

This arrangement provides that the points and signals move simultaneously by one and the same action, and no contradictory signals can be given, for when the signal is given the points must correspond to it. The rods connecting the signals and points are worked by cranks, and are less liable to get out of order than cog wheels, chains, and pullies.

38. Patent Improved Iron-faced Timber Joint for Railways; W. Bridges Adams, 1, Adam-street, Adelphi, W.C.

This joint is intended to be used with the longitudinal timber system, known as the "Sandwich Rail."

39. Patent Angle Iron Key; W. Bridges Adams.

This key is intended for use in ordinary chairs, in place of the usual wooden key.

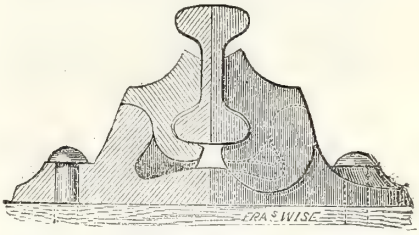
40. Patent Railway Iron Sleepers; Thomas Wright, 9, George-yard, Lombard-street.

Transverse System.—This is a bed-plate iron "intermediate" sleeper, with the double-headed rail applied, the rail being supported upon end grain wooden cushions, and secured to the sleeper by a vice jaw rail fastening. The transverse "joint" sleeper is a pair of intermediate sleepers connected together by a solid tie-bar. The two sleepers and tie-bar are cast all in one piece, by which at once the gauge of the line is rigorously preserved, the rail joints are supported and secured, and the road is kept in line by the ballast fang underneath the sleeper.

41. Patent Railway Iron Sleepers; Thomas Wright.

Longitudinal System.—This bedplate iron sleeper has the bridge rail applied. The rail is inserted in a recess, to prevent its lateral displacement by the side blows of the wheels, and is held down therein with bolts, having a timber and india-rubber cushion interposed between the rail and sleeper; the gauge of the line is secured by loose wrought-iron tie-bars, and the road is kept in line by the ballast fang underneath the sleeper.

42. Patent Tumbler Railway Chair; C. W Ramié, 23, Parliament-street, S.W.

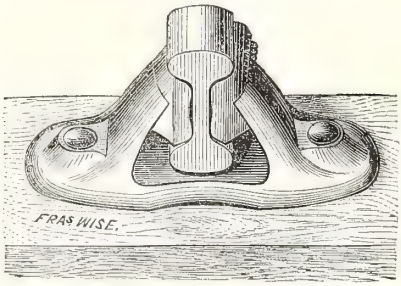


In this chair the rail takes a bearing upon the lower parts of two jaws or tumblers, which are supported upon abutments formed by the base of the chair. The rail bearing upon the tumblers causes them to turn slightly upon the abutments and thus to bite or hold the rail between them with a pressure equal to the superincumbent weight.

43. Metallic Key for Railway Chairs; William Parkin, Bridge Foundry, Attercliffe, Sheffield.

This key is split up the centre, and is expanded, after insertion in the chair, by a screw nut.

44. Patent Elastic Railway Chair and Sleeper; R. M. Ordish, 18, Great George-street, S.W.



These chairs are so proportioned that they will yield to the pressure of the driving key, and, by being forced out of their normal state, exert a corresponding pressure to hold the parts together. There is a double inclined surface on the inner pad, and a ratchet cast on the driving key, so that the chairs or jaws must be sprung open before the keys can become loose or be taken out. This system is also applied to several varieties of cast-iron sleepers, particularly to Graves' bowl sleeper.

45. Patent Joint Chair, for Bridge or Foot-rails; Henry Lee Corlett, Inchicore, Dublin.

This chair is laid on a sleeper into which it is notched to guage, the requisite "cant" being given to the rail in the chair itself. The rail being fixed in the chair, iron wedge-keys are set up tight by screws, which may be provided with extra nuts to insure them from becoming slack.

46. Patent Suspended Fish Joint Chair, for Bridge or Foot-rails; Henry Lee Corlett.

This chair is laid between two sleepers, and may rest on the ballast. Rolled iron wedge-keys are placed under the flanges of the rail, on an inclined plane formed in the chair, and being forced up in their place by set-screws, form a "fish joint" but little liable to derangement. A broken rail may be expeditiously "fished" at the fracture by one of these chairs.

47. The above Chair, with one end planed off, to show Arrangement of Keys; Henry Lee Corlett.

48. Double-headed Rail, with Patent Longitudinal Cellular Bracket Sleepers; Henry Lee Corlett.

This method of forming "permanent way" is applicable to all kinds of railways, but more particularly to those laid on coach roads or streets. In either case, there are cells in the brackets, which may be filled with blocks of previously compressed timber, concrete, broken stones, or other suitable material, the surface of which is level or nearly so with the top of the rail. A rail or tramway thus laid will not, in paved or macadamised roads or streets, require any longitudinal or transverse sleepers, and will expose but the surface of the rail, which being protected on either side by the cellular brackets, will diminish the chances of horses slipping, as well as the shocks to wheeled carriages passing over it.

49. Patent Continuous Surface Supported Rail; Henry Lee Corlett.

This rail, which may be laid with or without timber sleepers (the latter method being preferred), is formed of two parts, which, when bolted together, so as to "break joint," form a continuous rail, the lateral or supporting flanges being as close as practicable to the top. It will thus diminish the leverage exerted by the wheels, to the coned peripheries of which it presents a bearing surface the entire width of the tyre. In laying this rail, less than the usual amount of ballast will be required. For tramways on roads or streets this rail is applicable, not requiring either transverse or longitudinal sleepers, while it combines a tramway suitable for the flanged wheels of railway carrying stock, and the wheels of ordinary road carriages and waggons.

50. Methods of Securing the Bolts and Nuts in Railway Fastenings; John Tatlock, Chester.

The wooden model shows two of these methods. The nuts are formed with grooves or recesses on the inner side, next to the fish plate, and, in one mode, are secured from moving by a slotted plate, which is passed over them, and fills up the space between them. In the other mode the nuts are secured by a square rod passing over them, and pressing against the recesses, and against a suitable flange and groove, rolled on the fish plate. The iron model shows the mode of securing both bolt and nut from turning, either together or separately, after being screwed up, and this without any other appliance for securing the bolt head. Notches or grooves are cut in the nut and in the fish plate, which bear upon and intersect the hole through which the bolt passes. These grooves correspond, and are formed when the nut and fish plate are made. In laying the fish joint, &c., the groove in the nut is held to the groove in the fish plate, and the bolt screwed into the nut. Thus a recess is formed, into which a small wedge or cotter is driven, which prevents either the bolt or the nut from turning or becoming loose. In this model, the cotter and grooves are made larger than requisite, and the bolt also is recessed, which in practice is unnecessary, the driving in of the cotter being sufficient to form a bearing against the bolt.

51. Patent Cast Iron Paving; O. H. Knapp, Downshire-hill Cottage, Hampstead, N.W.

MACHINERY AND MANUFACTURING APPLIANCES.

(For the remainder of the Articles in this Section, see Drawings.)

60. Patent Cotton Gin; John M. Dunlop, Marlborogh-street, Oxford-street, Manchester.

This gin is constructed on the McArthy principle having a handle and multiplying gear, whereby the roller and crank for working the agitator are driven at a greatly increased velocity, the work turned off by the machine being in direct proportion to the speed obtained. A handle actuates a wheel gearing into two pinions, one on a leather covered roller, and one on a crank shaft. By turning the handle with one hand the roller and shaft are driven at a high speed, while with the other hand the operator feeds the machine. It is stated that the machine will turn off 5 to 6 lbs. of clean cotton per hour, leaving the staple or fibre uninjured, the seeds being whole or uncrushed, and well cleaned. The price of the machine is £3. It obtained the first prize of £20, offered by the Cotton Supply Association, of Manchester, and is intended for cottage use in India.

61. Patent Machine for Making Covered or Plated Twist or Cord; Joseph Lewis, 51, High-street, Bloomsbury, W.C.

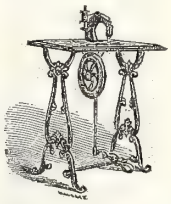
This machine consists of an iron frame or table, about two feet square, on four iron legs, having on its top, and parallel with it in the centre, two iron circular discs, of about three-eighths of an inch in thickness and a foot in diameter, which are made to revolve by means of a winch attached to other gear arranged under the table, and in connexion with the two discs. Passing through the centre of the two discs is an upright brass pillar, on the top of which is a cap, conical in shape, with grooves on its outer surface. Attached to the upper disc are various spools, on which is wound the cotton, or silk, or gold thread to be spun into cord. When the upper disc is put in motion the flyers revolve on their own axis, besides revolving with the disc, passing the threads up the grooves of the conical shaped cap, (which also revolves,) to a pulley suspended from a crane-like piece of mechanism, fastened at its bottom end to the iron table. The cord, after passing over the pulley, is taken to a drum or roller, which winds it off. By means of guides the strands are confined to the required angle, and this causes unity of motion, regularity of cord, and prevents any vibration in the instrument. If it be only required to make plated twist, such as is used for tassels, fringes, &c., the several warps, instead of being laid together after they are covered, are conducted to separate reels or spools, as each in itself constitutes what is known as plated twist. In that case one of the discs remains stationary. In making covered or plated cord this machine does at one operation what, by the usual process of manufacture, requires five distinct treatments, and the manufacture can be carried on in less than one thirtieth of the space required for the same amount of work by the means now in use.

62. Patent Cloth Cutting Machine; T. Allen, 9, Waingate, Sheffield.

This invention consists of an endless cutting knife, connected with other machinery, and is designed to facilitate the cutting out of clothing, boots, and every description of textile fabrics. The material being first folded the required number of times, is afterwards marked on the top layer with the pattern of the garment to be cut; it is then brought to the edge of the knife, which performs the operation of cutting rapidly and with precision. The machine may be worked by hand, or more advantageously by steam power.

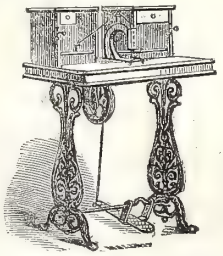
63. Cottage Sewing Machine; Newton, Wilson, and Co., 144, High Holborn, W.C.

A simple and cheap form of the sewing machine, easy to work, and producing the stitch known as



the single-chain or tambour stitch. The loop is spread by means of two hooks, between which the needle passes as each succeeding stitch is made.

64. The Boudoir Sewing Machine; Newton, Wilson, and Co.

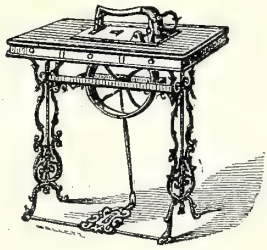


The improvements in this machine consist in a new arrangement for spreading the loop of the under thread. A lever underneath the bed of the machine acts upon a hook, which, taking the

loop of the under thread, holds it in such a position that the needle must inevitably pass into the loop thus formed, rendering it impossible for the machine to miss a stitch. The machine is simplified by this arrangement.

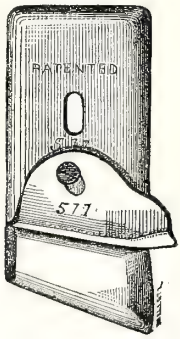
65. The Grover and Baker Family Sewing Machine ; Newton, Wilson, and Co.

In this machine a compound lever at the upper extremity works the needle, and at its lower extremity, by means of a spiral movement, it works the circular needle which secures the stitch. This arrangement simplifies the machine con-



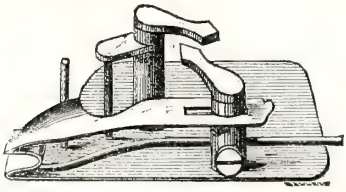
siderably, the arms formerly used being no longer required, whilst the machine is rendered very light, and almost noiseless in action.

66. Patent Apparatus for Hemming; Newton, Wilson, and Co.



In this machine there are two pieces of metal, arranged so that the upper part is operated upon by a spring that turns the fabric and stiches it on the same side, as done by hand.

67. Patent Apparatus for Binding; Newton, Wilson, and Co.

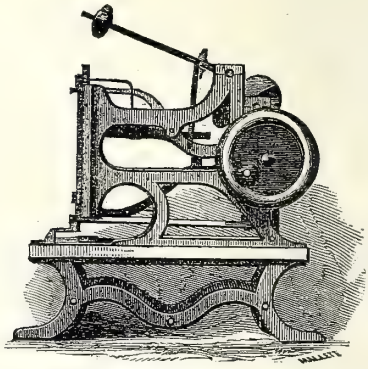


The binding is conducted on to the fabric by a curled instrument, like the letter S reversed ; while a double clip, one end of which rests firmly on the upper part of this curl, and the other slides in a small slot in the bottom of the curl, confines the binding to the desired position and lays it on more or less on either side of the fabric.

68. Patent Apparatus for Tucking ; Newton, Wilson, and Co.

In this machine the tuck is introduced between two flat metallic surfaces, the pressure on the fabric being regulated by a screw, while a moveable clip fixes absolutely the width of the tuck, so that no skill is required in the operation.

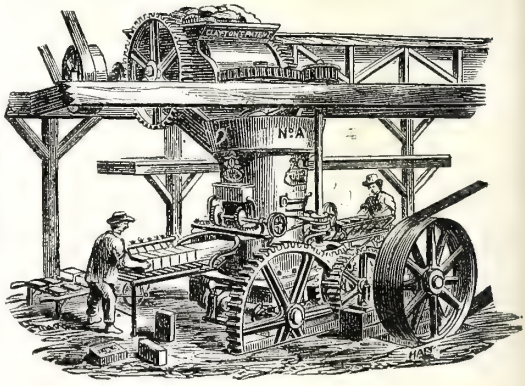
69. Patent Pegging Machine for Boots and Shoes ; Newton, Wilson, and Co.



This machine feeds the wire, cuts the pegs, bores the holes, and deposits and clinches the pegs. The instruments for these purposes are all distinct, and their action direct.

70. Patent Brick-making Machine; Henry Clayton and Co., Atlas Works, Upper Park-place, Dorset-square, N.W.

These machines are constructed of various sizes, adapted for working clay in a plastic state, and for motion either by steam, water, animal, or hand power. In these machines each die is constructed with revolving sides to form the moulding orifice, (instead of all fixed sides as heretofore); by these revolving sides, sharp pro-



jections, angles, or edges are produced, previously unattainable by the expressing principle of brick machinery. The method of lubricating these dies is accomplished by a sort of salivary

gland in the rotary portion of the die. The pressure of this machinery being equal throughout, causes the bricks to issue uniform, compact, of equal density, of perfect form, entirely free from sand flaws, and wholly void of the highly objectionable circular fracture, caused by the twisting action of screw forcing machines. Bricks of any kind or form, or of any size, (also paving and other tiles) are made by the same machine, by the addition of suitable moulds and accessories. Each machine is entirely made of iron. By the mechanical arrangement of these machines the bricks are cut perfectly true, as the streams of clay are stationary while being cut into the desired thickness, thus overcoming the objection to an unceasing delivery, and rendering unnecessary the use of delicate and complicated self-acting cutting apparatus. The bricks are made of such a stiffness as to bear handling, and walling some feet high, direct from the machine, which effects a saving in drying space, and quite avoids the necessity of flooring them. From the stiffness of the clay used, and the greatly diminished quantity of water required, a better quality of bricks is produced, and great saving of time and expense is effected in drying the bricks, besides the certain prevention of loss so frequent from exposure on the flats during bad weather.

71. Model Beam Engine; Joseph Lewis, 51, High-street, Bloomsbury, W.C.

This engine is intended for driving small turning lathes, &c.

72. Lubricating Can; John Robinson Scartliff, 119, Summer-lane, Birmingham.

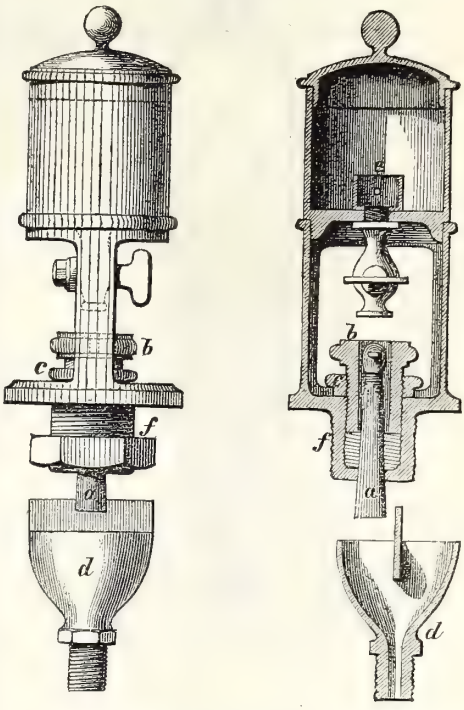
By pressing the thumb on the button which is on the top of this can, a sufficient portion of oil escapes into the valve or tube, and by slipping the thumb off the button, that portion of oil is instantly ejected to the required distance with great accuracy, thus avoiding the danger there is in lubricating machinery in motion with the ordinary can. It is impossible for the oil to escape until the thumb is applied to the button on the top of the can. This can also be used as an ordinary can, by keeping the thumb pressed on the button.

73. Clegg's Patent Lubricator; Edward Riley, Oxford-court, Cannon-street, E.C.

This lubricator has a cup at the top, into which the oil or tallow is first poured; it is then discharged into a ball by opening a cock. There is a valve at the upper part of the ball, which protects the cock, and also prevents the oil or tallow being blown from the ball, in case the cock should be left open. Another valve, at the lower part of the ball, is influenced by the action of the steam, and furnishes the supply of lubricating matter through a small pipe at the bottom of the vessel to the centre of the steam pipe, from whence it is conveyed by the steam to the valves and piston; the quantity of oil and tallow required being regulated by a small screw at the top of this lower valve.

74. Patent Crank Shaft and Connecting-Rod Lubricator; H. Hutton, 29, Palace-road, Lambeth, S.

This lubricator is designed more particularly for the crank shaft and connecting-rod of engines employed for imparting motion to screw-propellers, but is also applicable to other mechanism



of a similar character. The improvements consist, 1st, in employing a brush, *a* (see woodcut), of fine white horse-hair, instead of worsted or cotton. The great advantages of the hair are, its natural elasticity and durability. The brush can be raised or lowered by the screw, *b*, and secured in any position by the jam-nut, *c*, so as to allow the cup, *d*, on the connecting rod to take up from the brush as much oil as is required. 2ndly, in filtering the oil through the sponge, *e*, previously to its descending on to the brush, the supply of oil being regulated by the cock, the sponge preventing it running a stream. The lubricator may be fixed on any convenient part of the engine framing by a screw and nut *f*, so that as the crank rotates, the cup *d* on the connecting rod takes up a certain quantity of oil from the brush, and conveys it to the part to be lubricated.

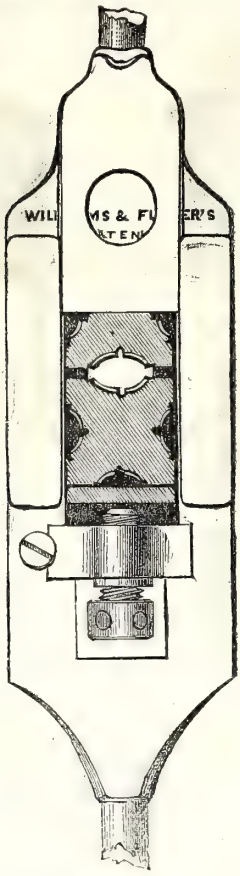
75. Machine-Made Nuts; W. Collier and Co., Salford, Manchester.

(See Drawing, No. 313.)

76. Williams and Fuller's Patent Screw Stock and Dies; John H. Fuller, 70, Hatton-garden, E. C.

By the arrangement of this stock—one pair of dies cuts four different sizes—no matter how they may vary in pitch of thread—and a larger number of sizes may be included—provided there are not more than 4 variations in pitch of thread.

In the woodcut a lid or cover, which slides on to keep the dies in position, is represented as partially drawn off.



77. O'Neill's Patent Universal Spanners; James Ferrabee and Co., Phœnix Iron Works, Stroud, Gloucestershire, and 76A, Holborn, W.C.

In these spanners the adjustments are completely closed in, and therefore not liable to be injured. The upper jaw is formed with a bar extending the whole length of the spanner. The moveable jaw, which slides on the bar of the upper one, has fixed to it on each side a metal rod, flat on one side, circular on the other. These rods are

screw-threaded at the ends, and they pass into a hollow handle, which is also screw-threaded inside, and is retained in its place by a collar screwed on the end of the bar of the upper jaw. The spanner is adjusted by turning the hollow handle, the screw thread in which acts on the screw thread on the side rods of the lower jaw. The whole of the spanner is case hardened.

78. Improved Pulley; Thomas A. Weston, 25, Temple-row, Birmingham.

In this invention the mechanical effect of the well-known differential axle is obtained without the long barrel and accumulation of chain thereon, and it is consequently useful for lifts of any length. It consists of two wheels of different diameter, and on the same axis, adapted to gear with an endless chain, which passes over both, forming two pendent-loops. In one of these loops is placed a snatch-block to which the object to be moved is attached. Motion being given to the wheels, the larger takes up chain from one loop faster than the smaller one lets it off to the same, and this loop is therefore shortened; while the other is equally lengthened by receiving over the large wheel more chain than is taken from it by the smaller one. Reversing the rotation of the wheels reverses the motion of each loop. In the specimen shown the wheels take respectively twenty and twenty-two links of chain in their peripheries, and motion being given by pulling the chain, the power gained is twenty-two to one. When the motion is given by a 20-inch ratchet-lever applied to the spindle, the power gained is about 125 to one, and it may be worked thus in an area eight inches square. Any weight lifted by it cannot possibly be made to run back of itself. It is adapted for use on forge cranes, in steamship engine-rooms and workshops, for suspended scaffolds, and wherever a very portable lifting apparatus, that cannot run back of itself, is required.

NAVAL AND MILITARY APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

80. Patent Floating Gridiron, for Raising and Repairing Vessels; Wm. Collett Homersham, C.E., 1*a*, Adelphi-terrace, W.C.

This invention consists of a rigid platform, formed of a longitudinal or lower series, and a transverse or upper series of air-tight caissons, united firmly to each other. The lower series of caissons have bulkheads at convenient intervals, which have the effect of dividing them into portions, into or from some of which water may be admitted or withdrawn as required, for the purpose of trimming the structure. This provision also enables the full amount of buoyant power to be placed immediately below that part of the vessel containing the greatest weight (say the engine-room of a steamer). The action of the shifting pontoons at the sides renders the structure stable when a vessel is being raised or lowered, and the curved form of the transverse pontoons has the same effect when it is floating with its load, as may be tested by this model. The mode of using is to let water into the longitudinal caissons so as to lower the structure, to permit a vessel being floated in position over it; when the caissons are lightened by either forcing or pumping out the water, the structure then rises with its load.

81. Model, showing New Mode of Constructing Vessels upon Economical Principles; Captain A. Macgregor Skinner, R.N., Belfast.

In this vessel the frames and beams are to be of galvanised iron T shaped, all the other parts of the vessel being of wood. The cieling, from the kelson up to the bilges, or first beam, is composed of logs bolted together. The outer planking is fastened to these, with tarred felt between. The model is on a scale of three-quarters of an inch to a foot.

82. Model of a Vessel of 536 tons; Captain A. Macgregor Skinner.

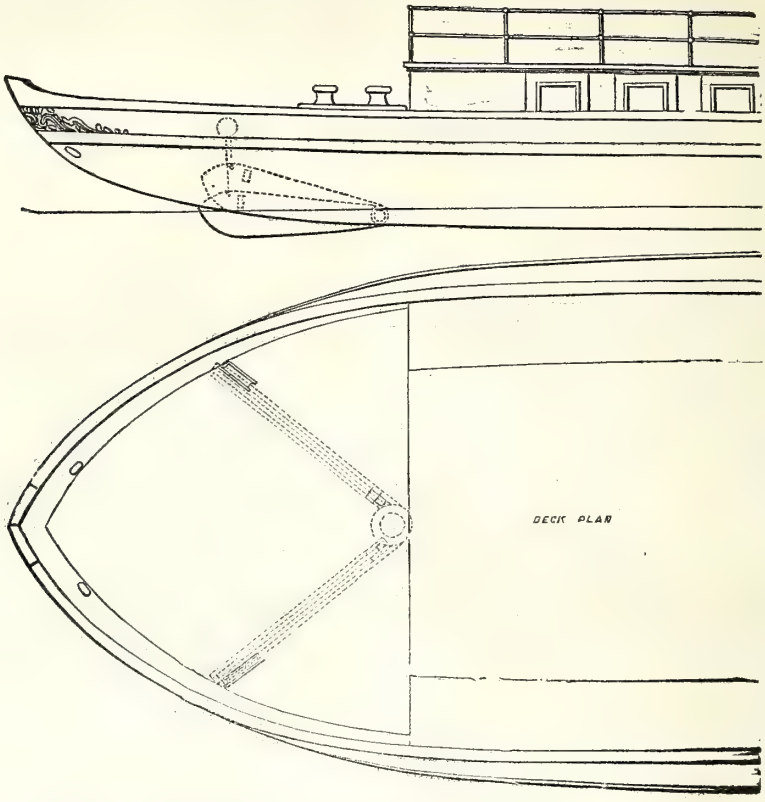
In this vessel the midship section extends one-third of the length of the vessel, between the perpendiculars. The extreme breadth is at the gunwale. This form, it is believed, will give great carrying power with a light draught of water. The model is on a scale of a quarter of an inch to a foot.

83. Iron Screw Canal Boat; Newbon and Smith, 63, Fenchurch-street, E.C.

The dimensions of this boat are as follows:—Extreme length, 70 feet; between perpendiculars 68 feet; extreme breath, 6 feet 10½ inches; depth in midship, 4 feet 8 inches. Several boats on this plan are about being built to ply on a portion of the Shropshire Union Canal, principally between Autherley Junction and Market Drayton. The expense of working, it is calculated, will be considerably less than that of the present method with horses. They will also, besides carrying their own cargo, (about 20 tons) tow one of the ordinary canal boats. The engine is to be high-pressure, of eight horse-power. The dimensions, both in length and breadth, are the largest that will pass through the locks in the district the boats are to be built for.

84. Patent Light Draught Steamers for Shallow Waters; Alex. Chaplin and Co., Cranstonhill Engine Works, Glasgow.

These steamers have a nearly straight flat bottom, with a slight rounding off towards each end, without keel, stem, or sternpost, and are steered by means of two plates or blades, arranged obliquely at the end of the vessel (see woodcut). Each of these plates is hinged, and works in a vertical casing, one plate being lowered into the water when the vessel is to turn in one direction, and the other when the vessel is to turn the other way, both being worked by an ordinary steering wheel and chains, a pair of these blades at one end being sufficient for the ordinary steering of a vessel going in either direction, while for intricate navigation, or in rapid rivers, a pair at each end of the vessel is used; in the latter case the two sets of steering plates may be actuated either simultaneously or separately. These steering plates have much greater and more prompt control on the movements of the vessel than an ordinary rudder, from their acting on each side of the vessel's centre line; and being inside of the disturbed water which generally follows the ship along the centre of her wake, they are always at the best angle for effect, being so arranged that only one at a time can project beyond the hull of the vessel, in which they are both completely encased when their action is not required. They can at no time project downwards beyond the bottom or draught line of the vessel, and, as their shape prevents their catching ropes or hawsers stretched across the vessel's course, they are not liable to receive injury from this cause, or from the vessel's running aground. The cabins are partly above and partly below the decked space at each end of the vessel, the larger class of vessels having a decked space all round; the upper deck is for passengers only. The proportions of the vessel, and the arrangement of its various parts, may be modified in practice to suit the particular purpose for which it is built. A vessel of the form described has a very small draught of water as compared with its floating or carrying



capacity. It skims the surface of the water with great facility, the angle of the entrance and the corresponding resistance being small, whilst the horizonal disposition of the advancing surface causes the resistance to act upwards, thus raising the vessel or lessening her actual draught. The stability of such a vessel is also very great, on account of the full breadth being carried nearly throughout her entire immersed length. 21 of these steamers have recently been constructed, 18 for the government, chiefly for navigating the rivers of India. They are of large dimensions, and only draw 2ft. when loaded with about 600 troops, stores, &c., and can therefore penetrate further into the interior than the large steamers hitherto constructed. (See the "*Engineer*" 24th March, 1860.) The first steamer constructed on this principle, was sent to Java in 1858, and has since been constantly and successfully employed in navigating the shallow waters of Sourabaya.

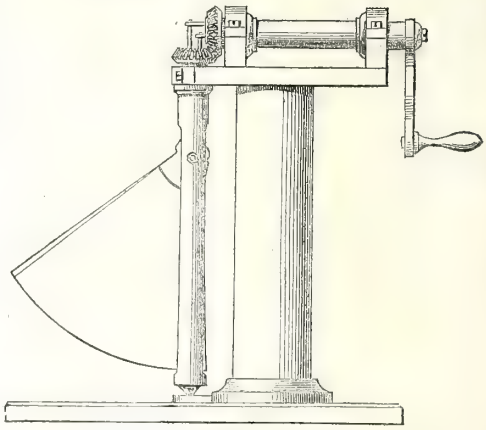
85. Safety Boat for Emigrant Vessels; W. D. Taunton, Oxford-terrace, Cliftonville, Brighton.

This boat has double sides, to give greater buoyancy.

86. Raft for the Preservation of Life in Case of Shipwreck, or to be used as a Temporary Bridge; J. White, Finchley, N.

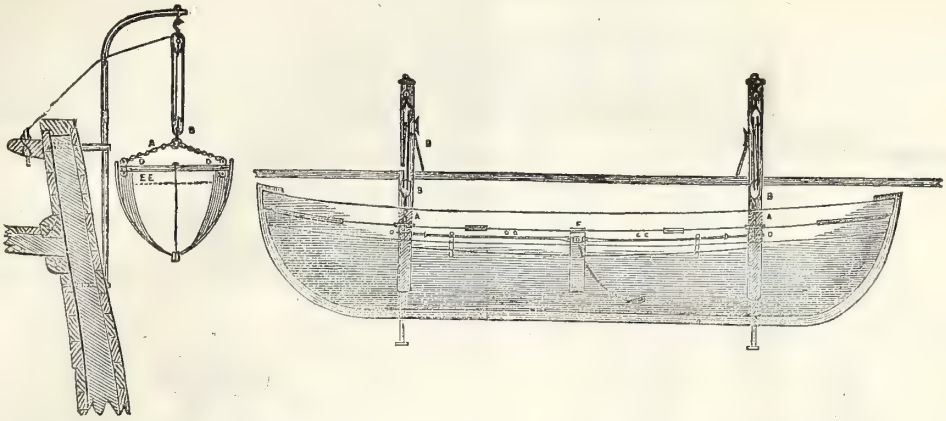
Two clamps, placed on the edges of the ends of a water-tight buoyant cask, filled with air, and connected by rope, chain, or rod, of the requisite length, and a screw, are fixed in that position by the action of the screw. Any number of casks thus furnished are attached to each other, sideways and endways, by means of a rod or rods, and ropes or chains, fixed under, or attached to, the screw cords.

87. Steering and Propelling Mechanism; Francis Pichler, 162, Great Portland-street, W.



This apparatus, when applied singly (as shown in the model), may be used for steering either when the vessel is in motion or not. If two of these are applied, thy may be used as propellers.

88. Boat Suspending and Detaching Apparatus; Wood and Rogers, 1, St. Peter's-alley, Cornhill, E.C.



The invention consists in suspending ship's boats from the davits from four points instead of two, preventing the canting of the boat while people are getting in or being lowered, and in detaching the boat from tackles instantaneously. A lever is raised about one foot, and the boat is then free, it not being necessary for a steamer to slacken her speed.

89. Respiratory Life-Buoy and Sub-Aquatic Boat; J. White, Finchley, N.

Two models of this apparatus are shown.

90. Lifebuoy; J. White.

A cask, or other hollow buoyant water-tight vessel, filled with air, is fastened to one end of a line, (coir, because it is buoyant), which is coiled, or wound round a reel, and is enclosed in a box, which is fixed outside the ship. In the upper part of the front of the box a roller is fixed, over which the coir passes. The lid of the box is held down forcibly by a spring, and, by pressure, fixes the coir on the roller, and keeps the buoy suspended. A rope is attached to the outside of the lid of the box. By pulling the rope the lid of the box will be opened and thus the buoy will be let go, and, by means of the motion of the ship and the resistance of the water to the motion of the buoy, the coir will be drawn out of the box.

91. Lighthouse and Pier-head Lamp; John Weir Draper Brown, 17, Guildford-road, Greenwich, S.E.

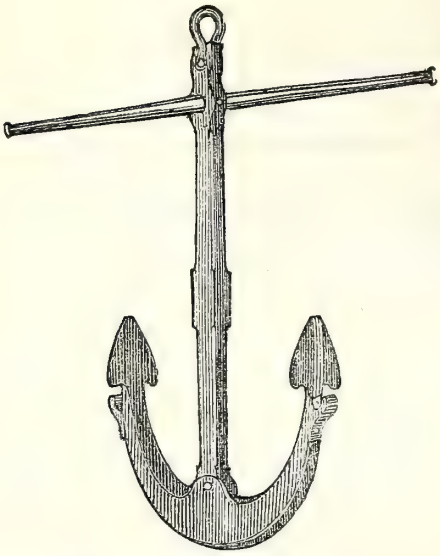
This lamp is constructed of tiers of lenses placed one above the other, the perpendicular edges of which are so mitred that they join each other like the key-stones of an arch, and according to the angle at which they are mitred, so a circle or half circle of any extent can be formed The model shows half a circle, constructed of two tiers of lenses, each tier consisting of seven plano-convex lenses, shaped so that where they join each other, lenses are formed. The interior presents a series of 30 distinct flat surfaces, 15 to each tier, without metal work separating them. The external appearance will be half spherical, the lenses of each tier being so blended one with the other that no depressions exist between them which can cause a break in the light. In this lamp 30 distinct and direct rays of light are obtained, which all become so amalgamated that the result is a more considerable increase of size, power, and brilliancy of the light than can be obtained from a lamp constructed of one large lens or piece of glass, because the power of the light, although the lens may be well filled, becomes weakened from the centre or focal point, and, therefore, unless the eye always rests on the centre, the light is lost. Another advantage of this principle is stated to be that the power of the light may be regulated, by lighting up one or more tiers of lenses, as required.

92. Gravity Binnacle; George Gibson Brown; 17, Guildford-road, Greenwich, S.E.

This binnacle is constructed either with a metal or wooden cylinder, having at its upper circumference metal bearings, to receive a brass gimbal, also with bearings, into which gimbal is placed a hollow metal globe, which contains the compass; the globe is loaded with lead, in order that it may always maintain a perpendicular position, the upper part of the globe being fitted to receive the day and night tops, which are fastened by a bayonet lock; the latter top, which is only intended to be shipped at night, is supplied with a lamp, which hangs in the centre of the top, so that the light may be thrown directly down on the card. The advantages claimed for this binnacle are, that it always keeps a perpendicular position, not partaking of the motion of the ship, thereby removing all friction from the compass-card and bowl, and transferring it to the binnacle itself. The ordinary binnacle being a fixture to the deck of the ship, the compass-card and bowl receive the whole vibration. Another advantage claimed for the "Gravity Binnacle" is, the better illumination of the compass, owing to the lamp being always perpendicular, which is not the case with the ordinary binnacle.

93. Reed's Patent Portable Anchor; Holsgrove and Reed, Trimdon Iron Works, Sunderland.

These anchors are made with the lugs or jaws forged on the arms, which, being in one solid piece, require no welds by the anchor smiths.



The shank has a collar or shoulder touching the jaws, between which it is fitted, and is connected by a bolt or pin at the throat, about which the arms turn. Anchors made on this principle are fished and the buoy-rope chain attached in the same manner as ordinary anchors. (See drawing No. 333.)

94. Martin's Patent Anchor; Emil Rettig, 2, Walbrook-buildings, E.C.

95. Patent Anchor Lift; Newbon and Smith, 63, Fenchurch-street, E.C.

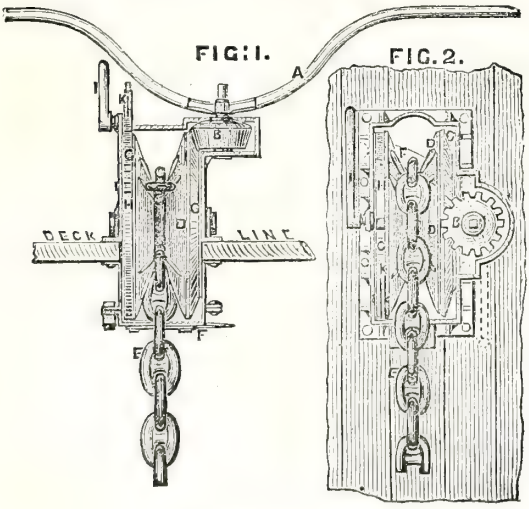
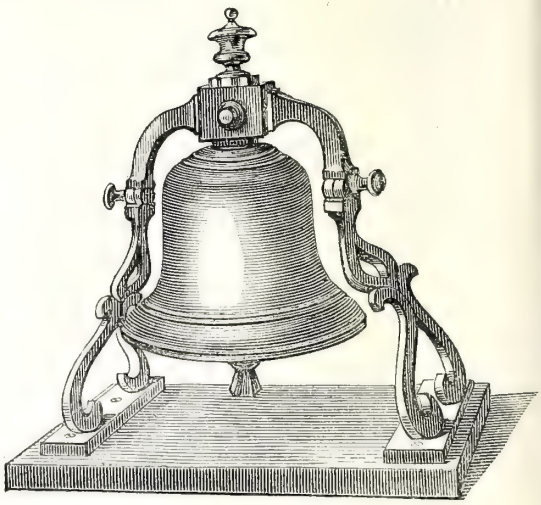


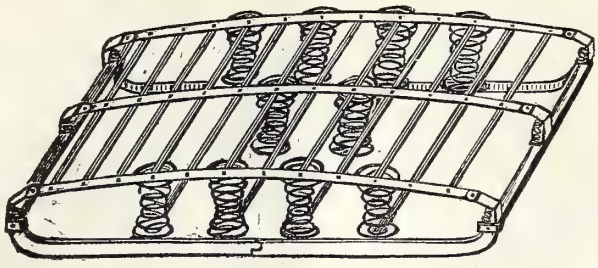
Fig. 1 is an elevational front view, and Fig. 2 a plan taken on the deck line. A is a double lever handle; B a pinion wheel, which gears into the bevel-wheel C, on one side of the chain wheel D, having bevel cheeks forming a chain groove, over which the chain E passes from the deck into the chain locker. A chain nipper, or compressor F, as seen in Figs. 1 and 2, is fitted under the deck, and is worked by a rope on deck. A break strap, H. and lever, I, are applied on the opposite side of the chain drum, and are worked from the deck; K are falls taking into the ratchet wheel G.

96. 12-inch Turned and Polished Ships' Bell, mounted in Bronzed Cast Iron Frame; J. Warner and Sons, 8, Crescent, Cripplegate, E.C.

97. 7½-inch Turned Ship's Fog Bell, mounted in a Polished Brass Scroll Frame; J. Warner and Sons.



98. Geyelin's Patent Portable Hygienic Spring Frames for Ships' Berths; W. H. Kennedy, 462, Oxford-street, W.C.



This is an arrangement of springs for affording ventilation to the under part of mattresses.

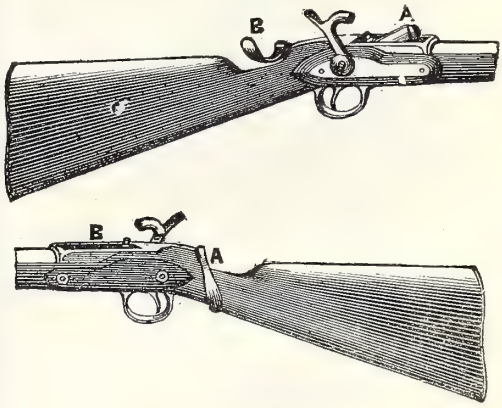
99. Two Pieces of the Original "Big Ben;" J. Warner and Sons.

100. Patent Bivouac-tent; Major Godfrey Rhodes, Unattached; Messrs. S. W. Silver and Co., 66, Cornhill, E.C.

The object of this invention is to afford a light, strong, and dry temporary abode for troops in the field, when the ordinary field-tents cannot be supplied. The covering of the tent is of double cotton (canvas), and waterproofed by a new process: it consists of two sheets of equal sizes, overlapping each other near to the top of the tent, attached by buttons or other suitable fastening. Two pliable jointed ribs, (of wood, metal, or any other suitable material), three lengths for each, constitute the frame of the tent, and by sliding a tube over each joint, the rib is converted into one stick or rod. This latter is then bent, and by means of a wire-rope, it is strung like a bow. The bottom extremities of each bowed-rib are forced into the ground, at six feet asunder. The waterproof tent-covering is then placed over the two ribs, and tied to their sides, by means of leather thongs or strings, secured to the tent-covering. A three-stringed wire-rope is fastened to each rib, at the open extremities of the tent, and by the aid of a "new-ground-screw," or anchor, the tent-covering and frame are pulled outwards; the ribs are pressed downwards, thereby firmly securing the bottom or butt-ends of the ribs into the ground. The "ground-screw" can be secured, or taken out of the ground, by the hands only. One end of this tent is closed by two curtains, buttoned together. Its size is 6 feet by 6 feet, by 3½ feet in height. Its total weight is from 7 to 8 lbs., and it is intended to be carried by two soldiers. The method of carrying the tent is as follows:—One rib is to be secured to the left side of the knapsack by two short straps, and one sheet with "ground-screw" to the right side, thus equalising the weight. The waterproof sheet can be used as a light temporary cloak or cape, during wet weather. Although this tent is only intended for the accommodation of two soldiers, three can find shelter therein. Its weight is about the same as the French "tente d'abris," but it contains 14½ cubic feet of air in excess of the French tent. Thus—Rhodes's Bivouac tent-contains 99½ cubic feet of air, and the French tente-d'abris 85 cubic feet only.

101. Mc Kenzie and Wentworth's Patent Breech-Loading Rifles; Exhibited by W. Strode, 16, St. Martin's-le-Grand, E.C.

These rifles have no plugs or other contrivances at the back of the barrel, but the whole breech is made of one solid piece of steel, and the joint is

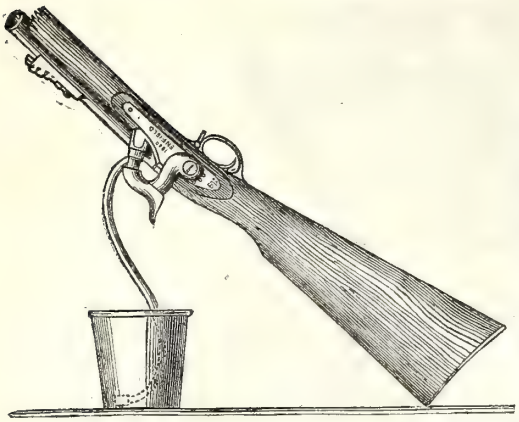


in front of the point of explosion. The breech is capable of adaptation to any barrel, as well as to any form of ammunition, and they can therefore be used with the present service ammunition. They have a sound joint at the junction of the breech with the barrel. They can be made with the existing machinery. The wood-cut represents the form of rifle with moveable breech adapted for the army. A represents the breech chamber tilted up, ready to receive the charge. B the lever, which actuates a screw by which the breech is forced into its place, making a sound joint with the rear end of the barrel. In the lower figure the lever and breech are shown in their places ready for firing, and until they are put in these positions, and the breech securely closed, the rifle cannot by any possibility be discharged. (See Drawing, No. 334.)

102. Patent Safety Bolted Gun; Joseph Atkinson, Market-street, Lancaster.

This arrangement is intended to prevent the accidental discharge of firearms. There is a safety bolt which prevents the hammers from reaching the cap unless the gun is placed to the shoulder. The bolt has no connection with the interior of the lock or with the trigger, so that it does not interfere with their free action.

103. Wilson's Patent Suction Tube for Cleaning Firearms; P. B. Cow, 46, Cheapside, E.C.



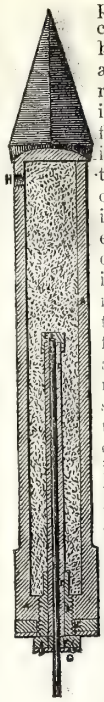
This consists of an elastic tube, which has a mounting for attaching it to the nipple of the gun, the other end being placed in water. The cleaning rod forms a piston within the barrel, and thus draws the water through the nipple.

104. Hollow-Rifle Punch; Capt. J. Norton, Rosherville, Gravesend.

This punch is formed of a mixture of lead and antimony, and in firing it from a rifle into a plank of wood, it cuts a clean hole like a wad-cutter.

105. Patent Bomb Lance; E. Balchin, Myton-gate, Hull.

The accompanying engraving shows the improved



lance projectile in longitudinal section, taken through the centre of the lance. The lance, A, is cast in iron, of a cylindrical form, and hollow, but tapering at one end to a kind of bayonet point, which is solid; the rear end of this pointed cylindrical shell or lance is tapped to receive a hollow metal plug, B, which carries a wad, C, and when screwed up secures the wad to the rear end of the lance. Through the plug, B, is inserted a tube, D, which is intended to receive a fusee match, and project it a considerable distance into the powder chamber, so that it may ignite the explosive compound near the middle of the chamber. The inner or forward end of the tube is covered by a pierced cap piece, E, and its rear end by a plug of soft wood, F, which is passed over the fusee match before the match is inserted into the tube, D, and driven tight into the hollow metal plug. The object of this wooden plug is to prevent the match from being driven in when fired from the gun. A plate, G, furnished with a central hole, is attached to the rear end of the metal plug, B, by screws, and thus the match is secured with its rear end projecting out through the plate. Near its closed or pointed end, the cylinder is furnished with a tapped hole, which is closed by a screw plug, H. Through this hole the powder or explosive compound for charging the projectile is admitted into the cylinder, A, which, when filled, is closed by screwing down the plug. To reduce as far as possible the friction of the projectile against the sides of the gun when being discharged, the extremities only of the cylinder are made to fit the bore of the gun; the diameter of the intermediate part being reduced, as shown in the figure. This explosive lance may be fired from an ordinary harpoon gun, and the match being made to burn a suitable time after the discharge takes place, the lance will, after it has struck the whale, explode, and inflict a mortal wound.

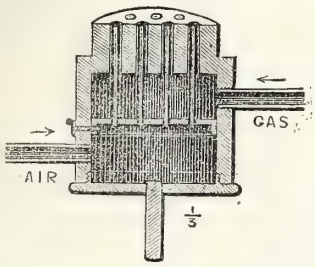
PHILOSOPHICAL APPARATUS, &c.

(For the remainder of the Articles in this Section, see Drawings.)

110. Patent Blast Gas Furnace; John Joseph Griffin, F.C.S., 119, Bunhill-row, E.C.

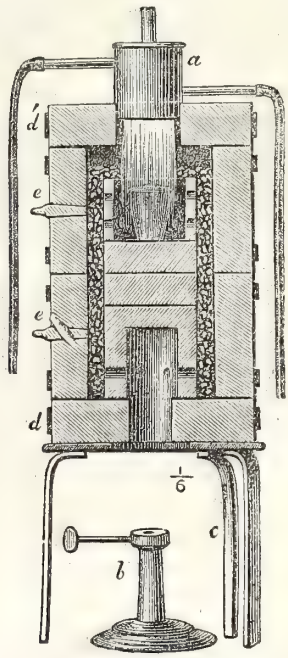
This furnace is intended for the fusion of refractory metals, and for other purposes which demand a high temperature, producible with readiness, and under complete control. The fuel is common coal gas, taken at the ordinary pressure, and supplied with a blast of atmospheric air by means of a blowing machine. The apparatus consists of an iron gas burner, and a clay furnace packed with small flints. The gas-burner is a cylindrical iron reservoir, constructed as shown in section in Fig. 1, which is drawn on a scale of

Fig. 1.



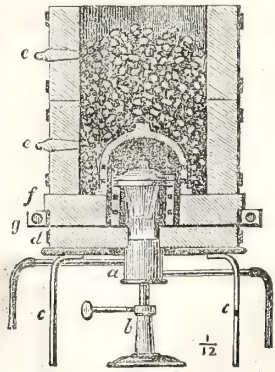
one-third the full size. It contains two chambers, which are not in communication with one another. Into the upper chamber, gas is allowed to pass by the tube marked GAS. Into the lower chamber air is forced by the tube marked AIR. The upper part of the burner is an inch thick in the metal. Through this solid roof holes are bored for the escape of the gas. The air passes from the lower chamber through a series of metal tubes placed in the centre of the gas holes, and continued to the surface of the burner, so that the gas and air do not mix until both have left the gas burner, and then a current of air blows through the middle of each jet of gas. The GAS and AIR pipes generally used are both half an inch in the bore, and about ten inches long; the gas has usually had a pressure of half an inch of water, and the blast of air about ten times that pressure. The quantity of gas used in an hour is about 100 cubic feet, when the gas burner contains 16 jets. The jet of blue flame produced by such a burner, when the gas is lighted and the blast of air is set on, is about two inches in diameter, and three inches in length. It can be directed into the furnace either at the top or the bottom. Fig. 2 represents a section of a gas furnace heated by the top; *a*, is a gas burner, similar to fig. 1; *b*, is a support for the burner, to be used as represented in fig. 3; *d*, and *d'*, are two plates of fire clay, bored to fit the nozzle of the gas burner; *e*, *e*, are two cylinders of fire clay; *c*, is an iron support for the furnace. Upon the base, *d*, is placed a perforated cylinder of fire clay, and upon that as many discs of fire clay as bring the crucible that is to be heated up to the top of the furnace. A perforated cylinder of plumbago is placed round the crucible, and the space between the middle

Fig. 2.



pile and the walls of the furnace is filled with flat stones, of about half an inch diameter. The cover, *d'*, is then to be put on, the gas is to be lighted, the blower to be put into action, and the

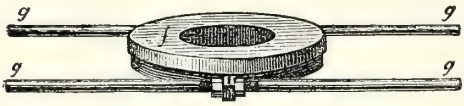
Fig. 3.



flame to be directed down into the furnace. The whole force of the blue flame then acts directly upon the crucible. The products of the combustion of the gas, and the nitrogen and surplus air escape at the bottom of the furnace, leaving

most of their heat with the pebbles, crucible, &c. Fig. 3 represents a gas furnace arranged for being heated at the bottom. The parts marked *a*, *b*, *c*, *d*, *e*, *e*, have been already described; but the piece marked *f*, *g*, *g*, and represented separately by fig. 4, is a false bottom, consisting

Fig. 4.



of a fire-clay plate, mounted with a pair of iron handles. The crucible to be heated is flanged at the mouth, fig. 5, and rests by the flange on a perforated cylinder of plumbago, fig. 6. This

Fig. 5.

Fig 6.

cylinder rests on the fire-clay plate, *d*, fig. 3. Upon the false bottom, *f*, is placed a perforated dome or hemisphere of fire-clay or plumbago, and above the dome the furnace is filled with small flints. The flame is put in at the bottom. When the crucible is to be examined, the whole upper part of the furnace can be lifted by means of the handles, *g*, *g*, and, if necessary, can be easily replaced. The heat produced by this furnace is sufficient for the fusion of silver, gold, copper, cast iron, wrought iron, nickel, and cobalt. One pound of copper can be melted in ten minutes, 3 lbs. in fifteen minutes, 10 lbs. in an hour. Cast iron melts with nearly equal facility.

111. Patent Plumbago Melting Pots, for Fusing the Precious Metals, Brass, Steel, &c.; The Patent Plumbago Crucible Company, Battersea Works, S.W., and 22, Bow-lane, E.C.

No. 1—Used by gold, silver, and brass melters.

No. 2—Shape used in South America.

No. 3—Shape used by steel smelters.

112. Clay Furnaces; The Patent Plumbago Crucible Company.

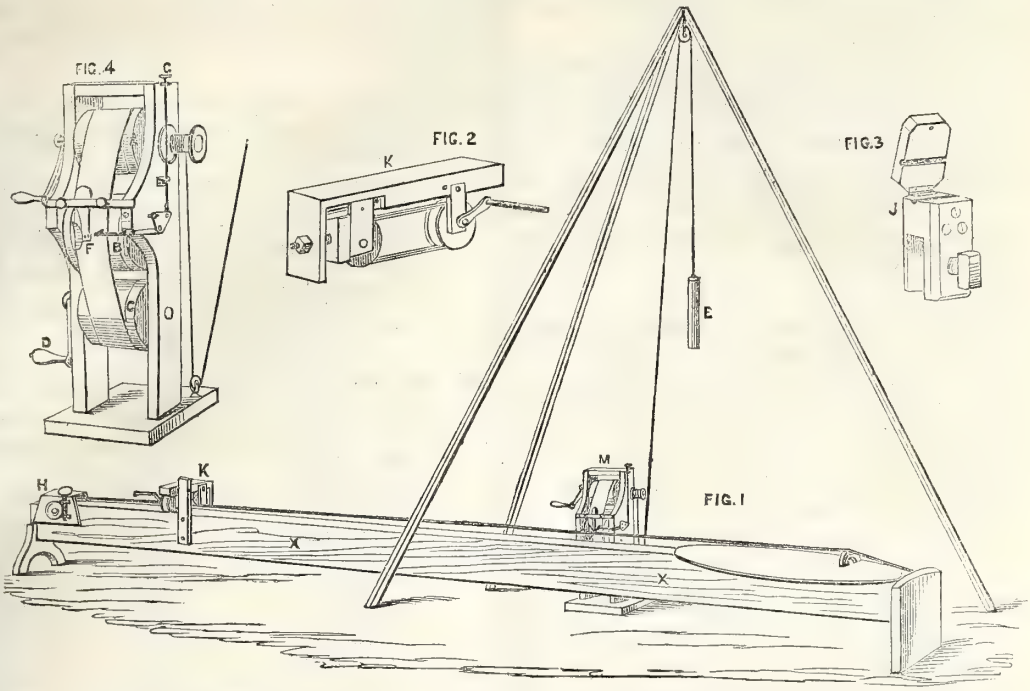
Muffle Furnace.

Melting Furnace.

113. Assay Pots, Roasting Dishes, and Scarifiers, employed in the Manipulation of Metal; The Patent Plumbago Crucible Company.

114. Apparatus for Registering and Printing the Vibrations of Strings; J. Henry Griesbach, 19, Carlton-road, Maida-vale, W.

This instrument is intended for ascertaining the nnumber of vibrations in a second, producing musical sounds. Fig. 1. M, the registering apparatus; X, the monochord; K, the rotating bow; E, counter-weight, and triangular support. Fig. 2. The rotating bow, by which the string of the monochord is kept in a state of constant vibration for any required time. (Seen in position at K, Fig. 1.) Fig. 3. The moveable bridge used in tuning the string of the monochord; seen in position on the apparatus, but removed when the apparatus is in action. Fig. 4. The registering apparatus. The upper cylinder, A, holds the paper on which the vibrations and seconds are to be printed. The middle cylinder, B, is covered with tracing paper. One end of the paper on the upper cylinder, A, is attached to the lower cylinder, C, and, when the apparatus is in action, is wound on to the lower cylinder by turning the handle, D. This paper is strained and kept in close contact with the tracing paper on cylinder B by the resistance of the counter-weight, E, in Fig. 1. The string to which the counter-weight is attached proceeds from the reel forming part of cylinder A, passing under a pulley on the foot-board of the registering apparatus, and from thence over a pulley attached to the upper part of the triangular support of the counter-weight. The string of the monochord, when put into a state of vibration, impinges on the piece of brass attached to the spring and printing-point, F (Fig. 4), which is thus caused to strike the paper in contact with the tracing-paper on cylinder B, the paper consequently receives a printed dot, and if the paper were at rest, the printing-point would continue to strike the paper at the place where the dot was printed; but as the paper, during the operation, is in constant motion by being wound from cylinder A to cylinder C, it receives a succession of printed dots from the tracing paper, thus recording the vibrations of the string of the monochord; at the same time, the plate at the end of the rod, G (Fig. 4), is struck by the finger every second, either by watching a pendulum, or, what is more convenient, a metronome set to 60, which will give seconds; by this process a second series of printed dots is obtained, which mark off the number of vibrations that have passed in every succeeding second. The string of the monochord is tuned by means of the screw, H (Fig. 1), three-fourths of its length being previously cut off by the moveable bridge, J, temporarily fixed for that purpose on the monorchord at the point marked $\frac{1}{4}$, the remaining fourth part of the string over the sounding board being tuned to any note. The moveable bridge must now be taken away, and the whole length of string will give the vibrations of the note two octaves lower than the note to which the fourth part of the string was



tuned. The number of vibrations in a second will depend on the pitch to which the string has been tuned, and it is practically convenient and advisable to take the number of vibrations given in 10, 20, or 30 seconds. Supposing 10 seconds to give 160 vibrations, one second will be equal to 16 vibrations.—(See Drawing, No. 330.)

115. Dial Electric Telegraph; Prof. Hughes, 20, Northampton-square, E.C.

This instrument consists of a train of wheels set in motion by a spring, and governed in its revolution by means of a vibrating spring. The dial revolves by means of friction, and whenever the keys upon which the letters of the alphabet are engraved are pressed down, the wheel is stopped and the electric circuit is closed. This attracts an armature of an electro-magnet at the distant instrument, which stops the dial by means of a catch; thus the distant instrument imitates what is done upon the transmitting one. Any person can work this instrument without possessing any previous knowledge.

116. Linograph; D. McCallum, Plymouth.

This instrument is a recording telegraph. The novelty consists in its being adapted to make the symbols on thread with black and red inks. It is constructed to be worked with one wire, by means of a train of wheels, which winds up the thread as it is marked, and if a relay is added, a dot alphabet may be introduced, and several duplicates of the message may be obtained at the same time. The linograph is also well adapted for recording train signals; in this case no train of wheels is necessary, as a loose pallet, working in a ratchet wheel, winds up the thread; the downward movement of each lever marks the thread, and the upward movement throws the receiving wheel a step forward after the thread is marked. Time is kept by a circuit formed with a clock, which, at stated intervals, brings down both levers at once, and makes a double mark, the two marks being close together, and readily distinguishable from the single marks.

117. Patent Improved Insulator; F. N. Gisborne, 3, Adelaide-place, London-bridge, E.C.

This insulator consists of an enamelled cast-iron cap, with an enamelled wrought-iron screw-pin; the interior of the cap being of a globular form, affords protection against the admission or accumulation of moisture. This insulator holds the main wire, upon a broad basis, without the assistance of any tie-wire or other fastening, and in such a manner that it cannot draw or slip; each pole therefore sustains its own legitimate amount of weight and strain. It is readily attached to a pole or wall without any additional fastenings, and when attached remains perfectly firm in every particular.

118. Wray's Patent Insulating Compounds; Exhibited by Messrs. W. Warne and Co., 9, Gresham-street, West, E.C.

One thin sheet One small plate	Composed of India-rubber, shellac, and powdered flint.
One thin sheet One thicker sheet	Composed of India-rubber, shellac, powdered flint, and gutta-percha.

Sundry electric telegraph wires, covered with Wray's Insulating compounds.

119. Patent Caoutchouc Insulated Telegraph Wire; S. W. Silver and Co., Silvertown

Essex, and 3, 4, 5, and 6, Bishopsgate Within, E.C.

India rubber is known to possess great insulating power for insulating telegraphic wires, it has also the additional advantage derived from its low specific inductive capacity, by means of which the speed of working long lines of telegraphic wire is much increased. In other respects also in the matter of elasticity, durability, immutability under the influence of heat and cold, impermeability under pressure and compressibility, India rubber has many advantages over gutta percha.

120. Ebonite Key Board, for Morse's Telegraph; S. W. Silver and Co.

For key boards this material is valuable on account of its not allowing waste of voltaic powers.

121. Ebonite Telegraph Office Insulators; S. W. Silver and Co.

In the ordinary wood testing boxes, the line and earth wires are attached to the same board, and as wood is, in a large degree, a conductor of electricity, much of the battery power, when directed to lines of great resistance, must necessarily pass through the wood to the earth, not only causing waste, but also depriving the line wire of much intensity of force. The use of ebonite insulators renders the insulation complete.

122. Ebonite Telegraph Pole Insulators; S. W. Silver and Co.

This substance is adapted for exposed insulation from its durability, strength, tenacity, and its remarkable properties of radiation of heat as well as the high insulating qualities it possesses.

123. Ebonite Electric Machine; S. W. Silver and Co.

Ebonite, as applied to frictional electricity, is stated to be superior to glass as two to one. The character of its electricity is negative; the material, being very hard and tough wholly resists blows or accidents that would prove fatal to glass discs. A great advantage is found in its being effective in an atmosphere that would render glass useless for the time.

124. Insulating Telegraph Conductors; Hall and Wells, Steam Mills, Mansfield-street, Borough-road, Southwark, S.E.

This invention consists in insulating the conducting wire or wires by covering them with a spiral layer of cotton, and then covering the cotton with strips of india-rubber in its pure or manufactured state; these strips are layed on with an overlap; a vulcanized thread of India-rubber is then wound round, which renders the covering homogeneous; the above process constitutes the insulating medium; after which two or more coverings of india-rubber are applied, and finally the whole is covered with yarn saturated with tar, which renders the core complete for submarine cables, &c. These coverings are all performed at one and the same operation.—See *Mechanics' Magazine*, 6th May, 1859, page 295; *Mining Journal*, 14th January, 1860.

125. Telegraph Cables; Hall and Wells, Steam Mills, Mansfield-street, Borough-road, Southwark, S.E.

This invention consists in covering telegraph cores upon a hollow tube braiding machine, whereby one set of wires or strands of hemp is laid longitudinally without any twist, while another set forms the braiding and incloses the longitudinal wires or threads of hemp.—(See *Mechanics' Mag.*, 6th May, 1859, page 295; and *Mining Journal*, 14th January, 1860.)

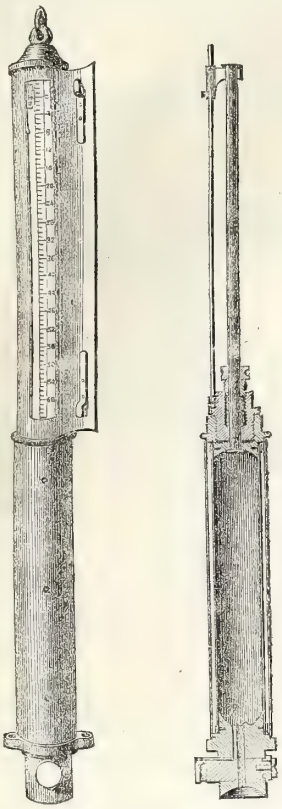
126. Apparatus for Preventing the Loss of the End in Laying Down Submarine Cables; A. Stewart Harrison, 133, Upper Thames-street, E.C.

A series of rings on levers (in two parts united by nuts and screws), are attached to a safety cable. In the vertical position of the rings the cable runs freely through them; when they are in an oblique or diagonal position, the cable is clipped by their edges. The rings are forced into the oblique position by a spring acting on the lower bar, and kept in check by a trigger. The trigger line is connected with a weight supported by the tension of the cable, on the breaking of which the trigger line is pulled, and the part running through the rings clipped. The splice would have to be made from a small boat. It may be modified by uniting the upper and lower half of the rings with staples, for the purpose of allowing the passage of a kink by their instant separation when the staples are withdrawn.

127. Deep-Sea Pressure Gauge; Invented by H. Johnson; Manufactured by F. Hoffman, 74, Myddleton-street, Clerkenwell, E.C.

This pressure gauge may, in its present form, be considered as a small hydraulic press, of which the ram is forced into the cylinder by the increasing pressure of the sea when sinking, and expelled by the expansion of the water in the cylinder when rising. It consists of a small tube or cylinder, having at one end a tap, through which water is admitted; the tap having, in addition to the passage admitting water, a smaller passage for the escape of air. At the other end of the cylinder is a packing-box, through which a round bolt or solid piston passes. A scale by the side of the piston contains the degrees of compression, and an index at the further end of the scale is drawn along it by the piston when forced by increasing pressure into the cylinder, and secured in its position by a spring taking hold on a toothed rack at the side of the scale, where it remains, when the piston is pushed back by expansion of water in the cylinder to its former position. The scale and index are protected by a tube screwed on to the cylinder, and the cylinder is protected from the risk of indentation by an outer tube. In an experimental instrument the packing-box has remained water-tight under the application of a pressure of 400lbs. to the square inch on the piston; so that the isolation may be considered sufficiently perfect, as in actual use this pressure on water in the cylinder

would be counterbalanced by the external pressure of the ocean. As the amount of friction required to obtain this isolation is considerable,



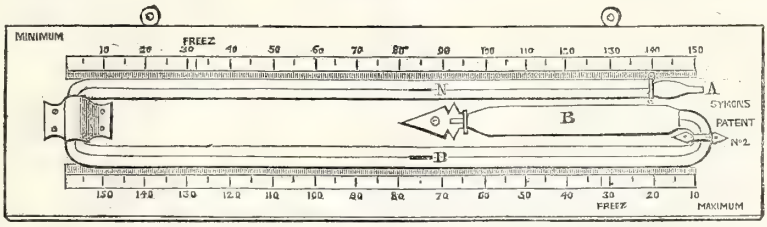
and may be affected by screwing down the packing-box, it would be desirable that after any alteration of the packing-box the instrument should be suspended, and the amount of friction ascertained, by hanging on to the piston a weight sufficient to overcome the friction. In ascertaining the pressure of water, the amount of friction overcome should be added to the compression indicated by the index, to obtain the total amount of pressure. Some portion of the diminution of bulk will probably be occasioned by variation of temperature causing a greater variation in bulk at high temperature:—As 4,000 parts of sea-water at the temperature of 86° Fahrenheit, contracted to 3,986 parts at the temperature of 65°, being $\frac{14}{4000}$ parts for 21 degrees, while the temperature of 65° to 35°, the diminution to 3,977 parts was only at the rate of $\frac{9}{4000}$ parts for 30 degrees. The expansion and contraction of the cylinder by variation of temperature counteract the variation of water to a very small extent, being about $\frac{2}{4000}$ parts for 40° Fahrenheit. The diminution in bulk of sea-water under pressure at the temperature of 56° Fahrenheit appears to be about one part in 19,600 parts per pressure of 15lbs., the assumed weight of the atmosphere.

128. Model of An Anemometer; W. D. Taunton, Oxford-terrace, Cliftonville, Brighton.

129. Patent Maximum and Minimum Hygrometer; William Symons.

This instrument is a modification of the combined maximum and minimum thermometer The upper thermometer turns on a pivot in the centre, and to adjust the indices it must be reversed. The indices of both thermometers may then be adjusted by inclining the instrument sufficiently, the bulbs being downwards.

130. Patent Combined Maximum and Minimum Thermometer; William Symons, 8, Hatton-garden, E.C.



This instrument consists of a glass tube bent as in the figure from A to B; the position and shape of the bulb may be varied. From B to D the tube is filled with mercury; at D the maximum index is placed. From D to N, spirit is introduced, in which at N floats the minimum index; from N to A the tube is filled with air. The indices are adjusted by holding the thermometer vertically a short time with the bulb downwards.

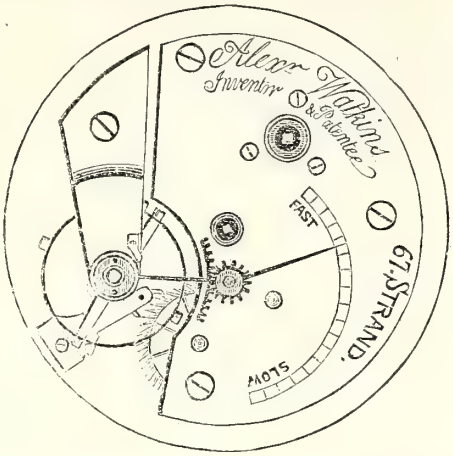
131. Watch, with Improved Patent Regulator; John Mallett, 4, High-street, Barnstaple.

In this regulator, the curb, acting on the balance spring, is moved by a screw, which being turned with the winding-key, either to the right or left, moves the curb either backward or forward on the spring with the greatest precision, and enables the wearer to regulate his watch with certainty, and with the greatest accuracy, and, at the same time it avoids the liability of derangement, common in ordinary regulators.

132. Polarizing Apparatus; W. Bestall, 1, Victoria Cottage, Royal-road, Kennington, S.E.

This apparatus, for showing the phenomena of polarized light in glass, acids, salts, crystals, &c., is adapted for night or day; it consists of a polarizing mirror, a glass stand for the proper angle, and an analyzing tube, all of the most simple and cheap form, but possessing the properties of an expensive apparatus.

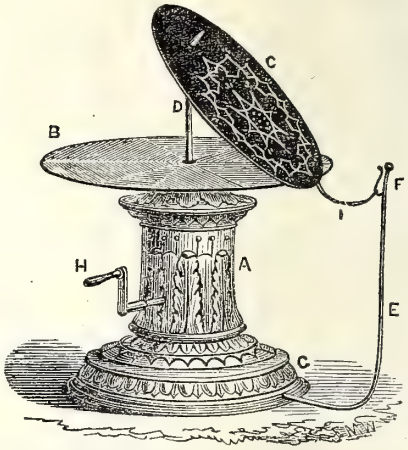
133. The Triangle Patent Timekeeper; Alexander Watkins, 67, Strand, W.C.



In this chronometer the plates are solid and simplified so as to reduce the number of pieces and the necessity for so much fitting. It is so arranged as to give direct power to the centre wheel upon a new principle. There is a means of preventing overwinding, and the fusee and chains, as well as some other parts, are dispensed with, including the stop-work, which is said to be the principal cause of the ordinary chronometers getting out of repair. The click head is sunk in the pillar plate and prevents the chronometer from being wound the wrong way. The running trains are high numbered. The escape wheel teeth are of 15 to 30 for dead seconds or fractions of seconds. The pallets and lifter are one solid triangle. On the balance cock is fixed, in connexion with the upper plate, a compound regulator for the greater facility of timeing. Watches on this principle can be made flatter than ordinary ones, and are stated to be sounder, cheaper, and less likely to get out of order.

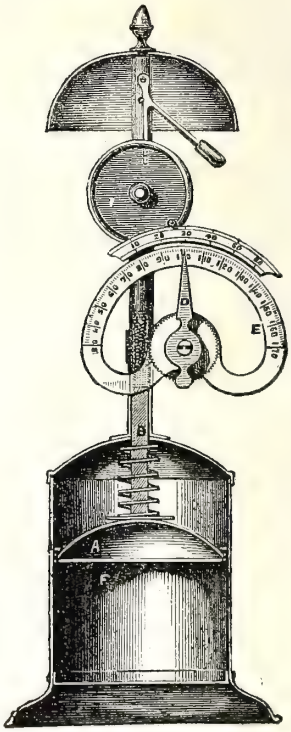
134. Trocheidoscope; Thos. Goodchild, Guildford.—Exhibited by Messrs. Horne and Thornthwaite, Newgate-street, E.C.

This instrument is a train of wheel-work so arranged, that by gently turning a handle, a horizontal disc table is made to revolve at varying speeds at the will of the operator, from fifty to two thousand revolutions per minute. In the centre of the disc table is a carefully fitted spindle, with a screw and flange at the lower end, and a shoulder at the upper end, just under which is a universal joint for adjusting the position of the topmost portion upon which the patterns or devices are to be hung when exhibited. Proceeding from the side of the instrument is an arm of brass, with a small appendage at the top for receiving the strings of the patterns, and a spring to act as a check upon the discs. The spindle is jointed near the top, to give a peculiar vibratory motion to the pattern when fitted. As the spindle revolves, it strikes the sides of the circular hole by which the pattern is suspended, and so imparts to it a shaking motion just sufficient to fill up the pattern with all the colours on the disc below, but then lost to the eye by its rapid revolution. If the pattern were perfectly still the colours would not appear, but if allowed slight motion as above described, the colours are reproduced upon the principle that images are retained upon the retina for a short period, which is thus elucidated in a very beautiful manner.



A, Chamber containing the motion work.
B, Disc table for coloured patterns.
C, Pattern to be exhibited and coloured.
D, Spindle with joint, and upon which the pattern is hung.
E, Is the check spring, and
F, Hook for holding the pattern strings.
G, Is the stand and drawer for patterns.
H, Is the handle by which motion is imparted to the machine.

135. Patent Fire Alarm, Ventilator Governor, Fire Detector, &c.; W. Taylor, Nursling, near Southampton.



This invention consists of a cylinder of metal, having in the inside a diaphragm of india rubber, and made air-tight, so as to enclose a given quantity of common air. When this is placed in a room, the air contained in the cylinder becomes the same temperature as that of the room. The instrument is then set to act at any given increase of temperature. As the external air becomes warmer so does the internal. This causes it to expand and give motion, so as to ring a bell or discharge a powder cell, and give an alarm at the approach of fire. It will open a ventilator at any required temperature, and again close it when the heat recedes to the former point, or it will indicate on a dial the temperature, showing the increase or decrease of heat at all times at any inaccessible place, such as a ship's hold. It is particularly applicable to hot-houses.

136. Microscopical Specimens of Fibres, to illustrate an Improved Method of Mounting; Wentworth L. Scott, Oakley-crescent North, Chelsea, S.W.

The preparations here exhibited are mounted dry, and not, as usual, in Canada balsam (which, it is stated, is liable to modify the natural structure of fibres, starches, &c.), the interposition of an "opal glass" slide between the object and the source of light removing all inconveniences arising from internal refraction. The "cell" is formed of very thin and pure gutta-percha, punched out to the size required.

137. Cotton, arranged in Fasciculæ; Wentworth L. Scott.

The fasciculæ are attached by fine wires to a plate of dark glass, which latter is graduated to tenths of an inch, so that the length of staple of each specimen can be seen at once. This arrangement is intended for museums and other Institutions, and for educational purposes.

138. Patent Tent and Tent Camera; Walter Jeffery, Eastgate-street, Gloucester.

139. Photographic Baths, Dippers, and Dishes of Sheet Glass; Philip Palmer, 118, St. Martin's-lane, W.C.

140. Photogenic Composition; J. Moule, 15, Sebright-place, Hackney-road, N.E.

This is intended for producing an artificial light for taking photographs at night.

141. Patent Pocket Stereoscopic Panorama; E. E. Allen, 1, Parkside, Knightsbridge, W.

In this apparatus a series of stereoscopic views, mounted on silk bands, are brought in succession under the glasses of the stereoscope by the action of finger knobs. The cases are made to contain several dozen views, and are fitted with a collapsible stereoscope.

142. Photographic Etchings; William Strudwick, 21, Bolton-terrace, Newington, S.

A drawing is made with an etching needle on a prepared surface of glass, and then copied by photographic printing. This is an application of photography which may be employed with advantage where a limited number of copies only are required and the cost of engraving would be too great.

143. Patent Photographs Printed in Enamel Colours on vitreous and ceramic bodies; F. Joubert, 36, Porchester-terrace, Bayswater, W.

144. Photographs Produced on Glass and Porcelain, and burnt in, in ceramic colours; John Wyard, Chatham-cottage, Montpelier, Bristol.

The inventor effects his object by covering the glass plate, first slightly warmed, with a solution of gelatine, gum arabic, and bichromate of potash, to which are added a few drops of honey syrup. The film is dried by the fire, and exposed to the light under a positive photograph for a few minutes in good sunshine. The ceramic colour, finely ground, is then applied to the surface of the film by means of a cotton pad, when it will be found that colour will adhere only to the unsunned parts of the film, forming on it a positive representation of the photograph to be copied. The film is then washed with alcohol, to which a small quantity of dilute nitric acid has been added, and when the brown colour of the changed or sunned portion of the bichromate film disappears the plate is washed with pure alcohol and dried rapidly. A flux is then applied as follows:—A solution of Canada balsam in spirits of turpentine is poured over the plate, which is then dried by heat, and the flux, consisting of borax and glass, or borax, glass and lead ground fine with water on a slab and dried, is applied evenly by means of a cotton pad tied up in very soft and flexibleleather. The plate should be glazed prior to the application of the film.

145. Collins's Patent Electro-Block Printing; Exhibited by The Electro-Printing Block Company (Limited), 27, New Bridge-street, Blackfriars, E.C.

Fi . .

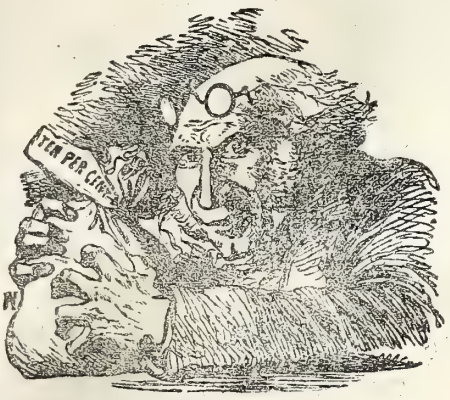
This process is a rapid and inexpensive means of producing an enlarged or reduced copy of any engraved plate, wood block, lithographic drawing, plan, map, or design, on zinc or stone, so that any number of copies may be worked off. This is done by a transfer impression on a sheet of Indian rubber, which is prepared with a composition possessing all the necessary qualities of transfer paper, and having an equally elastic surface with the rubber itself. This is then put into a frame mathematically divided into tenths of inches, and attached by means of hooks equally all round, sliding on bars which are acted upon by means of a handle connected with a right and left handed screw working through a

Fig. 3.

Fig. 4.

connecting collar, which can be turned with the greatest mathematical precision. When the necessary proportions have been obtained, the bars are then clamped at the corners, taken out of

Fig. 1.



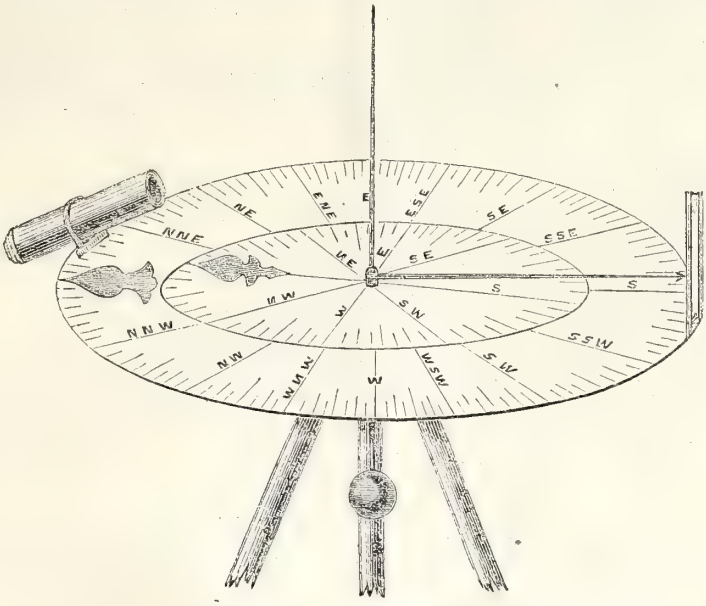
the frame, and laid down upon stone in the usual way. This is then charged with ink and printed off. For reduced sizes, the Indian rubber is extended before being printed, and afterwards relaxed by reversing the operations of the screw. The annexed sketches illustrate the process. Fig. 1 is the original; Fig. 2, the enlargement; and Fig. 3 the reduction. There is another process for making from these impressions on stone or zinc, when required, surface blocks for printing by hand or steam press. This is done by rolling up the picture, or whatever the subject may be, in a hard drying and equally distributing composition, in the same manner as rolling in with ink in printing. When dry, it is covered with another coat, and this operation being repeated until the necessary depth is obtained, a matrix is then formed in wax and electrotyped, which, when backed and mounted, is ready for press. This is illustrated by Fig. 4, the surface block for which has been produced from the lithographic stone exhibited. By these processes the artist's drawings are faithfully copied on surface blocks.

146. New Application of Electrotype; Paul Pretsch, 162, Great Portland-street, W.

These designs are electrotype deposits in silver, to be fixed on the wire-work used for making paper, for producing the water-marks.

147. Corners and Zinc Plates for the protection of Engravings on Copper or Steel; Thomas Dixon, 7, St. James's-place, Hampstead-road, N.W.

148. Azimuth Dial; Captain Toovey, Amersham-road, New-cross, S.E.



This instrument consists of a double disc of metal (sometimes silvered), swinging freely on a tripod, and is of sufficient weight to be always horizontal, whatever may be the list of the ship. The outer rim of the disc is graduated to the points (or degrees) of the compass, and turning on the same centre is a second disc similarly graduated. There is a small pointer for indicating the direction of the ship's head: and it is also fitted with a style for obtaining the sun's shadow, but this can be removed, and the ordinary telescope and sight-vane applied in the usual mode of taking an azimuth of an object. The instrument is used thus:—By the use of Godfray's time azimuth chart, the true bearing of a celestial object can be determined at any moment, when its meridian distance is more than two hours and less than six hours. Thus, within those intervals, the points of the true horizon are known for any given instant. Having placed the azimuth dial in a convenient part of the ship for making an observation, fix the in-

strument so that the pointer may be on the line of the keel and towards the ship's head; set the inner and outer graduated disc so that their difference may show the amount of variation as known at the place, such that the inner disc may indicate the true and the outer disc the magnetic horizon, then turn the dial on its axis until the shadow from the style on the inner disc coincides with the sun's true bearing at the time as given by Godfray's chart; the pointer will then also show the magnetic position of the ship's head on the outer graduated disc and the true position on the inner disc. If the compass in the binnacle differs from the reading on the outer disc, the difference is the deviation of the compass on that point. In the same manner the error of the compass may be determined for any number of points. It can also be used to determine the error of the compass from the bearing of any distant object, the correct position of which is known.

149. Patent Theodolite Level; P. Adie, 395, Strand, W. C.

This instrument is a combination of the dumpy and Y levels. The Telescope has the reversible and adjustable power of the Y level, with the permanence of the dumpy, there being collars on the telescope for reversing, and the level and hairs being adjustable to these collars, thus rendering it adjustable, as the Y level is, without a level datum line. The supports, or Y's, and stage, are, in this level, screwed tight together —the stage being very rigid and strong, and of bell metal, with the main centre cast in one piece with it. The Y's, instead of presenting a straight surface to the telescope collar, are curved so as to present more than a simple tangential point of support, for permanence—the telescope being held fast by strong clips. To make the instrument available as a theodolite—a transit axis has been added to the telescope; also, piers, which are either made to take off and pack up in the case, when used as a level, or fixed permanently to the stage. A very light horizontal limb, well guarded by the vernier plate overlapping it, is fixed under the stage, with these additions, and by lifting the telescope out of its place in the level collars, and placing the cross axis in its Y's on the piers, horizontal angles are accurately read. A vertical limb is added when required, this being separable from the telescope, and having a place in the case where it shall be packed away. A long needle is also added to each instrument, to take bearings with precision.

150. Patent Surveying Compass; P. Adie.

This instrument consists of a needle, delicately suspended and centred in the same manner as the finer magnetic instruments, instead of on the usual point which blunts so easily, at the same time care being had to give durability. So great precision is obtained, that verniers are added to the needle, by which means angles can be read to almost any degree of precision, the small 3in. circle giving much more accuracy than the usual large 6 in. circumferenter. A short, powerful telescope is also added to this, as the capabilities of the instrument require telescopic reading.

151. Station or Levelling Staves; Elliott, Brothers, 30, Strand, W.C.

These staves are semi-circular, and are kept together by two rings, making them more portable than the usual form; they are more readily held perpendicular in the wind, and are stronger, each portion of the curved part being composed of three layers of wood, the centre one having its grain in the reverse direction of the other two.

152. Patent Drawing Boards; Elliott, Brothers.

These boards are strengthed and prevented from warping by having a strip of iron inserted at each end the crossway of the grain of the wood. This invention is equally applicable to tables or any other wood surface.

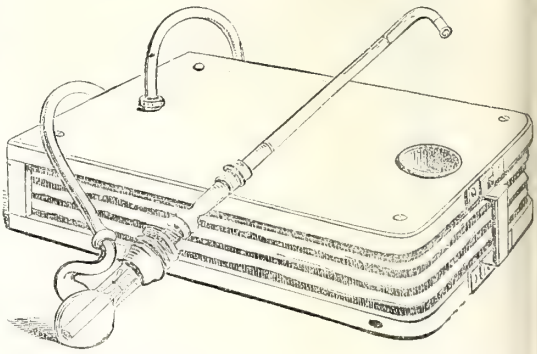
153. Improved Drawing Board; H. Hutton, 29, Palace-road, Lambeth, S.

This drawing board has a scale on two of its edges, so that measurements may be read off with a T-square.

154. Black Lead Pencils; B. S. Cohen, 9, Magdalen-row, Great Prescott-street, E.C.

These pencils are made of one unbroken length of lead, pressed into the required form by machinery, instead of being cut from blocks in short lengths as usual.

155. Patent Hydro-Pneumatic Inhaler; W. A. Tompson, 18, Cecil-street, Strand, W.C.



This instrument, which is easy of self-application, consists of four parts, viz., 1st. Self-inflating bellows worked with the foot. 2nd. A flask (for receiving the medicated fluid) which has a glass cylinder, traversed by about 16 capillary tubes, ascending from the bottom to the upper part of its perpendicular neck, where it is retained in position by a silver spring. 3rd. An adjusting apparatus which has a tube with a thread turned upon its outer surface to admit of its being more or less approximated to the top of the cylinder. 4th. A nozzle which has its remote extremity curved at a right angle with its shaft, and is furnished with a screw cup containing a disc of fine silver wire gauze. The nozzle being introduced to the back of the mouth, the opening of the bel-

lows is to be covered by the foot of the operator, and the air, impelled by his weight, will rush through the elastic tube into the flask, but, being unable to escape with equal freedom, owing to the relatively smaller opening between the glass cylinder and adjusting tube, which is regulated by turning the screw of the latter, becomes condensed, so as to raise the caustic or otherwise medicated liquid to the summit of the capillary tubes, whilst, at the same time, the air, which will have passed the above obstruction, has acquired increased space for its expansion, and, exercising its property of elasticity, removed any impediment to the ascent of the fluid. It will thus be seen that the supply of liquid, which regulates the fineness or coarseness of its final dispersion, depends upon the difference between the ingress and egress openings of the flask. The liquid (carried by a strong atmospheric current) has now been traced to the nozzle, along which it passes to the gauze disc at its extremity, whence it is discharged upon the diseased surfaces in a minutely-divided and misty spray, and thus passes through the opening of the glottis during inspiration, without causing the slightest inconvenience to the patient.

156. Leaf Gold, manufactured for Dental Purposes; Robert Pratt, 13, Broad-street, Golden-square, W.

157. Patent Ozonised Cod-Liver Oil; E. C. Allen, 1, Parkside, Knightsbridge, W.

The medicinal administration of ozone in oils was suggested by Mr. Dugald Campell, the analytical chemist to the Brompton Hospital for Consumption, and experiments instituted in that establishment by Drs. Thomson and Alison are stated to have proved that oils so prepared have peculiar properties in rapidly and permanently lowering the pulse, while at the same time they improve the general health. In cases of consumption, and some other morbid conditions, the first of these effects is of the utmost importance.

158. Specimens illustrating two patented processes for Rendering Fabrics Non-inflammable; F. Versmann, F.C.S., and A. Oppenheim, Ph.D., 7, Bury-court, St. Mary-axe, E.C.

1. Sulphate of ammonia for rendering fabrics non-inflammable in the manufacturing process, where no ironing is required. This process consists in soaking the finished goods in a solution of the salt, and then drying them in a frame. 2. Tungstate of soda. 3. Wolfram, the mineral from which tungstate of soda is obtained by fusing it with soda. 4. A mixture of tungstate of soda with starch, ready for use. 5. A window-curtain starched, and afterwards rendered non-inflammable by soaking it in a solution of tungstate of soda. This salt can be applied to every woven fabric of an inflammable nature, and offers the advantage of not injuring them under the influence of the heat of the iron.

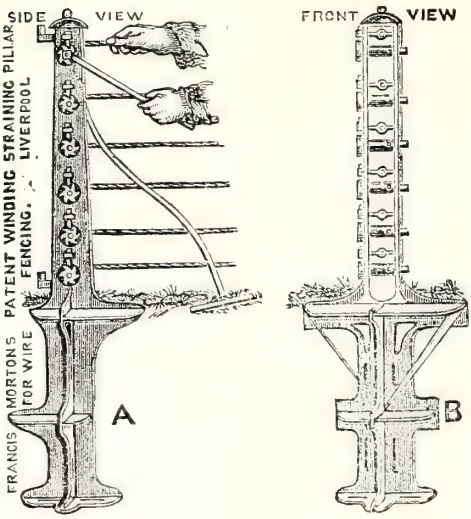
159. Patent Syphon; J. Musselwhite, Devizes.

This syphon has an elastic ball attached to it, by pressing which the air is expelled from the short arm, and when the ball expands by its own elasticity, the fluid from the reservoir in which such arm is placed replaces the air so expelled; and upon the arm to which the ball is attached being drawn forward, the fluid runs in a continuous stream.

AGRICULTURAL IMPLEMENTS, MACHINERY, &c.

(*For the remainder of the Articles in this Section, see Drawings.*)

170. Patent (Self-acting) Winding Straining Pillar, in cast or wrought Iron, for straining prepared Hoop Iron and Fencing Wire, and for hanging Railway Gates, &c.; Francis Morton and Co., James-street, Liverpool, and 19, Parliament-street, Westminster, S.W.



The object of this invention is to enable the railways of the country to be fenced with iron, at a small cost, in place of perishable wood railing; also to provide a fence economising weight and labour in erection to such an extent as to enable it to be exported to the colonies. Also to provide so cheap and permanent a fence that a large breadth of valuable land, at present occupied in the country by the old bank and hedge fences may be brought into beneficial cultivation, and the surface of the land better laid up. The patent winding straining pillar is complete in itself, will stretch lengths of fence from 300 yards to 500 yards, and will keep the wires perfectly rigid for any length of time without expense. It greatly reduces the cost of fixing, which it renders so simple that skilled labour is rendered unnecessary. The wire rope is tightened by passing it over an axle in the straining post, having a rack and pawl to keep it firmly in position. The winch is acted upon by means of levers, so as to give the desired amount of tension.

171. Travelling Suspension Rail or Roadway for Facilitating Agricultural Operations; Daniel Lancaster Banks, 26, Wellington-road, Cold Harbour-lane, Camberwell, S.

This invention consists in the application and use of a suspension rail or roadway, capable of being moved over the land with facility, and of carrying or supporting any agricultural implements or machinery required in executing the base operations of agriculture; such, as for example, the reclaiming of land, the drainage, clearing, and irrigation of land, &c., and also for performing the ordinary operations necessary in the cultivation of land. The piers or buttresses of the suspension rail or roadway are moved with facility in any required direction, so as to bring the rail or roadway over any desired portion of the ground by means of steam, or other power, the same power being used in the execution of any of the above-mentioned operations.

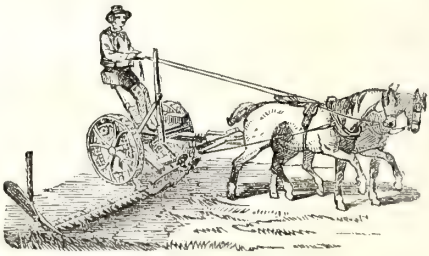
172. Winding Drum for Steam Ploughing; Collinson Hall, Princes Gate Farm, Havering, Romford.

This model shows a method of winding the wire-rope on and off a single drum when applied for purposes of traction.

173. Steam Plough; Chandler & Oliver, Bow, E.

174. Double Snatch Block; Chandler & Oliver.

175. Wood's Improved Grass-mowing Machine; W. M. Cranston, 58, King William-street, E.C.



This machine is constructed to run upon two wheels, both of which act as driving wheels, having gearing attached to their spokes or arms,

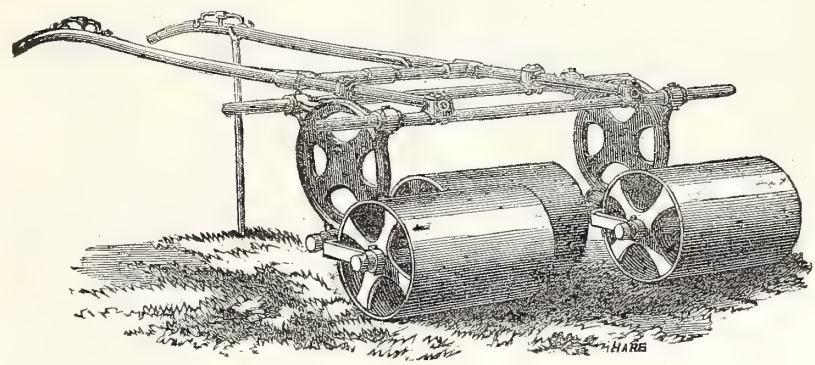
which work into pinions, both of which are upon the same shaft, and are constructed with ratchets and pawls, so that when the wheels, either or both, advance, they communicate motion to the pinion shaft, which in turn communicates motion to the crank shaft and cutters by means of bevel gear, but when the driving wheels are backed, the ratchets and pawls in the pinions relieve their shaft and the cutters from motion. By this arrangement each driving wheel has an independent action upon the cutters, so that one may remain stationary, and the other advance and move the cutters, but when advancing on a straight line they act in unison. The cutters are attached to the frame that carries the gearing, and it rests and balances upon the axle of the wheels in such a manner that, riding upon the ground, they have perfect freedom to rise and fall with its uneven surface. The lever is so arranged, with a chain attached to the front point of the shoe on the cutter bar, as not to interfere with the rise and fall (below a certain depth) of the cutters while at work, and by it the driver can raise them to a sufficient height to pass over cut grass or other obstacles in moving the machine. The seat and draft pole are attached to the axle of the driving wheels by a socket iron, so arranged that the weight of the driver in his seat balances and removes the weight of the pole from the horses' necks to the machine. By thus bringing all the weight of the machine and driver upon the driving wheels, and by the use of steel for those parts of the machine having the highest speed and most liable to wear, the object of the inventor is accomplished, viz., that of constructing a grass cutting machine requiring the least possible expenditure of power to work it, and of sufficient weight and strength to be durable.

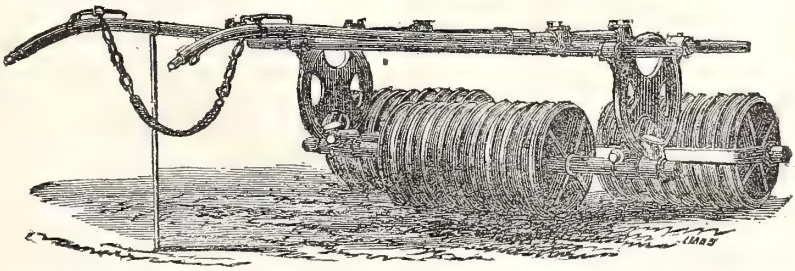
176. Patent Victoria Side Delivery Reaping and Mowing Machine; Robert Hellard, North-street, Taunton, Somerset.

In this machine two knives are used, one playing over the other, and they can be raised or lowered at pleasure. Its entire width is 8 feet 9 inches, and its cutting width 5 feet. The corn is bound on the machine with its own material, and is divided into sheaves by the use of a lever rake, the canvass or travelling band that brings the corn to the side of the machine being kept in its proper travelling position by the side chains and cross bars. The reel vanes that revolve over the corn as the machine is working are made of steel or metallic rods, for causing the corn to lean towards the knives and back part of the machine. Fig. 1, in the drawing (See No. 332) is a perspective view of a reaping machine, with the lever dividing rake, A, winged roller, C, feathered fingered knife guard, D, metallic reel vanes, E, with the rods, F, chains, G, for working the travelling band, H. The whole of the machinery is worked by the driving wheel, I, which, when drawn forward rolls on the ground, similar to other reaping machines. Fig. 2 is the cradle platform, for binding the corn on the machine, which, when used, is fixed behind the rake, A, near to the roller, B, for receiving the corn in sheaves. Fig. 3 is one of the feathered knife-guards, of which any number might be used for getting up lodged or down-laid corn. Fig. 4 is a two winged roller, to be employed behind the knives, to prevent the short ears being cut off, the same as C, in Fig. 1.

177. Patent Noiseless Lawn Mower; James E. Boyd, Hither-green, Lewisham.

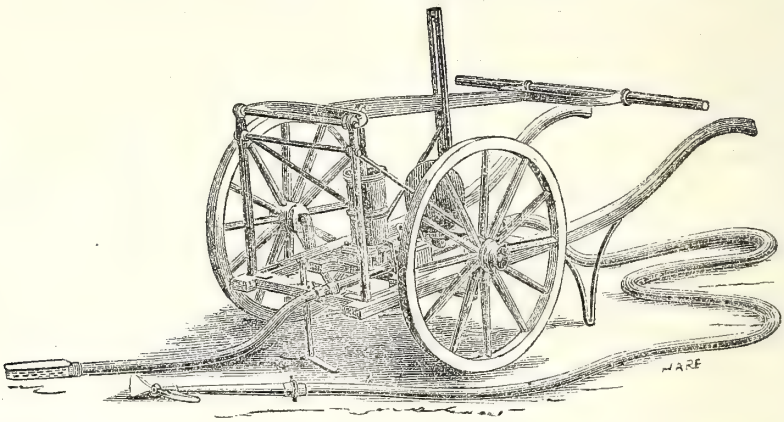
178. Patent Universal Jointed Land Rollers; W. N. Nicholson, Trent Iron Works, Newark.





Land or clod crushing rollers on this system will adapt themselves more perfectly to the irregular surface of the ground than the ordinary straight rollers. They are usually made in three parts, 2 feet 4 inches or 2 feet 6 inches wide, of diameters varying from 14 to 30 inches, though sometimes in five parts, and by the arrangement of universal joints, each part will move up or down, or at any angle vertically independently of the others. With ordinary rollers, land that is in ridge and furrow, must be rolled crosswise, and this cannot often be done when necessary, the dampness of the furrow causing the soil to adhere to and clog the roller. The present arrangement allows the land to be rolled lengthways with equal, if not better effect, and the high part can be rolled whilst the furrows are drying. Two models are shown, one (No. 1) of an ordinary plain hand-roller, and (No. 2) another of what is called the Cambridge clod roller. The principle can be adapted to serrated, spiked, or any other description of rollers or clod crushers.

179. The Farmer's Fire-Engine; M. Merryweather, 63, Long-acre, W.C.



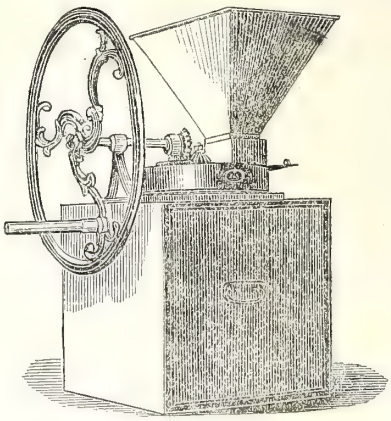
The object of this fire-engine is to combine, in the smallest compass, at the lowest cost, the several capabilities of a larger and more expensive engine. It is very portable, and simple in its construction. All the parts are so constructed and arranged as to be fitted for the roughest work of a farm without fear of injury. The valves are of metal, and not liable to derangement; but should any derangement occur, it can be removed instantly, without disturbing any of the working parts of the engine. The branch-pipe is furnished with a spreader, by means of which the water can be spread over a large surface, a valuable appendage in the event of fire in corn or hay-stacks, weather-boarded buildings, and such like. The suction and delivery hose are kept constantly affixed to the engine, so that the unbuckling of a single strap is all that is necessary for putting it into operation. Worked by three men, this engine will throw a jet of water from fifty to sixty feet high. As an agricultural force-pump this machine is convenient, and adapted to all the ordinary operations of a farm, such as emptying ponds, clearing ditches, irrigating land, pumping liquid manure, &c.

180. Method of applying Chemical Manure; John Roberts, Upnor-lodge, near Rochester.

This manure is mixed with seed, and made into small cubes, by which means the seed is to be protected from birds, mice, and insects.

181. Improved Apparatus applicable to the treatment of Seeds, Tea, &c.; Edward Francis, Wrexham, Denbigh.

This apparatus mainly consists of a flat horizontal riddle or sieve (with a vertical circular side), and is provided with any required number of horizontal radial arms, mounted on a vertical revolving shaft. The radial revolving arms are so fitted to the revolving shaft that their distance from the bottom of the riddle or sieve may be



regulated at pleasure, and they will yield, when subjected to an undue amount of pressure. This apparatus is specially adapted to breaking and sifting tea, dressing seeds, disintegrating chicory, raw sugar, and a variety of other articles, the speed of the machine being regulated according to the nature of the article to be acted upon.

182. Unicomb Case for Bees; Robert Downie, Barnet, N.

This invention consists of a square case, made of

any kind of wood. On each side of it is fixed a square of glass for the purpose of seeing the bees at work, which answers as a substitute for an observatory hive. The bar which forms the top of the case is moveable with the comb attached to it. One side of the case is moveable also for the purpose of taking out the comb without injuring it. On each side of the bar, at the top of the case, is a strip of wood to keep the bar in its place, and a strip of perforated zinc is fixed in the wood for ventilation. The bees ascend from the hive into the case. By using these cases, pure honey can be obtained without the bees filling the cells of the comb with pollen.

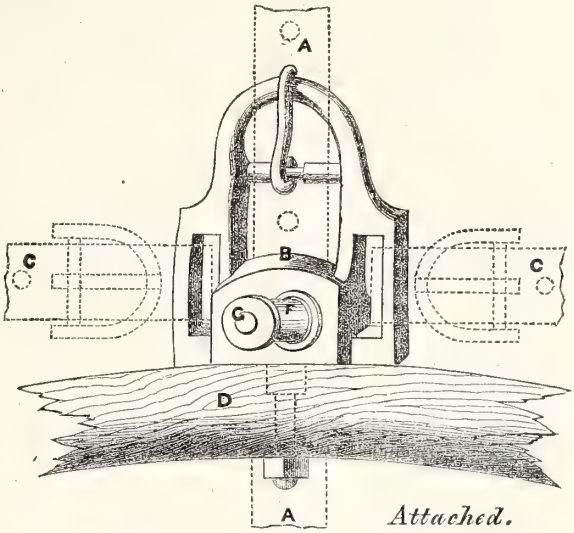
183. Flower Stands and Vases; Edward Wilkins, 8, Bath-terrace, Camberwell New-road, S.

The vases are of Staffordshire ware, so constructed as to convey air and liquid to the roots of the plants. Some of them are intended for the drawing-room, or dinner table, and others for sick rooms.

184. Patent Stable Fittings; William Hood, 68, Upper Thames-street, E.C.

This invention prevents waste of hay from the rack, by means of a spring-hinged grating, so pressing upon it as to allow of only a small portion being withdrawn at a time; and waste of corn by the curved flange of the top plate projecting over the manger. The water-cistern is provided with a cover, which cannot be opened by the horse, and there are tubes to receive a noiseless tying apparatus, which serve to keep the halter-balls out of the way of the horse—also acting as brackets for supporting the stable fittings.

185. Patent Harness Regulator; Earl and Sons, Melbourne, near Derby.



Attached.

This invention is intended to supersede the use of traces, backband tugs, and shaft breechings, and consists of a fastening bolted on to the shaft near to its end. The regulator is buckled on the backband in the place of the present backband tug, that portion of the backband on each side which constitutes the bellyband, passing again through the regulator inside the shafts, and buckling under the horse as usual. A strap is passed from the harness tug to the front loop of the regulator, and the breeching is continued up the side of the horse, to the back loop in the regulator. By this arrangement the backband, bellyband, trace, and breeching, are attached to the regulator, and the horse can be attached and detached by the instantaneous action of a spring bolt.

BUILDING AND DOMESTIC APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

190. Specimens of Patented Process for Preserving Stone; Frederick Ransome, Ipswich, and Cannon-row, Westminster, S.W.

By this process the material operated upon is impregnated with a solution of silica to such depth as its absorbent character may determine. This solution of silica, *i.e.* silicate of soda, would remain in a soluble form and liable to absorption by the humidity of the atmosphere or rain but for the secondary application, consisting of a solution of chloride of calcium, which decomposes the soda, turning it into common salt. The calcium with the oxygen of the soda, forms lime, which, combining with the silica, constitutes silicate of lime, and forms a solid and indestructible mineral in the texture of the stone.

191. Green Marble from Greece; E. Ionides, 28, Threadneedle-street, E.C.

This marble was excavated from the quarries of Mr. Stamatis Kleanthes, architect, of Athens, and is very similar to, if not exactly the same as, that known as "Vert antique." It can be produced and delivered in England in blocks of almost any size.

192. Mosaic Parquet Floor; The London Parquetry Works, Victory-place, New Church-road, Camberwell, S.

This floor is composed of wainscot, birch, satin, rosewood, purple wood, and barwood, showing the richness of design obtainable by the system of plating (veneering with $\frac{1}{4}$ to $\frac{3}{8}$ in. hardwoods upon solid framed groundwork). These floors are made chiefly $1\frac{1}{8}$ in. thick, and require no other flooring underneath.

193. Parquet Border in Wainscot, Walnut, Satin, and Rosewood; London Parquetry Works.

The woods employed in this pattern, although far too expensive to be used in "solid" parquet floors, are economically introduced as veneers.

194. Veneered Wall Panelling; London Parquetry Works.

One side of this specimen is a plain walnut surface, and the other is "fluted," having all the appearance of a carved panel, while the weight and expense are much less, and the woods used of a much richer description than those employed in carving.

195. Wall Panelling; London Parquetry Works.

This panelling is composed of an inlaid border (suitable also as a parquet border), and containing in the centre specimens of the Hungarian ash.

196. Small Parquetry Table; London Parquetry Works.

The design for this table is taken from a ceiling in the convent on the Lago Maggiore.

197. Builder's Hoist; Geo. Johnson, East-hill, Wandsworth, S.W.

This machine is intended to receive and lift the labourer's hods, baskets, stone, &c. The required motion, quick or slow, is imparted by means of two sheaves keyed on to the propelling shaft below. One machine is stated to supply 20 men. The time occupied in raising a hod of bricks a height of 60 feet, is 15 seconds. (See drawing, No. 336.)

198. Patent Ladders; J. Maryon, 9, Stanhope-street, Hampstead-road, N.W.

In these ladders the rounds are made with a shoulder, which is let into the inward side of the ladder about a quarter of an inch, and a smaller hole for the pin of the round is bored through to the outside. The hole is then made to taper inwardly, to allow for the expansion caused by a wedge driven into it from the outside. The shoulders and pins of the rounds are made by a machine, and are put into the sides with white-lead, and the outside wedges glued.

199. Hydraulic Fire Escape Ladder; Thomas Greenacre, Engineer, Millwall, E.

The sides of this escape are composed of three or more pairs of tubes fitted telescopically, so that when closed up it only occupies the space of an ordinary short ladder. The bottoms of each pair of tubes are fitted with cup leathers, similar to those used in hydraulic presses. On the top ends of the smallest pair of tubes (forming the top of the ladder) are fitted a pair of rollers to run against the wall, and between the rollers a block or pulley can be placed to lower either persons or goods by. On the outside are two eyes to receive the upper ends of the ladder (the ladder is made of chain with cross pieces, technically called a Jacob's ladder), and the other end is made fast to a barrel or winch, secured near the lower end of the lower pair of tubes. Upon this barrel the chain ladder is wound when closed up. At the bottom of these tubes, forming the frame, is a pipe fitted with a stop-cock and union to receive the hose from a small hand-pump. By means of this hand-pump, and a few buckets of water, the ladder may be quickly raised to any height between its limits, when by turning the stop-cock the pump can be taken away, and used as a portable fire engine. To lower the ladder it is only necessary to open the stop-cock and let the water escape.

200. The Ottoman Fire-Escape; Dr. Robert Gardiner Hill, F.S.A., Inverness-lodge, Brentford, S.W., and 8, Hinde-street, Manchester-square, W.

The fire-escape can be used both as an ottoman and fire-escape. It consists of a cradle, made of wood, tied together by iron rods and covered with canvass (non-inflammable), of pulleys, ropes, rings, hooks, chains and rollers, the whole being enclosed in a covering. A ring is securely fixed in the floor of the room in a house, near the window. In the event of fire the covering is removed, the chain attached to the block-pully is fastened to the ring and the cradle suspended from the window on the outside. The inmates of the house are then enabled to place themselves and their property in the cradle, and by means of the ropes and pulleys to descend, (see drawing No. 338.)

201. Patent Ribbed Sash Iron; William Bruce Gingell, 37, Corn-street, Bristol.

This invention consists of improvements in the form of metal bars, used for sashes, casements, &c. Longitudinal ribs or projections are made upon the back surface of the bar, which in the old form, known as "half" or "single rebate," was always flat. These ribs may be of any projection, and either rectangular, curved, or beveled. The ribbed bar is stated to be stronger and more rigid than the old form. Sashes, casements, &c., of every description, usually constructed of wood, can be made of metal, and in a very economical manner. Neither vertical nor horizontal divisions are necessary for sashes of ordinary size, so that they may be glazed with large squares of glass. In the model, the upper sash shows how the present form of "double rebate" bar may be used with the "patent ribbed bar" where required.

202. Self-Coiling Revolving Shutters, in Wood and Steel; Clark and Co., Gate-street, Lincoln's-inn-fields, W.C.

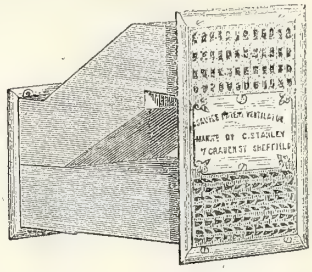
203. Patent Silent Spring-regulating Blind Roller; C. Vinall, 25, Walton-street, Ovington-square, Brompton, S.W.

204. Lever Bracket for a Bent Curtain Rod; W. Milton, 16, Blundell-street, Caledonian-road, N.

This arrangement consists of two rods, with pullies at each end for the cords, by which the curtains are drawn together and back by means of a rack pulley on one side only. The rods are fastened at the ends in a bracket and thumb-screw, and can be taken down with great ease.

205. Davies's Patent Self-Adjusting Ventilator; Charles Stanley, 7, Carver-street, Sheffield; agent, John Hale, 27, Queen Anne-street, Cavendish-square, W.

This ventilator is made of cast iron, and consists of two tubes placed one above the other, the upper or longer one adapted for the egress of vitiated air, and the lower one for the ingress of fresh air. Each tube is fitted with self-regulating valves, those of the upper one opening outwards, and the lower inwards. This ventilator is fitted in an aperture, cut through the wall, close under the cornice or ceiling, as far from the fire-place



as possible, and the body of the ventilator is inserted from the outside, the outer and inner ornamental plates being made moveable, and fixed by screws.

206. Noiseless Arnott's Ventilator, with Vulcanized India-Rubber Flap; Hart and Son, 53 to 58, Wych-street, W.C., and 20, Cockspur-street, S.W.

207. Wright's Patent Gill Calorifer; Crichley, Wright, and Co., Burton Weir, Sheffield.

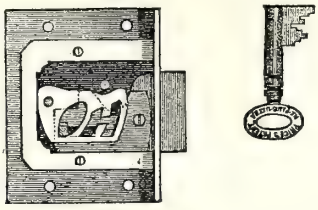
This stove is intended for warming churches, public buildings, mansions, &c. It consists of a number of metal plates, constructed in such a manner as to form, when bolted together, a cockle of great heating power. The inside of the stove being corrugated, acquires heat from the fire with great rapidity, while the very large extent of surface presented by the projecting wings or gills, communicates the heat to a considerable volume of air at a low temperature. It is provided with receptacles for water, the evaporation from which, being in a direct ratio to the amount of heat generated by the stove, will be found to correct any tendency to dry the air. The feed and ash pit doors or valves are so constructed as to give a perfect control over the admission of air to support combustion. The specimen exhibited is one of the smaller sizes. It has upwards of 150 feet of heating surface, and is calculated to warm a building containing 50,000 cubic feet, at a cost, varying with the price of fuel, of from three to six pence per twenty-four hours. (See drawing No. 337.)

208. Patent Heat Indicator for Kitchen Ranges; Brown and May, North Wilts Foundry, Devizes.

The object of this invention is to assist in culinary operations, giving at a glance the amount of heat in the oven, also showing the highest variation in it. The operation of baking, which has hitherto been performed by guess, is by this means rendered a matter of comparative certainty. This indicator is formed of a compound metallic bar, of a semicircular form, which, when exposed to a variation in temperature, expands or contracts, acting on a lever or fork, prolonged at its extremity and fitted with teeth, which teeth act on a pinion, upon the spindle of which

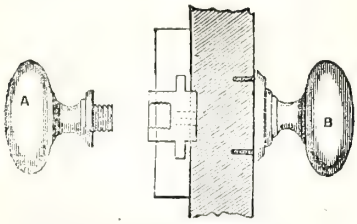
the pointer or hand is fixed. This pointer travels round a dial marked with figures or degrees of heat. The apparatus is fixed by cutting a hole through the oven door, as near the centre as possible, rather below than above, sufficiently large to admit the indicator; and then fixing it against the door by means of two screws through its rim.

209. Patent "Ne-plus-ultra" Lock; George Price, Cleveland Safe and Lock Works, Wolverhampton.



This lock has the case, bolt, levers, and springs of an ordinary lever lock, and the security against picking is obtained by the peculiar and novel arrangement and position of its parts, and by the addition of one limb, called the safety-plate, to the bolt. The peculiarity of its action may be explained thus:—The stump, the lever-pin, and the guide-stud of the bolt are so placed as to form the points of a triangle, and, on pressure being applied to the bolt in any other way than by the proper key, the notched part of the safety-plate is thrown upon the guide-stud (or runner-stump) when the triangle becomes distorted, or altered in shape, in such a manner as to lengthen the side or distance between the main stump and the lever-pin; the consequence of which is, that the faces of the racks of the levers recede from the stump, and are perfectly relieved from its pressure.

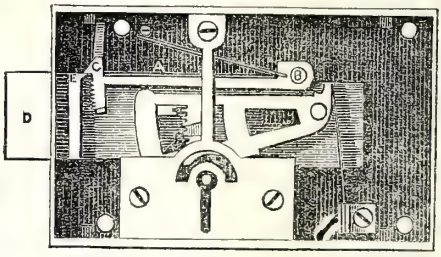
210. Patent Locks and Latches; Gibbons and White, 345, Oxford-street, W.



In this invention the usual tapped screw through the necks of lock-knobs is dispensed with. The followers are made with a square hole half-way through, and a tapped round hole through the other half. The knob, marked A, has a screwed shoulder, to suit the tapped follower, into which it is screwed; when the plain square spindle is passed through the follower, the knob cannot unturn; by this arrangement locks and latches will suit doors of varied thicknesses, and the followers will not wear out.

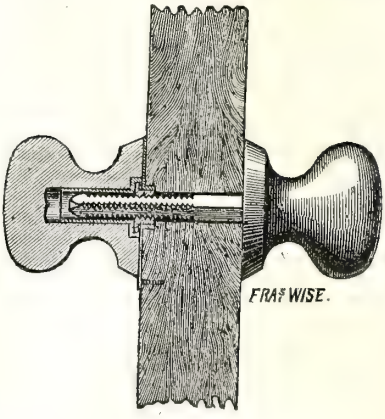
211. Patent Locks and Latches; Isaiah Ash, 17, Great Bridport-street, Blandford-square, N.W.

In this invention the improvement consists in the addition and arrangement of certain lever guards to be applied to locks. One or more levers or lever guards working on a pin, either in the centre or at one end thereof, are placed above the bolt. One end of each lever guard is formed with a notched or toothed piece or segment, such pieces or segments being of different radii, and each lever guard being of the thickness of two of the ordinary levers or tumblers. The bolt is provided with appropriating stop, adapted to take into the notches or teeth of the lever guards. Upon the key being applied to shoot the bolt, the levers or tumblers are elevated in the usual manner, raising with them the said lever guards, which being clear of the bolt stop, allow the bolt to be shot. If, however, an attempt be made to pick the lock by the ordinary method of raising the tumblers one by one with the pick, and forcing the bolt back to meet the gatings, the object is defeated by the bolt stops taking into the notches or teeth of the lever guards which have not been raised, the same result taking place upon any one of the tumblers or levers being moved with the pick. In order to allow of the bolt stop being forced into the notched or toothed segments of the lever guards, the foremost chamber of the levers or tumblers is enlarged to admit of the motion of the main bolt stump. In order that the bolt may be shot back, all the tumblers or levers must be lifted simultaneously, so that the bolt stump will pass through the several slots or gatings therein, the lever guards being at the same time lifted by the tumblers or levers, and allowing the bolt to return to its position within the lock. The invention, with some modifications, is also applied to latches.



212. Patent Door Handle; C. W. Ramié, 23, Parliament-street, S.W.

This mode of attaching knobs to spindles con-



sists in having a loose nut secured, but free to revolve in the round collar of the square mortice piece which is inserted in the knob for the purpose of turning the spindle. The washer-plate is used to travel the nut along the threaded spindle, and brings the knob close up to any gauge of door.

213. Improved Floor Centre, for Swing Doors; Hart and Son, 53 to 58, Wych-street, W.C., and 20, Cockspur-street, S.W.

214. 12 inch Turned and Polished Hemispherical Gong Bell, mounted on Ornamental Stand; J. Warner and Sons, 8, Crescent, Cripplegate, E.C.

215. Roller Measurement Table; B. Baillie, 7, Henry-street, Cumberland-market, N.W.

This table is mounted on a roller, having the superficial measurement in one direction printed on the back, so that when partially rolled up, it may always be brought into close proximity with the column on the front giving the measurement in the other direction.

216. Portable Gas-making Apparatus; D. Hulett and Co., 55 and 56, High Holborn, W.C.

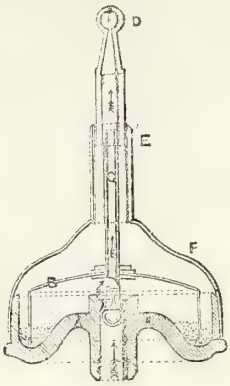
This apparatus has condensers, scrubbers, and purifier, and is constructed to occupy a very small space, not requiring any brickwork; the whole is so arranged as to be easily repaired or cleaned. The condensers are on each side; and on the top of each pipe is a screw-plug, for the convenience of clearing the pipes should they get foul. The bottom plinth on each side forms the hydraulic main and wash-vessel. The circular purifier, under which is the scrubber, is placed at the back of the apparatus. The apparatus exhibited is capable of making about 150 feet of gas from Newcastle coals in 12 hours.

217. Patent Gas Meter; D. Hulett and Co.

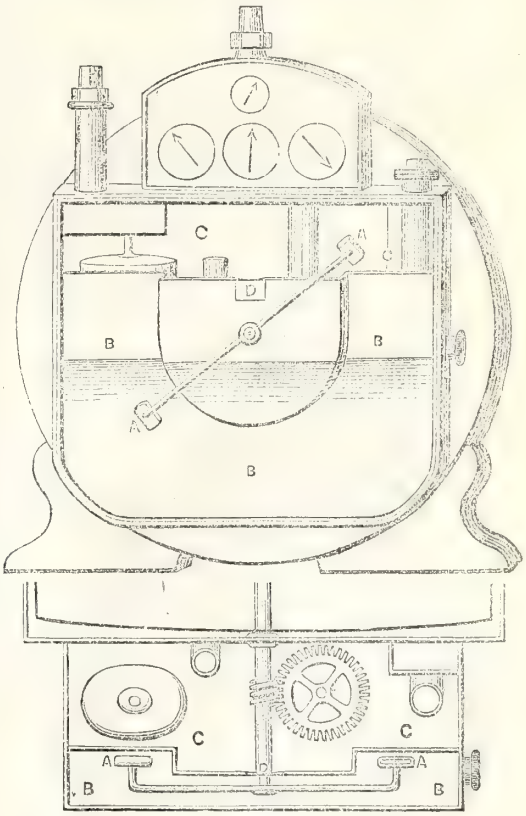
This meter is constructed on the compensating principle. To every revolution of the drum, or measuring chamber, a few drops of water are raised into the water-line reservoir, by which means the line is always kept at its proper level. The inlet and outlet are so placed that none of its parts can be tampered with or deranged. It cannot be worked without the proper quantity of water, and is arranged to meet all the requirements of the "Sale of Gas Act."

218. Patent Street Lamp Regulator; D. Hulett and Co.

The wood-cut shows the apparatus. A A, an iron cup containing mercury; B, the floating vessel to which the outlet, C, is attached; the lower end of the outlet also carries the valve; when the pressure exceeds that to which it is adjusted, the inverted vessel rises, carrying the valve with it, and partly closes the opening to the required size, maintaining an uniform flame under any pressure.



219. Patent Direct Action Compensating Gas Meter; Charles Botten and Son, 10, Crawford-passage, Ray-street, Clerkenwell, E. C.

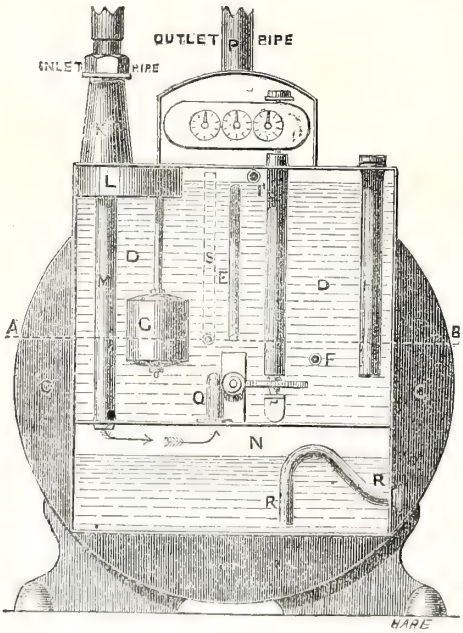


The Sale of Gas Act requires that no meter be stamped by the inspector, which allows the passage of gas, should the water be more than two per cent. above, or three per cent. below, the correct level or water line. It is easy to construct meters fulfilling these conditions, but as condensation, or evaporation, is constantly affecting the water in meters, they will require almost daily attention, unless provided with some self-acting

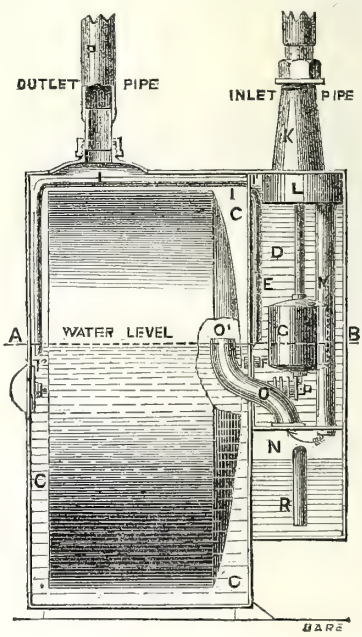
apparatus for adding to, or drawing off, the water as occasion may require. In the direct-action compensating meter this additional apparatus is so simple as in no way to complicate the meter or lessen its durability. B B B, termed the compensating chamber, is an addition to the ordinary measuring chamber which is shewn as C C. D the water level, a piece of white metal exactly adjusted before soldering on the front, and E the side plug; no plug is required to the syphon. On charging the meter the surplus water flows over at D into the box B, and as soon as it runs out at E no more water should be poured into the meter, and what is in it allowed to drain to the level as in an ordinary meter. A A are buckets or cups, attached directly to the shaft of the wheel, and revolving with it, these cups fill in passing through the compensating chamber B B, and discharge their contents into the measuring chamber C C, the surplus of such discharge, after keeping up the water level, returning over D into the chamber B. The bottom of the syphon is open to the chamber D, so that if water is introduced above the plug E, it will enter the syphon and stop the passage of gas, and the float is so constructed as to open unless the body of the meter is charged to the proper level with water. The addition above described can be applied to most meters.

220. Improved Compensating Wet Gas Meter; Alexander Allan, Bellevue House, Perth.

By this improved meter, water is held in suspension (under any pressure) as a reserve to compensate for waste, evaporation, or abstraction from the measuring case, and to maintain therein, under all circumstances, a true and uniform water level. The chief features of this meter are—1st. The application of the pneumatic dip-pipe principle for compensation. 2nd. Upon the slightest fall of the true water-level, the dip-pipe action commences, and restores it at once.



3rd. Arrangement of the front chamber so that all space above the water-line is converted into a reserve or supply fountain. 4th. By placing the float directly below the inlet valve, and within the supply fountain, it will fall and close the valve when the surplus or reserve water is exhausted, effectually preventing the passage of any gas which is not accurately measured. 5th. The supply fountain may be re-filled without allowing an escape of gas, or disturbing the conditions of the meter. 6th. There is no more moving mechanism than in the ordinary meter. In the drawing (No. 339) the meter is shown with the water up to its true level (A B) in the drum case, C, and the supply fountain (D) is filled ready to supply waste. Assuming that gas is acting on the meter, the same fluid pressure exists in the pneumatic dip-pipe, E, as in the case, C; the water, therefore, cannot rise in the dip-pipe, so that it stands full of gas. On the smallest quantity of water leaving the case, C, so as to disturb the true water level, the pneumatic balance between the fountain, D, and the case, C, is destroyed, and a bubble of gas will pass from the dip-pipe, E, rise to the surface of the fountain, D, and allow of sufficient water to pass through the orifice, F, into the case, C, to restore the level therein to the line, A B, and this operation will continue so long as water, by evaporation or otherwise, is leaving the case, C, and water remains in the fountain, D, to supply the waste. When the fountain, D, is exhausted, the float, G, will fall, close the inlet valve, and shut off the gas, and, therefore, the water cannot fall below the true level, A B,



whilst gas is passing through the meter. The fountain, D, is refilled through the tube, H, and the gas in it is allowed to pass through the pipe, I, into the measuring case, C. This exhaust pipe has its orifice, I^1, at the top of the fountain, and is sealed against a return of gas by dipping slightly below the water level, A B, at I^2. Should the meter be tilted forward to make it register incorrectly, or should the dip-pipe, E, by any means become obstructed, the orifice, I^2 would be uncovered, and gas would pass to the

top of the fountain, D, and allow the water to flow therefrom, and restore the true water-line. The supply fountain, D, may be of any convenient size to suit the required conditions. The gas enters the meter by the inlet pipe, K, through the valve-box, L, down the passage-pipe, M, and by means of the low spout, O, into the measuring drum, O^1, thence to the case, C, and out at the outlet pipe, P. The low spout O, will carry off any accumulation of water from the case, C, to the waste box, N; the surplus water can be drawn of by the tube, R, yet sufficient will be left in the box, N, to prevent escape of gas, and this at any working pressure. A variety of methods may be adopted to relieve the water from the fountain, D, such as the pipe, I, before described, as also by a pipe, S, fixed as shown by dotted lines, but owing to impurities floating on the surface of the water, these are liable to fail, and have failed, and are besides irregular and uncertain in their action. To obviate these defects the pneumatic dip-pipe, E, was designed. It is very sensitive, the slightest fall in the level (A B) causes it to act, while it and the orifice, F, being immersed in water, they are kept free from impurities.—(See drawing No. 339.)

221. Kay's Patent Hydraulic Valve Gas Meter; William Cowan, Buccleugh-street Works, Edinburgh, and Strutt-street, Manchester.

This is a simple means of meeting the requirements of the Sale of Gas Act, without the addition of any compensating reservoir or fountain In this meter a water valve is substituted for the ball float and valve at present in use in the ordinary meters. The meter not only shuts the gas within the prescribed limits, but it gives a full supply to the very last moment before shutting off. It may be described as a syphon having one of its legs larger than the other, the larger of the two dipping into a trough, into which the water is poured when filling the meter, and the smaller leg dipping into the meter case itself. The outlet is fitted with a "dip pipe," which reaches down into the trough, to within half an inch of the level of the water, which, by means of the syphon, stands the same height as that of the meter case itself. If, therefore, water is withdrawn from the meter, the mouth of the smaller leg of the syphon will be unsealed, and the syphon destroyed by the admission of air, the effect being to cause the water contained in the larger leg to fall, which, rising in the trough, seals the outlet dip pipe, and prevents any gas being obtained till the action of the syphon is restored by water being poured in again.

222. Esson's Patent Compensating Gas Meter; William Cowan.

This meter is specially manufactured to be within the limits of the Sale of Gas Act. Being furnished with a waste water box and overflow pipe, cut to the true water line, it cannot be overfilled so as to register to the prejudice of the consumer. It is also fitted with an air-tight fountain, which communicates with the meter by means of two tubes, the one the air pipe, and the other the feed pipe. The air pipe reaches from the top of the fountain down to the surface of the water in the meter, and the feed pipe extends from the bottom of the fountain to about an inch below the water line in the meter. If the latter falls below its proper height, air is admitted to the fountain which causes water to descend through the feed pipe, until the level rises sufficiently to seal the air pipe, and prevent further descent till again required. A float is placed in the fountain, which closes a valve, in the event of the fountain being emptied, to shut off the gas when more water is required. The fountain contains enough water to compensate for twelve months' evaporation under ordinary circumstances.

223. Gas Lamps, with Patstone's Regulated Shade; Lloyd and Summerfield, Park Glass Works, Birmingham.

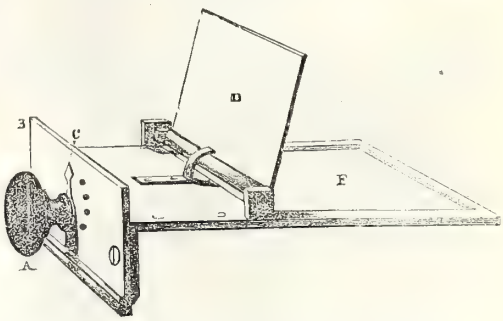
The perforated metal diaphragm in this lamp, and also in the gas moon accompanying it, with the glass cover to each, has the effect of moderating the draught of air through the lamp or moon, thus producing a more perfect combustion of the gas, and obviating the escape of unconsumed carbon.

224. Liquid for Burning in every description of Lamp; John Moule, Seabright-place, Hackney-road, N.E.

This liquid is a combination of alcohol, benzole, turpentine, and other hydrocarbons.

225. Improved Broiling and Boiling Stove; W. H. Phillips, Cemetery-road, Nunhead, S.E.

226. Improved Register Stove Door; J. Mills, 40, Great Russell-street, Bloomsbury, W.C.



This door can be fitted to most of the stoves now in use. In the woodcut, A is the knob to open the door D; B, front of stove; C, pointer, showing the width the register door is open; D, register door; E, opening of chimney.

227. Patent Filter; John Roberts, Upnor, near Rochester.

In this filter first the water is aerated as it passes through, thereby obviating insipidity or flatness; secondly, there is no sand, gravel, &c., employed, nor does the water pass through a sponge. The filtering material consists of a kind of porous earthenware.

228. Patent Filter; Harrison and Co., 62, Fleet-street, E.C.

229. Patent Suspender Frame; Charles Iles, Peel Works, Birmingham.

Upon this frame are hat and coat pins, as well as a mirror.

230. Patent Noiseless Carpet Sweeper; Newton, Wilson, & Co., 144, High Holborn, W.C.

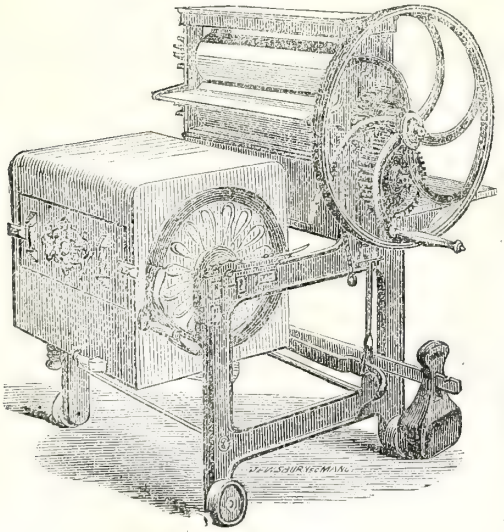
In this sweeper the brush is driven by india-rubber bands.

231. Patent Self-Adjusting Sweeper; Newton, Wilson, and Co.

The brush is centred on bearings which gravitate with the brush, so as to make it self-adjusting to any surface to which it may be applied, whether flagged, boarded, or carpeted floors. Both this and the noiseless sweeper take up their own dust.

232. Carved Mirror; Matthew Wheeldon, 108, Liverpool-road, Burslem, Staffordshire Potteries.

233. Patent Washing Machine, with Self-adjusting Rollers for Wringing and Mangling; Thomas Bradford, 63, Fleet-street, E.C., and Cathedral-steps, Manchester.



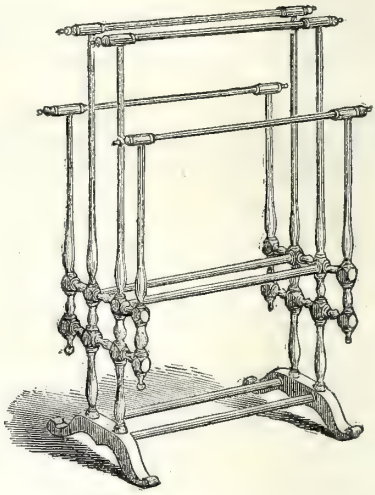
This invention consists of an oblong tub (to contain the clothes and water), fitted with a water-tight lid, which also confines the steam, thereby effecting a great saving in soap; and being hung upon its axis, an oscillating motion can be obtained. The interior is ribbed. The rollers for wringing and mangling are on same frame, rendering the machine very compact.

234. Patent Clothes Washing Machine; Mark Bogg, Duggleby, near Malton, Yorkshire.

The interior of this machine is supplied with reeds or friction bars, fixed without nails or screws, so as to prevent iron mould. There are soap trays at each end. The vessel is kept in position by teeth projecting from rockers entering corresponding holes in the frame. Motion is given by raising and lowering the handle. The linen is thus made to pass from end to end of the vessel and is speedily cleansed. For stopping the motion while wringing, a pin is applied through the frame and the centre tooth of the rockers.

235. Patent Electro-Galvanic Washing and Cleansing Apparatus; E. Merrett, 4, Little George-street, Minories, E.C.

236. Patent Towel Stand, or Linen Airer; James Soutter and Son, 97 and 98, Princes-street, Swinton-row, Elder-street, Edinburgh.



This invention consists in the upper rails of the stand being free and open at the ends, so that the articles to be aired can be laid on with perfect freedom.

237. Patent Linen Marker; Frederick Vernon Hadlow, 8, Prince Albert-street, Brighton.

This stamp is made of boxwood or other absorbent material.

238. Patent Paper Enamel; Brierley and Geering, Cheapside, Birmingham.

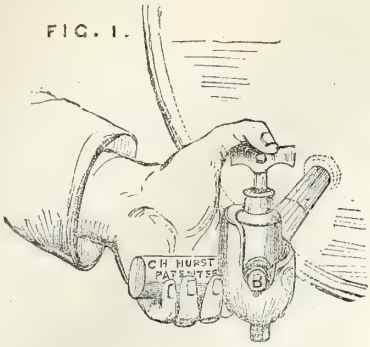
This invention consists in coating with ornamental papers, the pillars and other parts of iron bedsteads, whether of wrought-iron, cast-iron, or tubes. The surface is subsequently preserved and rendered brilliant by means of waterproof varnishes.

239. Patent Wrench or Spanner; C. H. Hurst, Royal-road, Kennington-park, S.

This is an apparatus for tapping and untapping casks. The wrench is padded inside with soft, pliable material, and adjusts itself to taps of

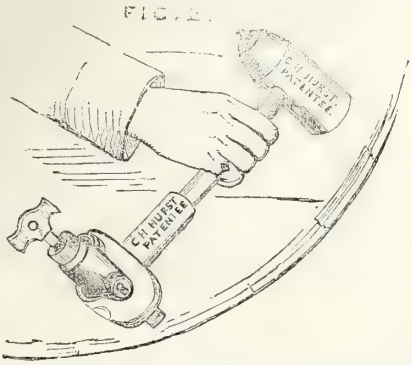
every kind and shape. Fig. 1, position of wrench on tap in the act of tapping a cask, ready for

FIG. 1.



driving with mallet on projecting part of tap, B. Fig. 2, position of wrench on tap (with mallet forming a lever), in the act of wrenching a tap

FIG. 2.



from cask. Fig. 3, tap wrench only, with lever handle. Fig. 4, publican's lever tap wrench, with spanner for union-joints.

FIG. 3.

FIG. 4

240. Improved Galvanised Wire Sieve; John Reynolds, 57, New Compton-street, Soho, W.

The bottom of this sieve is made of hard iron wire galvanised after manufacture. The rim is not bored through, as in the old method, and is thus smoother to handle.

241. Bottle Corker; Henry Levy, 26, High-street, Sheffield.

A wooden cap is placed over the neck of the bottle, and the cork is placed within the throat of the cap, and forced down by means of a piston.

242. Razor Warmer; Henry Bailey, 8, Broad-street-buildings, E.C.

243. Tea Percolator; George Keith, 55, Great Russell-street, Bloomsbury, W.C.

This consists of a small tin vessel, perforated at bottom. The vessel is placed in the tea cup, and the tea within the vessel; the water is then poured upon it.

MISCELLANEA.

(*For remainder of the articles in this Section see Drawings.*)

250. **Figures in Aluminium; F. W. Gerhard.**

The metal is produced by Gerhard's process, and is of British manufacture.

251. **Ebonite; S. W. Silver and Co., Silvertown, Essex, and 3, 4, 5, and 6, Bishopsgate Within, E.C.**

The insulating properties of ebonite are considerable, and it answers for all electrical and telegraphic purposes. Ebonite is lighter and more durable than jet, takes a finer polish, and can be made into the most beautiful and intricate ornaments. For surgical appliances it is far better than metal, acids, caustic, &c., having no effect upon it. Ear trumpets, stethoscopes, syringes, and caustic holders are exhibited as well as its new application as the base for artificial teeth. The marble ebonite is also manufactured into combs, beautiful in appearance, and not liable to break.

252. **Specimens of Articles in Improved Vulcanized hard India-rubber; Blackwood and Co., 18, Bread-street-hill, E.C.**

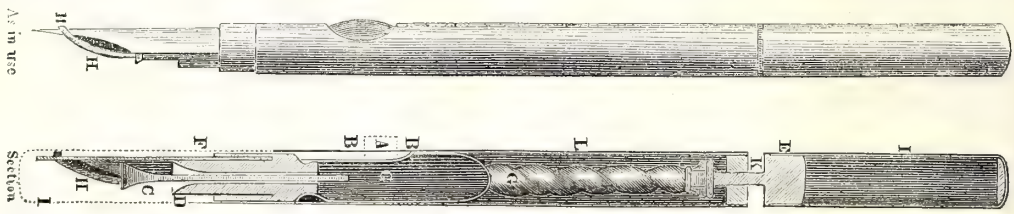
253. **Improved Process for the Preparation of Materials for the Manufacture of Paper, &c.; Dr. Collyer, Beta House, 8, Alpha-road, St. John's-wood, N.W.**

These specimens are of wheat straw—the silica and gluten being entirely removed, which renders the fibre of straw equal in strength to that of flax and hemp. The principal features in this process are:—1st. Soaking the straw, then, in its entirety, opening it out into a fibrous state, rubbing out the knots-ears and disintegrating the silicious cortex by a suitable machine. 2nd. In this divided, fibrous preparatory condition, all the parts exposed, it is boiled in sieved trays, in a weak alkaline solution, which, after a few hours, entirely dissolves the silica and gluten. 3d. The boiling completed, the trays, with their contents, are removed from the boiler to undergo the next or washing process, which consists of a "jigging" motion; this is continued until all the flinty covering and gluten are effectually removed. 4th. The fibre being entirely freed from the gluten and silica, is now subjected to the action of a bath of chloride of lime, which soon brings it to the colour desired for writing and printing papers. The process is effected in one-third the usual time occupied, with three-fourths less alkali, without resorting to high pressure boiling. It is estimated that the best class papers can be made at 3d. the lb., now worth 7½d. to 9d.

254. **Pulp for Paper; Charles Mayburn Archer, 6, Raglan-street, Kentish Town, N.W.**

The specimen exhibited was formerly a copy of *The Times* newspaper. The ink has been removed, and the paper re-converted into pulp for paper making.

255. **Patent Fountain Penholders; John Moseley and Son, 17 & 18, New-st., Covent Garden, W.C.**



These penholders are chiefly made of vulcanite. The reservoir, G, is made of elastic india-rubber. This is fastened to a top piece, which, being turned round to the left-hand, expels the air. The mouth of the reservoir is then dipped into the ink, and held there whilst the top is turned back. The elastic tube then recovers its tubular form, and fills with ink; a stopper fits into the mouth of the reservoir and prevents the escape of ink in the pocket. The ink is supplied to the pen by pressing the elastic tube at the finger-hole. The tongue, at the end of the stopper, C, is one of the most recent improvements, and by means of it a larger supply of ink is held in the nib of the pen.

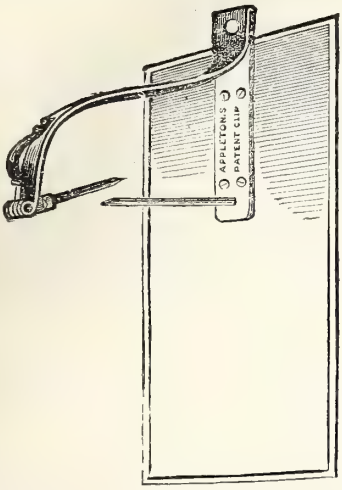
256. **Patent Index Ledger; House and Martin, 1, Watson-walk, Sheffield.**

In this ledger the index, when in use, folds out from the book at either end, and lies beside it, as is the case with the ordinary loose indexes, but with this advantage, that being permanently attached to the book, it cannot in any case be lost or misplaced, and admits of being used or referred to without having to lift a leaf of the ledger. It also has the additional advantage of showing all the preceding as well as succeeding letters of the alphabet at one view, at whatever page the index may be opened, avoiding the necessity of turning

over the index to find any particular letter required. This principle is applicable to all descriptions of indexes, whether loose or fast.

257. Portable Copying Press; William Lund, 34, Fleet-street, E.C.

258. Improved File or Clip for Patterns, Letters Invoices, &c.; Leonard Appleton, 25, Clarence-road South, Kentish Town, N.W.



It consists of a horizontal peg, projecting from a plate of metal, above which is an arm, extending double the length and coming down opposite the peg. At the extremity of the arm, connected by a hinge is a moveable peg, which drops into a slot or notch at the end of the horizontal peg. The utility of the invention consists in its affording a speedy method of referring to patterns, &c., and detaching one without removing the others.

259. Patent Chenille; T. S. Bottom, 1, Park-terrace, Old Ford-road, E.

This chenille is made by a new combination of machinery upon an elastic thread.

260. Registered Material, composed of Fur and Velvet; George Ellis, 4, Collier-street, N.

This material is composed of alternate strips of fur and velvet, sewn together, and is intended for muffs and other articles for winter wear.

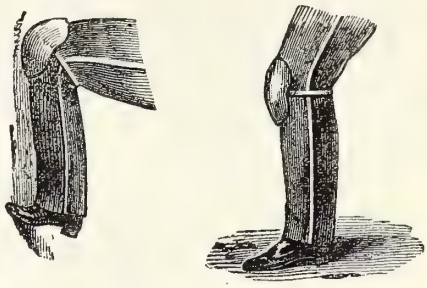
261. Patent Mode of Currying Leather; George Gregg, 25, Flat-street, Sheffield.

This leather is curried by the "dry stuffing" process, which only occupies about twelve hours.

262. Registered Knee Cap Gaiter; Bowley and Co., 53, Charing-cross, and 25, Spring-gardens, S.W.

This is a combination of knee-cap and gaiter in one piece, the cap being hollowed to fit the knee. It may be worn with the cap up or down.

263. Patent Rifleman's Knee Cap; Bowley and Co.



This cap is hollowed to the form of the knee, and obviates the objection to the ordinary flat piece of leather that mud, stones and dirt get between it and the knee. It is made of gutta percha, but may be had also in leather. It is thoroughly waterproof.

264. Manufactured Articles in Patent Vegetable Leather; George Spill and Co., Old Farm-house, Stepney-green, E.

This material is manufactured in every colour, and the surface is rolled so as to imitate the natural grain of leather. It will not tear without considerable force, resists damp, bears a good polish, does not sodden or cockle, and is not easily affected by friction. It is made of various thicknesses, in lengths of 50 yards by 54 inches wide, and is available in the manufacture of most articles that have hitherto been made of leather. It is used for gaiters and leggings, and is also adapted for soldiers' belts, knapsacks, carriage aprons, furniture-coverings, book-binding, and particularly bands for machinery.

265. Patent Clog; George Sample, High-street, Whitechapel, E.

In this clog, or wooden shoe, a wooden sole is attached to the upper leather, without the nails being visible, and this is done in such a manner as not to destroy the appearance, which is that of an ordinary boot or shoe.

266. Improvements in the Manufacture of Boots and Shoes, Traces, Whip Handles, &c.; S. Middleton, 10, Rolls-buildings, Fetter-lane, E.C.

The soles of these shoes are attached to the upper leathers with two sets of bayonet-shaped pegs. The advantages claimed by the inventor are economy of manufacture and greater durability

in wear. The same principle is applied to traces or bands, where more than one thickness of leather is required. It is also applied to the manufacture of whip handles. The various kinds of pegs employed in the different manufactures are shown.

267. Patent Boot and Shoe-cleaning Machine; James Rawlings, 10, Carlton-hill East, St. John's-wood, N.W.

This apparatus consists of a bracket piece, with a lever hinged thereto, the lower part of which forms the front part of a last, and when the boot or shoe is placed on it, and the lever pressed back, it is held in a state of tension by the bottom of the bracket piece resting against the heel, as that of the lever does against the toe. It is retained in its position by a rack and pawl, and is instantly released by raising the latter. This arrangement enables the operator to use two brushes at once, by which a great saving of time is effected. It may be made entirely of iron, or with a wooden foot, and it can also be made with a moveable plate to fill out the leg of a Hessian or Wellington boot.

268. Hatters' Block-metron; Oliver H. Hodges, 11, Alfred-place, Old Kent-road, S.E.

269. Patent Articles manufactured of Cork; T. C. Clarkson, 56, Stamford-street, Blackfriars, S.E.

These articles consist of boots, shoes, and leggings; also harness, traces, &c., in which cork is combined with leather and a textile fabric.

270. Perforated Hat Body; B. Rider, 61, Red-cross-street, S. E.

The body of this hat is entirely perforated, as shown in the wood-cut, before applying the covering of the velvet plush. The plush being manufactured on a woven fabric, gives free circulation of air, and renders the hat much lighter.

271. Double Sheet Cork Hat Body; B. Rider.

272. Patent Wool-Flock Material for Hat Bodies and Leathers; B. Rider.

The hat leathers are coated with wool-flock at the back, to prevent the grease passing through.

273. Patent Pulverized Cork Hat Material; B. Rider.

This is employed in the same manner as the wool-flock material.

274. Wilson's Patent Postal Box; John Harris, Oat-lane, Noble-street, E.C.

This invention consists of a wooden envelope, with a canvas back, so formed as to fold up and make a secure, light, and cheap covering for fragile goods. When unfolded the postal box occupies but little space.

275. Patent Portrait Knives and Scissors; Benjamin Matthewman, jun., Milton Works, Sheffield.

276. Cellular Needle Box; A. Walker, 47, Gresham-street, E.C.

The box shows six thousand needles, of different sizes, in two hundred and forty papers, arranged in small cells, side by side, and at a convenient distance for any one paper to be removed without disturbing any of the others.

277. Patent Instrument for Stoning Raisins. John Algernon Clarke, Long Sutton, Lincolnshire.

This instrument performs two processes,—first flattening the raisins between a pair of pressing-plates, so that the fruit is rendered semi-transparent, and the stones can be plainly seen; and then cutting out the stones by a perforating punch.

278. Patent Repose Perambulator; James E. Boyd, Hither-green, Lewisham, S. E.

279. Fumigating Ribbon; Piesse and Lubin, 2, New Bond-street, W.

This consists of a perfumed ribbon, coiled in a small vase. When it is required to fumigate a room, a small piece of the ribbon is drawn out and set fire to.

280. Patent Trap for Catching Flies, Mosquitoes, &c.; J. W. Hart, 60, St. Mary-axe, E.C.

281. An Improved Music Stand of Wrought Iron; W. T. Gidney, East Dereham, Norfolk.

282. Cheap Picture Frames for Cottagers; exhibited by the Rev. J. G. Joyce, Strathfieldsaye, Hants.

283. Ornamental Surfaces for Advertisement Tablets; J. M. and E. Johnson, 3 and 10, Castle-street, Holborn, E.C.

DRAWINGS.

290. Patent Combined Small Coke or Breeze Oven; Joseph Davis, Lichfield-street, Birmingham.

The improvement consists in combining a coke oven with the furnace of a steam boiler, the heat and products of combustion from the coke oven being conducted into the furnace of the steam boiler by a flue above the fire-bars, the flame and gases from the coke oven being caused to impinge on the under side of the boiler. Coal of a cheap description, from which the fine slack is sifted, is supplied from time to time to the upper surface of the fire. In the coking chamber or oven, as the smoke and gas are evolved, and when the chamber is sufficiently charged, the flue between the furnaces is closed by a damper, and jets of water are discharged upon the coke to cool it gradually, when the contents are withdrawn. It will be found to be suitable for the forge, the coke or breeze made in this manner being free from sulphur. The fire under the boiler requires but very little fuel whilst the coke oven is in operation, and this may consist of the small slacks and siftings from the breezes.

291. Improved Method of Connecting Steam Boilers; J. Grafton Jones, 4, Cambridge Villas, Battersea, S.W.

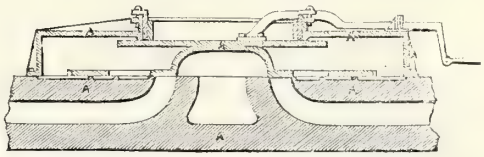
It is proposed, when several boilers are to be worked at the same pressure, to "seat" them so that the water line in each shall stand at the same level, and to permanently connect such boilers by means of two pipes one above and the other below the water line. By this arrangement the risk of explosion will be considerably diminished, for should the evaporative power of one boiler exceed that of another, the increase would be shared by each, and the pressure being the same in all the boilers, the water, by its gravitating power, would maintain the same level in all. In the drawing, A is the pipe for regulating the pressure of steam, and B, the pipe for maintaining the water at the same height in each boiler. The pipes, A and B, are fitted with cocks to close the connection during repair.

292. Improved Alarum for Steam-Boilers; George Haselden, 8, Dyer's-buildings, Holborn. W.C.

In the drawing, *a* is a cylinder in which a piston, *b*, works, having a rod, *c*, attached to its under side. At the end of this rod is a T-shaped weight, which is embraced by the forked end of the lever, *d*. The other end of this lever is attached by a link to the float *e*. When the water in the boiler sinks below the proper level, the forked end of the lever raises the T-shaped weight, and with it the piston, *b*. When the piston arrives at the top of the cylinder (as shown in red lines), the steam will blow off at the passages, *ff*, and sound the whistle. The piston is weighted by the T-shaped weight, to the extreme pressure at which it is desired to work the boiler; and should the steam rise beyond that pressure, it will raise the piston, *b*, and sound the whistle as before.

293. Equilibrium Slide Valve; J. B. D. A. Boulton, Engineer's Office, Guernsey.

This slide valve is applicable either to high or low pressure engines. There is no more pressure on the back of the valve than is necessary to maintain a steam-tight contact between it and its seat. To effect this an iron plate is attached to the back, parallel to its face, and a rim or



packing, enclosing an area equal to the greatest that causes pressure on the valve is pressed on it, and a connection is made between this area and the exhaust port or atmosphere; the pressure is greatest on the valve at half stroke when both induction ports are shut; then, supposing the valve to be moved so as to slightly open an induction port, the valve would be lightened of the pressure on the area of one of the ports, which would cause, if in equilibrium, at half stroke, a tendency to lift off the valve seat; to obviate this, the seat at each end beyond the ports is lowered a little, and then a small rib, enclosing an area equal and similar to a port, is placed at each end of it, and the valve is lengthened, leaving appertures similar to the induction ports, so that when an induction port is opened, an area shall be closed, and the steam allowed to escape, thereby equalizing the pressure throughout the stroke. The pressure caused by the packing on the plate at the back of the valve is left unbalanced to keep the contact between valve and seat steam-tight.

294. Patent Steam Valves; W. P. Wilkins, Ipswich.

(See model, No. 9).

295. Improved Stop Valve; W. P. Wilkins.

(See model, No, 10.)

296. Patent Pump Alarum; Guest and Chrimes, Rotherham.

(See specimen, No. 12.)

297. Parson's Patent Internal Loaded Safety Valve; Guest and Chrimes.

(See specimen, No. 11.)

298. Patent Self-acting Water Feed; Guest and Chrimes.

(See specimen, No. 13.)

299. Patent Pressure Gauge; A. Allan, Perth.

(See specimens, No. 14.)

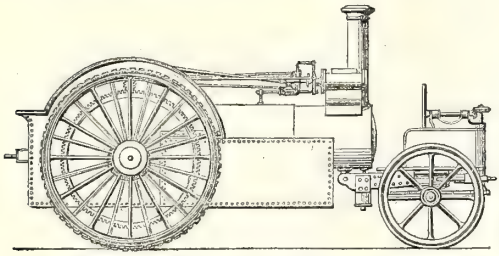
299A. Giffard's Self-acting Water Injector; Sharp, Stewart, and Co., Atlas Works, Manchester.

(See model, No. 5.)

300. Patent Double Cylinder Marine Engines; E. E. Allen, 1, Parkside, Knightsbridge, W.

These engines are intended for working screw propellers in cases where it is desirable to keep the machinery below the water level. They are designed so as to occupy the least possible space, and to consist of the fewest possible parts consistent with the duty performed.

301. Barrans' Patent Traction Engine; Gardiner and Mackintosh, Railway Foundry, New Cross, S.E.



This traction engine is worked by two sizes of pinions, so as to give at different times different speeds. Each driving wheel consists of two or more parts or rings which are so arranged that all may press on the ground and act as one wide ring thereon, or only one or more of the parts or rings of which the wheel is composed may bear on the ground. The cylinders are 7 inches in diameter, and the stroke is 15 inches. This engine is stated to have drawn 40 tons with ease upon a level road, and 10 tons up an incline of 1 in 7, at the rate of 2½ miles per hour.

302. Patent Propeller for Vessels; J. Smith; Tongue and Birkbeck, 34, Southampton-buildings, E.C.

In this invention air is forced into channels formed under the vessel, the air being discharged against a fixed stop in the channel, instead of towards the stern as is usually the case when air or fluids are being employed for the purpose of propelling.

303. Steam Ship Propeller; T. D. Hulme, Park Mill, Park-street, Congleton, Cheshire.

This invention is worked in tubes, the length and size of the tubes corresponding to the stroke of engine and size of ship; these tubes are placed within the ship four at the stern, two on each side of the stern-post one above the other, and as much below the water-line as possible, and in a horizontal position, open at the outside ends, and on the inner end having a cover with a stuffing-box in the centre for a rod to work through connected with the engine. The propeller acts by pushing out and drawing in, like the piston of a horizontal steam-engine, and is fitted on the rod working through the stuffing-box, and consists of two vertical loose flaps fastened by hinges to a centre-piece of iron, and having a front stopper at such a distance before the flaps as that the flaps close down in drawing back, and to keep them from shutting too close together.

304. Patent Elastic Pipe Joint; T. S. Truss, 53, Gracechurch-street, E.C.

(See specimens, No. 22.)

305. Improvements in Permanent Ways; Henry Lee Corlett, Inchicore, Dublin.

Figures 1, 2, 3 illustrate, in elevation, section, and plan, a suspended fish-joint chair, for bridge or foot-rails. This chair is placed between two sleepers, I, and may rest on the ballast; A is the cast metal chair, of which the lugs, B, overhang the rail flanges at either sides; E E are iron wedge keys, which are placed between the rail flanges and the lugs of the chair, and are set up and kept in position by the screws, F, which are tapped through the nuts, G. Figures 4, 5, 6, show a similar joint chair to be laid on a sleeper. Figures 7, 8, 9, 10 suspended joint chair, the wedge keys being underneath the rail flanges. Figures 11, 12, 13, "continuous surface supported rail," illustrated in transverse section. This rail is formed in two parts; A is the chief or carrying portion, presenting a bearing surface (the full width of wheel tyre), rolled at an angle to coincide with the cone of the peripheries of the wheels. The two parts, A and C, of the rail being bolted together so as to break-joint, form a continuous rail, supported on the ballast by the lateral flanges, and kept to guage by the vertical web or keel, and tie-rods, at suitable intervals. Figures 16 and 17 illustrate, in section and plan, a method of laying rails more applicable to street tram-ways. A is an ordinary double-headed rail; B B are cast at metal cellular brackets, secured in the channels either side of the rail by bolts passing through all. The cells in the brackets may be filled with previously compressed blocks of timber, as shown in drawing, or they may be filled with concrete, broken stones, or any other suitable material. (See models, Nos. 45, 46, 47, 48, 49.)

306. Patent Self-acting Brake; David Jones, Machen, near Newport, Monmouthshire.

(See model, No. 31.)

306A. Improved Locomotive Traction Engine; J. Giles, 8, Cannon-street, E.C.

(See model, No. 33.)

307. Plan for the Prevention of Accidents on Railways; Henry Harris, Newport, Isle of Wight.

308. Patent Improvement in Hansom Cabs; James Evans, 32 and 34, Tarlton-street, Liverpool.

In this invention, instead of connecting the scroll ends on the front part of the floor of the cab to the shafts by means of rigid iron stays, they are connected thereto by springs, the tail-end of the springs being attached to scroll loops, fixed upon the under side of the shafts. The back stay also, which connects the floor of the cab to the heel of the shaft, instead of being rigid, is furnished with a butt-hinge joint at or near its centre, having only a very slight amount of movement, but still sufficient to allow of the play of the springs.

309. Manumotive Carriage; Thos. E. Merritt, Rochester.

In this carriage the wheels run loose on the axles. It is propelled by levers A, A, one on each side of the framing B. These levers have toes, C, the toes being kept straight by springs, D. The traveller sits with his back to the front wheels,

and pulls the levers as in rowing. The toe of the lever affords a fulcrum during the pull, but when the lever is pushed forward to prepare for another pull, the spring yields, and the toe runs over the ground until it finds a new beginning of the stroke, when, on pulling it over to E again, the machine runs forward as before, in the direction of F. G is a guide-bar, having two rods, H H, proceeding from it to the swivelling axle of the fore-wheel I. The feet of the traveller rest on either side of the pivot of this guide-bar, and thereby he is enabled to guide the carriage.

310. Direct-Acting Steam Crane; R. Morrison, Ouseburn Engine Works, Newcastle-upon-Tyne.

The principal improvements in this crane are the doing away with spur wheels, pinions, axles, barrels, brakes, ordinary steam cylinders, piston rods, valves, chains, crane checks, and all other complications of gearing necessary to enable the present cranes to lift, lower, and swing round both ways. For these there is substituted a piston, with a flexible piston-rod working steam-tight through a stuffing-box in the top of the crane-post, and passing over two pulleys forming the chain. By this arrangement the different movements of the crane are performed with facility and precision, the lifting being performed by the admission of the steam above the piston—forcing it down the cylinder or crane post to a distance equal to the lift required, when the steam is shut off and let on to the turning round disc, when the crane is swung round to the required position. The steam in the crane post or cylinder is then allowed to escape, fast or slow, as may be required, and the weight is lowered in the same time. The steam is again let on above the piston, to lift the empty tub, and also upon the disc, to swing the crane back to its first position to get loaded, and the same operation is repeated so long as the crane is required to work. By these means it is stated that a crane with a lift of twenty-four feet, and a radius of twenty feet, will lift, swing round, discharge, and swing back to re-load, four times a minute. In addition to the expedition gained with these cranes, the smoothness of motion, and the absence of any jerking, such as takes place with chains and the ordinary gearing, are of great importance, preventing undue strain upon the foundation, and also the sudden breaking of chains or other parts of the crane. The steam does not condense in the cylinder or crane post, and no perceptible change can be seen in the position of the weight, if allowed to remain suspended to the rope or flexible piston for twenty minutes without any steam being admitted into the cylinder; in fact, with a well proportioned crane there is no perceptible condensation of steam, even with the first lift, when the cylinder is cold, and no more power is required to lift two tons than a pressure of two tons upon the area of the piston, with the usual allowance for friction.

311. Planing Machine; W. Collier & Co., Salford, Manchester.

This machine will plane 10 feet wide and 10 feet high, and is made as an ordinary large planing machine, with two tools on the cross-slides, self-acting at all angles, with self-acting apparatus for oiling the slides. The chief novelty in this machine consists in the application of tool-boxes fixed to, and (being self-acting vertically) upon the uprights, for facing or planing the sides of articles at right angles to the tools on cross-slide. By this arrangement the tools (on cross-slide) are not required to project or stand out, and turning articles over with the risk of re-setting is entirely avoided. In this machine four V slides are used, and two racks, the bed and table being made in halves and jointed up the middle the whole length. If a narrow article only is required to be planed, one of the tables can be run off the rack pinion, and the other used in the ordinary way.

312. Patent Machinery for the Manufacture of Forged Horse Shoe and other Nails; Lemuel Dow Owen, 192, Tottenham Court-road, W.

In this machinery the end of a heated rod of iron is operated upon by a series of blows given by a rotating and vibrating hammer acting against the horizontal and vertical faces of a fixed anvil, the rod of iron being moved from one face of the anvil to the other by a guide, by which the "scale" is prevented from accumulating upon the anvil, or adhering to the nail whilst being forged.

313. Patent Nut-making Machine; W. Collier and Co., 2, Greengate, Salford, Manchester.

The mode of operation of this machine is as follows:—The end of a bar of properly heated iron, one-sixteenth of an inch narrower than the cavity in the die (A), (*i.e.* the width of the nut to be produced) is laid upon a guide bolted upon the crosshead (B), immediately in front of the die-box (C), and as soon as the end of the knocker (D) has passed from between the upper and lower swages, the bar is to be pushed forward, immediately below the end of the upper swage (E), (which at this position of the cams protrudes from the die-box a short distance), until it comes against the stop (F), which is screwed to the bottom of the die-box, and measures the size of the blank; and now the end of the bar being placed immediately between the moving die and the stationary or bottom die (G), the cam shaft being caused to revolve the full-stroke cam operating on its frame, which is attached by means of a connecting rod to the rocking shaft or lever, causes the crosshead (B) to be depressed; the die-box, being fixed to the crosshead by means of two bolts, is carried down on to the stationary die (G), and the end is thus severed from the bar, and enclosed in the upper or female die (A); for although at the commencement of the turning of the cam shaft, the cavity of the die (A) was entirely filled up by the upper swage (E), still there is nothing to cause the descent of the said swage until after the end is severed from the bar and enclosed, when on the further descent of the crosshead (B) it comes in contact with the check-piece (H), which is inserted through from back to front of the crosshead, in an elongated opening immediately above the upper end of the upper swage, and as the crosshead comes against the check-piece, it presses upon the upper end of the swage (E), and causes it to descend with the die-box (C), and thus compress the nut while therein confined; immediately after this the cam in front of the machine (which is fixed on the same shaft as the other cam), operating upon its frame, by means of the upright wrought iron rods, brings down the upper

crosshead (I), in which is affixed the punch (K) for perforating the blank, and causes the punch to pass quietly through the nut and out again, while thus confined, and after it is pressed and before it is relieved from the position in which it was pressed, or in other words before the pressing began to return. Then the die box (C) is carried up by the return motion of the cam, and as the nut at this stage of the process is tight in the die box, it is carried up by the friction on its sides, taking with it the top swage and the check-piece (H). But the check-piece is prevented from rising more than one-half the distance that the die box is made to rise, by means of the screw (L) on the top of the machine, and thus the upper swage (E) is made to force out the nut, and project through the die box as before, with the finished nut below it, ready to be knocked off by the revolving arm or knocker (D), which is fixed on the upper end of the vertical shaft, and driven by mitre wheels from the cam shaft. The dies, swages, and punch are fixed to the machine, so as to be easily removed and others of different dimensions put in their places; by this means the same machine is made to make various sizes of nuts, both hexagon and square. Nuts made by this process are much stronger than the hand made ones, the iron not being strained in the punching, the nut during that process being under powerful compression. The machine makes 60 strokes per minute, and a perfect nut may be made each stroke, all the sides being parallel to each other and the hole perfectly central. (See Specimens, No. 75.)

314. Patent Spiral Fluted Driving Pins for Railway, Ship-Building, and other purposes; M. Wigzell, Friars-green, Exeter.

These driving pins are so constructed as not to require any holes to be made for them, as they screw themselves into any kind of timber by a direct blow from a hammer.

315. Grooved Roller Crushing Machine; E. O. Tindall, Scarborough, Yorks. Exhibited by W. & J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

In this machine it has been sought to combine the advantages of an even feed with increased working surface for operating upon the material to be crushed. The details of the machine are carried upon the top of an open cast-iron frame, in which are the bearings for a pair of crushing rollers; these rollers are grooved annularly, and when at work the projections on one roller fit into the corresponding recesses in the other. The rollers are geared together, and are adjustable by means of a pair of horizontal end screws. The feed is regulated by a sliding diaphragm fitted outside the hopper, and capable of being set by an adjusting screw.

316. Dry Clay Brick-making Machine; Bradley and Craven, Westgate Foundry, Wakefield. Exhibited by W. & J. H. Johnson.

The clay, after passing through a mill to pulverise it, is carried up by an elevator to the hopper of the brick-making machine, which feeds it into suitable moulds in a revolving table, where it receives pressure from pistons moving vertically both upwards and downwards. The finished bricks are removed from the moulding table either by hand or by an endless belt or carrying band.

317. Steam Hammers; W. Naylor, 3, New Broad-street, E.C. Exhibited by W. and J. H. Johnson.

One arrangement of these hammers is with an overhanging frame, and is well adapted for jobbing work. The large hammer, which is represented in front and side elevations, is constructed with open framing, and is adapted for the heaviest kind of work.

318. Mechanical Hammer; A. McKechnie, Carron Iron Works. Exhibited by W. and J. H. Johnson.

This hammer is actuated by a belt pulley on one end of a short horizontal shaft, running in bearings on the top of the main frame. This shaft has upon it a spur pulley, in gear with a spur fastened to a lower horizontal shaft. Both these shafts carry broad frictional pulleys, between which the hammer shaft is raised, when the pulleys are caused to nip it. By means of a hand lever, within convenient reach of the operator, the frictional pulleys are caused to nip or release the hammer shaft, as required.

319. Portable Cannel Coal Gas Apparatus; G. Bower, Vulcan Foundry, St. Neots. Exhibited by W. and J. H. Johnson.

The generater consists of a cylindrical base chamber or reservoir, having on each side of it an inclined shoot or laterally projecting open chamber, in full communication with the main central cylindrical chamber. The top of the latter carries a set of circular grate bars, for the fuel to be used in working the gas retort. Over this grate there is placed an upright cylindrical or slightly conical fuel chamber or furnace of metal, lined with fire-clay or bricks on the whole of its surface—the fuel is supplied to this furnace by a side fire door. The gas-holder is composed of vulcanised caoutchouc distended to a cylindrical form by internal metal rings. It is fitted with a convex metal top, and is guided in the usual way by pulleys and vertical pillars. Its base is formed by a shallow metal tank, filled with water, so that when wholly collapsed it is entirely contained in this tank, and is therefore peculiarly portable, whilst the whole of the contained gas can be expelled from it. In this arrangement of apparatus, the generator, "combined" apparatus or purifier, and the gas-holder are all upon the same level, and as they are each and all independent in themselves, no foundation is necessary for any of them, and the whole can be at once removed when necessary. Either of these arrangements of gas apparatus may be employed for the manufacture of gas from oil, resin, or other gas producing matter, by simply dropping the material into the retort.

320. Gas-Singeing Machine; James Cooke, York-street, Belfast. Exhibited by W. and J. H. Johnson.

The fabric, in passing through this machine, is subjected to the action of brushing rollers, for the purpose of raising the filaments on the surface. The singeing rollers have two series of gas burners, fitted one on each side, and parallel; the fabric is drawn lightly, and with great rapidity, over the singeing rollers. The gas flames are caused to impinge on the fabric as it passes over the rollers, and the intensity of the flame is

greatly increased by means of a current of heated air, which is directed by tubular ducts immediately on to the gas flames.

321. Sugar Boiling Furnaces; W. R. Alexander, Glasgow. Exhibited by W. and J. H. Johnson.

This invention is intended to facilitate the use of "megass" in a green or damp state, thereby obviating the necessity of expensive "megass" houses, for storing, drying, and rendering this fuel fit for combustion. This plan consists of a long "firemouth," or drying chambers fitted up immediately in front of the furnace, being formed with a double bottom, perforated on the upper side for the discharge into the chamber of heated air. The "megass" or waste sugar cane is deposited in this chamber, and pushed into the furnace from time to time for use through a perforated door, which forms the communication between the drying chamber and the furnace. The furnace bars are tubular, opening at one end into a hollow fire bridge at the back end of the furnace, and at the other into the false bottom space of the front drying chamber. The grate bars are also minutely perforated on their upper side, for the discharge of air amongst the burning fuel upon the bars. Air is forced into the furnace by a blowing fan, or other mechanical forcer, at the extreme back end of the structure of the furnace. In this way, the full supply of highly-heated air, subdivided into numerous minute jets, effects the perfect combustion of the fuel, and prevents all, or nearly all, discharge of smoke. The same arrangement, or modifications of it, will answer for burning coal and other fuel.

322. Coffee Machinery; John Gordon, 3, Billiter-square, E.C.

Coffee is generally planted on the slopes of the mountains or on undulating ground, and the pulping-house is usually placed against a high bank, and a gangway run out from the cherry coffee floor, so that the coolies may walk in direct, and deliver the cherries they have picked from the trees. The cherry coffee is then run with water into three pulping machines, which separates the pulp from the parchment coffee, the pulp being carried away by the water to the manure-pit, while the parchment coffee falls into the soaking cistern, where it remains from 12 to 24 hours (according to the state of the weather) until the saccharine matter dissolves, when it is transferred to the washing cistern, and the parchment made quite clean and put out on the drying-ground and exposed to the sun, and when quite dry it is then ready for the peeling-mill, where the parchment and silver skins are taken off; it then passes through the fan, and a machine, which separates the peaberry, also divides the other beans into different sizes; it is then ready for the markets.

323. Plan for Coast Defences; Henry Harris, Newport, Isle of Wight.

This plan consists of square iron rams, varying from 1 to 2 feet in thickness, and from 10 to 20 feet in length, constructed to fit securely one on the other, so that any required depth can be arrived at; and of iron casements, 8 feet square, filled with concrete, constructed so as to slide down the iron rams, whereby each ram, when fixed and completed with its adequate number of casements, will present a surface of 8 feet square, forming a solid foundation, sunk to any depth that may be required.

324. Floating Dock; John Pile, West Hartlepool, Durham.—Exhibited by W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

This invention consists in the application of two sets of pontoons, one set being kept constantly floating upon the surface of the water, and the other set being alternately submerged and floated for the purpose of sinking beneath the bottom of the ship and of then rising and lifting the ship up with it, the water for such purpose being pumped out of the submerged pontoon by rotatory pumps, or other water-elevating apparatus. The first set of pontoons serves as a means of steadying the ship, and the second pontoon as her bed, when elevated by reason of the top of the elevating pontoon being against the underside of the floating pontoons. The floating pontoons are guided over the elevating pontoons by suitable uprights passing through apertures made in the floating pontoons, and connected with the elevating pontoon. Chains and winches, carried on the floating pontoon, and connected with the elevating pontoon, serve to prevent its immersion to an unnecessary depth, whilst during its elevation the slack is duly taken in. The dead weight of the elevating pontoon is neutralised by having air-tight spaces attached thereto, so that it may be more easily supported by the chains before referred to.

325. Harbour of Refuge; T. Richardson and G. W. Jaffrey, Hartlepool Iron Works, Durham. Exhibited by W. and J. H. Johnson.

The details employed in this invention consist mainly of a series of tapered towers, made either of cast or wrought iron, or of stone, and having a clear intermediate space between each. These spaces are filled in with balks of timber or cast-iron pipes, so arranged as to form a species of vertical lattice, or screen, to break the violence of the waves, and at the same time prevent the inner sides of the harbours from silting up with sand. Harbours or sea barriers may be constructed according to this plan in a very short time as compared with that required in the case of ordinary works, and at a greatly decreased cost.

326. Continuous-Action Pile-Driver; Thos. E. Merritt, Rochester.

In the drawing, A A, are the guides for the ram; B, the ram; and C, the rack attached to it; D, pinion, gearing into the rack; E, worm-wheel on axle of pinion; F, tangent-screw, for driving the worm-wheel; G, H, bevil-wheels, worked by the winches, I, I; J, axis of bevil-wheel, having a ball-and-socket communication with L, the shaft of the tangent screw; M is a lever, working on a stud in the ram-guide, A; the upper part of of this lever has a short arm, N, bored through the end, to serve as a standard for the shaft of the tangent screw. This lever also carries the worm-wheel, E, on its upper end, the pinion, D, being keyed on the axle of the worm-wheel. The horizontal arm of this lever is provided with a cord, which, when pulled downwards, disconnects the pinion, D, from the rack, C, which is fixed to the ram. The lever, M, and the gearing carried on it, are counterbalanced by a

weight, O. It will be seen that the action of the winches will produce a slow and powerful action of the elevating pinion, by the combination of a tangent screw and worm-wheel; and that there is no danger from the winches to the men. The rack ensures a constant hold on the pinion, which can be instantly disconnected by pulling the cord.

327. Kenney's Patent Balanced Rolling Bridge; Turner and Gibson, Hammersmith Iron Works, Dublin.

328. Plan for a New System of Iron Shipbuilding; Henry Harris, Newport, Isle of Wight.

This invention consists in forming the vessel in two distinct parts. The lower part or hull contains the hold, 200 feet long, 40 feet wide, and 30 feet deep, along the centre of which and firmly attached thereto is an iron keel, which is continued to the depth of 15 feet, to the bottom of which are likewise firmly attached iron ribs surrounding the hull, with iron crossings and bearings connecting the ribs with the hold and keel. The numerous compartments thus formed contain buoyant substances, so that the whole when complete will form a solid mass of buoyant substance, 15 feet thick all round the hull.

329. Improved Log for taking Soundings; J. Grafton Jones, 4, Cambridge-villas, Battersea, S.W.

With this instrument the depth of water is ascertained by the pressure of the water acting against confined air. The degree of compression, and consequently the height of the column of water necessary to give the compression, is shown upon a graduated scale. In the drawing Fig. 1 is an exterior view, and Fig. 2 is a section (in each of the figures the same letters are used for like parts); A, A^1, is the outer casing, jointed together by the union piece, A^2, through which the plunger rod, B, works. On the top of the plunger rod there is a flange, B^1, against which two stops, A^3, A^3, press, forcing the plunger rod a short distance into the air tube, C (which is made of vulcanised india rubber). so as to keep the plunger rod pressed up to the starting point on the graduated scale D, which is divided into fathoms. D^1 is a pointer, capable of sliding in the groove D^2 when pressed on by the flange on the end of the plunger rod; it has sufficient friction given to it, by a spring at the back, to retain it on any part of the graduated scale to which it may be forced by the descent of the plunger rod B. E is an eye to which the rope is attached. The action of the instrument is as follows:—As it descends in the water the plunger rod, B, is gradually pressed down by the increasing column of water, its end forcing in the end of the india-rubber air tube; the air contained in the tube having no means of escape, is compressed with a force corresponding with the vertical height of the column of water. As the instrument is drawn up through the water the plunger rod gradually returns to its former position, the pointer remaining behind shewing upon the graduated scale the exact depth of the water. The graduated scale shown in the drawing is only marked up to 50 fathoms, but this may be extended so as to measure any depth.

330. Apparatus for Registering and Printing the Vibration of Strings; J. H. Griesbach, 19, Carlton-road, Maida Vale, W.

(See specimen No. 114.)

331. Patent Machine for Preparing Grain; Garrett and Son, Leiston Works, Saxmundham.

This machine is adapted for preparing all kinds of grain for market in one operation, effectually and economically. The principal novelty in the machine is in the dressing apparatus, where, by the introduction of a fan of an improved description, the necessary blasts are produced simultaneously, instead of employing three separate blowers, with the requisite machinery for each, to effect this purpose. The machine is materially less in bulk and weight than those on the old principle, and is therefore worked with less power, and it has less than half the number of wearing parts.

332. Patent Victoria Side-Delivery Reaping Machine; R. Hellard, Taunton.

(See Model No. 176.)

333. Reed's Patent Portable Anchor; Holsgrove and Reed, Trimdon Iron Works, Sunderland.

(See Model No. 93.)

334. Patent Breech-loading Guns and Rifles; McKenzie and Wentworth. Exhibited by W. Strode, 16, St. Martin's-le-Grand, E.C.

The drawings marked A, show three arrangements of breech-loading guns, in which tubular screw collars are employed to draw the end of the barrel up to the end of a moveable tilting breech, the parts which come together having conical surfaces which fit into each other to form a perfectly tight joint. In the first arrangement the screw collar is formed with a screw thread, which screws on the end of the frame on which the barrel slides, the screw collar being connected with the barrel by a collar, which rotates between two other collars placed on the barrel. In the second arrangement the tubular screw collar is formed with right and left handed screw threads, one of which screws on to the frame in which the barrel slides, and the other on to the barrel, by which arrangement the barrel is very quickly drawn up to make joint with the tilting breech. In the third arrangement the tubular screw collar, formed with the right and left-handed screw, is placed behind the tilting breech, the partial rotation of it drawing the barrel up to make joint with the tilting breech. The drawing, marked B shows an arrangement of breech-loading guns or rifles, in which combinations of right and left-handed screws are employed for forcing a moveable breech-piece into position, to make a perfectly tight joint between it and the barrel. In this arrangement a screw socket is formed in the frame, behind the breech-piece, which is capable of sliding to and fro in the frame, and tilting into an inclined position to receive the charge. In the screw socket a tubular screw works, having screw threads on its internal and external surfaces cut in reverse directions—the one being a right and

the other a left-handed screw; and in the internal screw there is a screw-plug, which is connected by links to trunnions fixed on the tilting breech-piece, the trunnions and links sliding to and fro in slots in the frame. The tubular screw is formed with a stem or axis, on which a short lever is fixed, and by which the moveable breech-piece is placed in a position to receive the charge, or to make joint with the end of the barrel, which is fixed to the frame as shown. The axis of the tubular screw also acts on a lever, to tilt and lower the breech piece. (See Specimen No. 101).

335. Gwyn's Patent Breech Loading Gun or Rifle; Tongue and Birkbeck, 34, Southampton-buildings, E.C.

The invention consists in so arranging a moveable breech that by the movement of the trigger-guard the breech is placed in an inclined position to receive the charge, and again moved into a line with the barrel, a cam surface being employed to hold it firmly in position.

336. Builder's Hoist; George Johnson, Easthill, Wandsworth, S.W.

(See model, No. 197.)

337. Wright's Patent Calorifer; Crichley Wright and Co., Sheffield.

(See specimen, No. 207.)

338. Ottoman Fire Escape; Dr. R. G. Hill, Inverness-lodge, Brentford, S.W.

(See specimen, No. 200.)

339. Patent Improved Compensating Wet Gas Meter; A. Allan, Bellevue-house, Perth.

(See specimen, No. 220.)

340. Cinder Sifter; John Greenfield, 12, Speedwell-street, Oxford.

341. Inodorous Sewerage and Drainage Apparatus; John Whitelaw, Dunfermline. Exhibited by W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

The object of this invention is to so arrange the apparatus that whilst the sewage and drainage matters shall have free discharge, all effluvia from them is prevented. The trap, or sewer, and drain chamber is so contrived that the fluid matters discharged from the road or street are caused to flow into a receiver through a hinged grating into the body of the trap-chamber. From this the matters flow off beneath a hanging diaphragm, thence passing off to the other side, over the top of a second diaphragm, down to the main sewer or discharge duct.

342. Plan for the Purification of the Thames; Henry Harris, Newport, Isle of Wight.

This plan consists in turning the course of the river above Chelsea, so as to admit of the bed of the river being thoroughly cleansed, as well as the embankments improved.

343. Patent Hand Boxes for Travellers; John Raphael Isaac, 62, Castle-st., Liverpool.

The object of this invention is to combine the dressing case, hat or bonnet box, hand bag, stationery case, &c., in one package, not larger than the ordinary sized band box.

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Journal of the Society of Arts.

FRIDAY, APRIL 13, 1860.

INTERNATIONAL EXHIBITION of 1862.

The Council of the Society of Arts are engaged in forming a Guarantee Fund, in order to carry out the International Exhibition of 1862. The principal conditions of the Guarantee agreement are :—

1st. That no Subscriber will incur any liability until at least £250,000 have been guaranteed.

2nd. That no calls will be made unless it should happen that, contrary to the experience of the Exhibition of 1851, when there was a surplus of nearly £200,000, there should be a loss, when the call will be *pro rata.*

3rd. Any surplus will be at the disposal of the Guarantors, for the promotion of Arts, Manufactures, and Commerce.

4th. The Trustees and Managers of the Exhibition named, are :—

The Earl Granville, K.G., Lord President of the Privy Council, Vice-President of the Society of Arts.
The Marquis of Chandos, Chairman of the London and North Western Railway.
Thomas Baring, Esq, M.P., } Royal Commissioners
C. Wentworth Dilke, Esq., } for the Exhibition of
Vice-Pres. Soc. of Arts, } 1851.
Thomas Fairbairn, Esq., Chairman of the Manchester Art Treasures Exhibition.

The Council do not propose to limit the fund to the £250,000 named, but, having secured that sum, they will endeavour to increase it as much as possible. Already a few Members of the Society, and other persons and bodies, have promised their names as Guarantors to the amount of £170,000.

A circular letter has been addressed to the Members of the Society, drawing their attention to the importance of filling up the Guarantee List as soon as possible, and those Members and their friends who are desirous of giving their assistance to this undertaking, are requested to send in their names to the Secretary of the Society of Arts as early as possible, with the sums they are willing to guarantee.

The amounts guaranteed by individuals vary from £10,000 to £100.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection. Any persons having in their possession works by Sir Wm. Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session ; the first on Saturday, the 28th April, at the Society's house, the card for which will admit the Member only ; the second on Saturday, the 26th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday last, the 9th instant, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

EIGHTEENTH ORDINARY MEETING.

Wednesday, April 11, 1860.

The Eighteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 11th instant, Apsley Pellatt, Esq., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Charlesworth, Ed., F.G.S.	Hall, Walter
Davies, Herbert, M.D.	Macnaughten, Stewart
Defries, Moss	Young, Alexander

The Paper read was—

ON STONEWARE.

By Edwin Goddard.

In presuming to address such an audience as the present, I have undertaken a task which it will be my desire to perform briefly, and, without claiming anything original in my treatment of the subject, I shall endeavour to interest you for a short period whilst, as clearly as I can, I detail a few facts and figures relative to stoneware. I am sustained in my presumptuous effort by feeling assured that my crude remarks will be accepted in that spirit of indulgence so characteristic of this Society. The many adaptations of stoneware to the wants of life, its active participation in the great strides which trade has made in the last quarter of a century, and its not unimportant position in British manufacture, would appear to entitle it to the notice of a Society for the Encouragement of Arts, Manufactures and Commerce, and the fact, that with these apparent claims to your consideration it has not been included in the many papers which have been read in this room, joined with the hope that the manufacture, though only "over the water," might be foreign to some of you, must be my apology for placing the subject and myself so prominently before your notice this evening.

The following definition of stoneware is from the Hand-book of the Official Catalogue of the Great Exhibition of 1851 :—"Stoneware is a dense and highly vitrified material, impervious to the action of acids, and of peculiar strength ; it differs from all other kinds of glazed earthenware in this important respect—that the glazing is the actual material itself, fused together." This description is perhaps vague, and though I believe

intended to characterise the London-made goods, would equally apply to a large portion made in Staffordshire and elsewhere. As I purpose, however, to confine my remarks exclusively to the stoneware as made in Lambeth, which has always been the chief seat of manufacture, you will kindly understand that I use the term in its general acceptation—that of a "stone," or vitrified body, the surface of which is coated with a glass or glaze formed at a high heat by the combination thereon of a portion of silica (a constituent of its own) with the soda of decomposed salt in a state of vapour, generated by throwing salt into the kilns when the requisite heat is attained.

Though pottery, or the art of forming vessels from clay, is as old as the hills of which it is made, I have no facts to assure me that stoneware is of so ancient a date. A Captain Grose, or any one equally curious in such matters, might find for it a pedigree as long as any morsel of a superior kind of clay might desire; he might pursue backward its history until he found the stoneware coffin of the present day the degenerate descendant of the sarcophagus of a Pharaoh, or the Portland Vase the patrician progenitor of the present pitcher, but as such respectable antecedents would not enhance its value in the eyes of its consumer, I shall only call your attention to its utility.

In so doing I name its only title to your respect; it has none of those enrichments and embellishments which give rise to love at first sight; it is too plain to throw into raptures any pilgrim in pursuit of the beautiful; it stands in very unadorned simplicity, valueless except in its capability to perform offices of the most plebeian character. Thus viewed, it is not surprising that we find few chroniclers of its progress as a trade.

I have been unable to ascertain with certainty at what date stoneware was first made in Lambeth, it is certain, however, that three generations ago the little trade there was then was principally in what is called Delftware, indeed the last indication in the shape of a Delft signboard if I may so call it, has quite recently been removed from Mr. Stiff's pottery in High-street, in building new premises. As far back, however, as 1570, we find potters crying aloud for protection. Stowe, in his Survey of London, speaking of the potters, says:—"About the year 1567, Jasper Andries and Jacob Janson, potters, came away from Antwerp, to avoid the persecution there, and settled themselves in Norwich, where they followed their trade, making galley paving tiles and apothecaries' vessels and others very artificially. Anno 1570, they removed to London. They set forth in a petition to Queen Elizabeth, that they were the first that brought in and exercised the said science in this realm, and were at great charges before they could find the materials in this realm. They beseeched her, in recompense of their great cost and charges, that she would grant them house room in or without the liberties of London by the water side."

In the year 1688 two brothers, of the name of Elers, came from Nuremberg, and located themselves in Staffordshire, the then seat of manufacture. Here they stayed for about 20 years, practising their trade with the greatest secresy, and subjecting themselves to considerable annoyance thereby. With all their precautions of building a high wall around their premises, and employing idiots to do their labour, they could not succeed in keeping secret their manufacturing processes, and about 1710 they removed in disgust from Staffordshire to Lambeth or Chelsea. Others affirm that their removal was in consequence of persecution on account of the volumes of smoke emitted from their kilns, and inseparable from the manufacture; if so it may be inferred that Lambeth was more indulgent than at the present day. "Too often," says a writer of 1837, "does research develop instances in which the existence of many of the arts has depended on police regulations; and manufacturing industry, also the manufacturer's welfare, has been rested on the frail basis of the caprice of a magistrate. Driven by ignorance, prejudice, jealousy, to a distance from materials, workmen, or market, some manufacturers continue to endeavour to surmount the obstacles which oppose their progress, and maintain a disadvantageous struggle with the difficulties of their situation." To the brothers Elers is ascribed the introduction of the salt glaze. How long they practised in Lambeth or Chelsea, whether they were the founders of the trade, or whether the before mentioned Andries and Janson were there before them, I have been unable at present to ascertain. A backward flight of forty years, however, will suffice to show how rapidly the trade has since been developed. I am sorry that the little time which successive snatches from business really amounts to has not sufficed to allow me to fill up the intervening century.

Forty years ago commerce had not received those aids and appliances which steam was destined to bring it; railways were only looming in the distance; the cheap postage might have been an embryo in the brains of the suggester, but no more; conveyance of all kinds was very slow and expensive, and necessarily operated strongly against so cheap an article as stoneware; raw material was not so readily obtained; salt, an important article to the stoneware potter, was taxed to an exorbitant extent—it then cost more pounds per ton than it now does shillings—a tax, moreover, was upon all goods of a certain size, and free trade had in no way blessed the land. In the face of these impediments it is not to be wondered at that the market was limited, and a healthy expansion of the trade prevented. The potters then in Lambeth were in number some six or seven, working some sixteen small kilns of seven or eight feet in diameter, the produce of each kiln being under £20 worth of ware, the principal articles made being blacking bottles, ginger-beer bottles (very extensively made still), porter and cider bottles (not so largely made now), spruce-beer bottles (gone with the beer quite out of fashion), ink bottles (more used now than ever), oil bottles, pickle jars, hunting jugs, &c. A few chemical vessels were also turned out well from one kiln belonging to an eccentric individual, whose chief boast was to drink a gallon of beer a day, and do without rest on Sundays. The introduction of new blood and energy, however, induced an active competition, and soon sent them to other fields, and stoneware was found to be just the thing for articles which were previously unthought of, but which now, with others, form standard products. The trade gradually assumed a healthy vigour, and steadily increased up to the period when the Board of Sewers discovered the advantages of stoneware drain-pipes, and the subsequent overwhelming demand for them completed what energy and enterprise had begun, and brought the trade up to its present position.

In this space of 25 years, many improvements in machinery had been effected, and many new articles introduced: among the former I may mention string wheels in lieu of the so-called "kickers," by which the workman was enabled to make more articles, and the price was consequently lowered. Another introduction was that of moulds for flat bottles; the practice previously had been to throw them on the wheel round, and then to flatten the sides to the requisite shape—the result, as compared with the moulded ones will be seen by the two specimens on the table. The mould also insures the bottles being of one size, which is not always the case with thrown bottles. Other moulded articles quickly followed to a very large extent, and now continue. The turning lathe, for giving a greater finish to articles requiring it than can be done on the wheel, was also an introduction of this period. It enables the clay to be cut into any form by taking the article in stiff clay, which can then be worked like a very soft wood. Sharp outlines can be well defined, and running ornaments thrown up with clearness and precision.

Among the manufactured goods introduced, I may mention filters, the necessity for which is still ignored by the mass of the public, and the construction very imperfectly understood. Their introduction to any extent is due to the celebrated Mr. George Robins, and the quantity made for him and scattered broad-cast through the land is most sur-

prising. The utmost means of Messrs. Stephen Green, and Doulton and Watts were insufficient for a time to meet his requirements. The filter trade is still a very important item in the Lambeth potteries, and large quantities are annually exported. No article in domestic use is more indebted to stoneware than the filter, and few have had more attempts made to improve them; in fact, amateurs, professionals, scientific men, and country gentlemen, are all in the habit of inventing filters; as the best of them, however, will clog itself up in time, that is of most value which will hold out the longest. Here I may refer to a company, either formed or upon the point of forming, having in view the remedy of these drawbacks, in, as I think, the only practicable way. They are to supply a cheap filter at a rent of a few shillings annually, to be placed in the cisterns of the house to be supplied. It is a vessel of stoneware, of a simple form, having a pipe attached, with tap to draw over the side; it is filled chiefly with animal charcoal, arranged to filter quickly. Any number of these can be placed in a cistern, and when they become clogged can be replaced by new ones—that is to say, with new charcoal, &c. When we consider the importance of pure water, and the difficulty, according to Drs. Lankester, Letheby, and others, of obtaining it, any attempt to secure it for us cannot be too highly estimated,

The clay best suited for making stoneware is brought from Devonshire or Dorsetshire, and recently a deposit has been found at Farnham, in Surrey; the main supply, however, is from the two first counties. Cornwall sends a small proportion of prepared clay, which though principally used for chinaware, is nevertheless in a degree employed in Lambeth. The best quality of stoneware clay is found at depths varying from 20 to 50 feet from the surface. After cutting through an upper deposit of waste mould, &c., 10 to 40 feet thick, we reach a very aluminous bed of clay, about 3 feet thick, called "Tough Tom;" beneath this is a bed of a very useful clay for the common kinds of ware, from 5 to 10 feet thick; to this succeeds 4 to 5 feet of "Domestic" clay, used in the north of England very largely for whitening stone steps, &c., which brings us to the stoneware clay proper, from 10 to 16 feet thick. Beneath this is the tobacco pipe clay, formerly used for the same purpose as the best white clay is now, until about some forty-five years ago, when, at the suggestion of Mr. Duggan, the London proprietor of the stoneware clay, Mr. Stephen Green's father introduced it as a substitute for the tobacco pipe clay, which it has now quite supplanted. I may here add that to Mr. Stephen Green is due the introduction of the string wheels, the moulds for bottles, and the turning lathes before alluded to.

To procure the clay an upright rectangular shaft is sunk until the required kind of clay is reached, the sides of the shaft being prevented from collapsing by stays and cross beams. The clay is cut into uniform oblong lumps, of about 30 lbs. each, and stacked awhile in sheds, to get rid of superfluous moisture, and is then shipped by steamer or sailing vessel to London, unloaded with barges, and delivered at the various wharves on the river, where it is again stowed in open sheds, this time with heated flues beneath the floors, or about the kilns or any other place where the evaporation can be accelerated. When the balls of clay become dry and compact, or as it is called "white hard," they are forwarded to a crushing mill, whence the clay issues in a moderately fine powder; the necessary mixtures of other clays, &c., are then made for the different kinds of ware required. These mixtures vary with different potters, but speaking generally I may say all small ware up to 2 quarts is made from white clay alone, whilst larger vessels have increased quantities of strong clay, sand, rough stuff, *i.e.* pulverised burnt ware, or other ingredients to meet the requirements of strength, liability to fly to pieces in the bu ning, or to stunt and crack in the cooling, &c. Chemical vessels which are subjected to the action of acids, alkalies, sudden expansions or contractions, &c., require above all others a careful and complex mixing. The powdered clays are now ready for the pugmill or kneading process; formerly, after the clay was ground it was spread on the floor in the way that a bricklayer mixes his lime and sand to make mortar, and after being thus mixed was trodden out with the naked feet, and so welded together; it was then thrown on one side in a heap, and allowed to lie and mellow, or become a mass of an equalized consistency; this mode is still practised to some extent where time is not an object. However, it is impracticable for a large demand, and, therefore, various machines are in work for this kneading process, differing in minor particulars only, and I shall confine my description to one kind, which performs its work admirably.

The pug mill is an upright iron cylinder, some six feet high, and, say, 18 inches in diameter, with a rotatory shaft passing vertically through its centre. To this shaft are attached a number of blunt knives, so disposed as to form a disjointed Archimedean screw; to these are opposed similar knives, projecting from the interior of the cylinder. The shaft being set in motion by overhead gearing, the clay, which is poured in at the top with a graduated supply of water, is, by the form of the screw, propelled towards the bottom of the cylinder. In its passage downwards the action of the knives is changed from a rapid cutting motion to that of cutting and pressing, and by the time it is ejected from the bottom of the machine, it is pressed into almost a fit state for the thrower. The action of the above mixing process is assisted by sectional gratings at certain distances in the cylinder, which is also provided with openings and doors, that any part may be the more easily repaired when damaged.

The clay is divided into lumps something like the original form, and either stacked away in walls or conveyed by lifting machinery to the different floors for distribution to the throwers and moulders. As it is essential that the clay, when received by the workman, should be free from all irregularity of substance, it is again subjected to another sort of kneading called wedging, which is simply the repeated cutting in two (done by a length of wire with a handle at each end) and the lifting of one half and throwing it anglewise forcibly upon the other; by this means air bubbles, &c., are liberated, which if allowed to remain and worked into a vessel, would expand whilst burning, and so destroy it. Portions, in accordance with the size of the vessel required, are then handed to the workman, whose first action is to dash the lump forcibly on the revolving wheel, working it between his fingers, first to a hollow column and then to a flat disc as a last assurance that foreign bodies are dispelled. The potter's wheel is probably known to you simply as a turning lathe, with its mandril in a vertical position, instead of, as usual, a horizontal one. By this means a flat revolving table is obtained, on which the workman forms his vessel; the motion of the wheel is accelerated or retarded as the shape of the vessel may require, and very beautiful it is to see the apparent ease with which the workman makes the clay "firm to his hand—obedient to his will." No form is strange to the experienced hand, though it requires years of assiduous industry to become one. The acquired expertness which some attain in this department may be judged from the fact that one man can make as many as 160 bottles for ginger beer in an hour, or at the rate of nearly three per minute, from as many shapeless lumps of clay, and when it is remembered they have to be true to the guage for height, width, and internal capacity, it forcibly shows the power of practice. Most of the smaller articles at this stage, after being put by for a while to become white-hard, are ready for the glazing and burning, but many which require a more finished appearance are smoothed by a turning lathe proper. On the time of drying, and careful attention that it is not forced, depends in a great measure the safety of the vessels when in use.

In the case of chemical apparatus, required to stand sudden alterations of temperature, it is requisite the pre-

paratory drying should be as slow as possible, to prevent irregular contractions from the first. It has frequently been suggested that machinery, so potent in other manufactures, might be substituted for manual labour at the wheel, but the perfect blending together of the atoms between the workman's finger, which is of paramount importance, has always been considered an insurmountable obstacle. This manipulation is nowhere more manifest than in the making of vessels of great capacity (one of which, containing 300 gallons, I should have had here to-night, but, like the vicar's picture, it would have been too large for the door). It is necessary, like the marten with her nest, to make them in layers, so as to secure the hardening of one layer before the next is put upon it. A jar of this kind will, therefore, require some half-a-dozen different rings of moist clay at different intervals, worked one upon the other, and when it is remembered that each layer of clay has to shrink a considerable extent, and that according to the shape of the vessel these shrinkings will vary, and that, in the burning, if one portion shrinks more than is reckoned for, the vessel is either distorted or destroyed, it is no mean certificate to a manufacturer to perfect such goods, which can only be accomplished with great care. Indeed, care or incessant vigilance is the mainspring of a potter's success. He must be always on the *qui vive* to forestall a chance of error, and numberless are the little opportunities to give strength to the proverb of "a stitch in time saves nine."

At the commencement of this paper I stated that my remarks would chiefly, if not exclusively, apply to stoneware, or salt-glazed ware. As, however, the more fastidious taste of late years has almost ignored the use of salt-glaze for articles of domestic use, the present appearance of Lambeth ware is not of stone but of a dipped glaze. This kind, called "double-glaze," from being glazed by two processes, one inside and one out, ensures an uniformity of colour which cannot be produced in the salt-glaze; and whilst the latter, from its being part and parcel of the vessel itself, is the best, the former is thought to have a better appearance. It is secured by dipping the article into a composition of glass, Cornish stone, and other ingredients, fusible at a high degree of heat. For large vessels this is, of course, impracticable; nor is it adapted to resist the action of acid to the same extent. Now the heat to fuse these ingredients is about the same as that required to convert salt into a glaze, hence the simple plan of throwing salt into the kiln.

The constituents of the clay being about two-thirds silica and the remainder alumina, with a little alkali, when the kiln is at the highest (suppose about 1,900 deg. Fahr.) the ware is in the condition requisite to take up a certain amount of the soda contained in the salt vapour. The two combining not only deposit a surface of glaze on the vessel, but the glass thus formed permeates the interstices of the fine particles, thus becoming incorporate with the body, as is easily seen under a lens. Whilst at this point, permit me to draw your attention to a paragraph from the Jurors' Report of class 27, in the Exhibition of 1851; it refers to stoneware thus:—"In addition to the high degree of firing, the glaze, instead of being applied by dipping, as is usual with earthenware, is produced by throwing into the furnace, at a certain stage of the process, a quantity of coarse salt, which is instantly vapourised by the intense heat, and this vapour, penetrating to every part of the kiln, produces decomposition where it touches the vessels that are being baked; a film of glass is formed by the combination of a portion of the silica of the clay surface with the soda, while any iron that exists is brought to the surface, becomes oxidised, and gives a tint of colour, apparently also adding to the strength of the glaze."

This assertion, from so high an authority as the writer of that report, is of so much weight as to appear beyond question, but instances apparently pointing to the reverse are so frequently turning up that I feel justified in reverting to them. I have a chemist's ladle with the film of glass formed by the combination of the silica and soda, which could only be done at a very high heat; and yet, if colour is an indication of the presence of iron, none is brought to the surface; on the other side, it will be seen to have the colour, but is deficient of the glaze. What, then, is the cause of this? If the professor is right in stating that it is the salt that brings the iron to the surface, why is it not coloured all over? And if the brown colour, said to be the iron, adds strength to the glaze, where is the glaze on this side that it is to strengthen? My belief is that the brown colour is due only to the foreign matter brought up by the flame during the salting process, and deposited on the vessel wherever the flame licks it. It is the very fine incombustible particles of the fuel; and if the article could be kept from the flame, and supplied with salt and oxygen, a colourless glaze would be produced. If the vessel on the table be examined, it will be found to be covered with a multitude of small colourless dots: in the centre of each of these is a very small hole, filled, however, with the glaze. I account for this appearance in the following manner:—The small hole of course is one of the interstices which the evaporation had left unfilled before the glaze was applied; when the boiling glaze reached it and covered it, the air expanded in the form of a small bubble, driving backward, in a circle, all the fine particles brought up with the flame, and when the bubble bursts, the recoil, as it were, is not sufficient to counteract the attraction of the body of the vessel, and they are left in a circle instead of being gathered together. If this is the case it would prove that the colour is conveyed to the ware, not drawn out of it, and, as far as strength is concerned, it makes no difference at all. I have said thus much, because, as a general rule, brown ware is preferred, as being most burnt, when, provided the glaze is on the paler sort, it is equally good and much handsomer.

There are three kinds of kilns used in Lambeth:—The Staffordshire, or slab kiln, the saggar kiln, and the patent kiln. The first may be described, when viewed from the inside, as a circular structure, 12 to 16 feet in diameter, with a flattened dome, surmounted by a conical chimney. It is built of good stock bricks, with the walls some 3 feet thick, and a lining throughout of the best fire-bricks; through the ceiling or dome are a number of holes, to admit of the egress of the smoke, and also for glazing by salt. There are several openings around the base of the kiln through which the fire is introduced, around the sides are a number of shelves or cupboards, formed by slabs of fire-clay, to contain the smaller ware; other shelves, as the kiln is filled, are extended from side to side, and the large ware piled upon the top, and on each other, finishes the setting; the doorway through which the articles were carried is bricked up, and the burner lights his fires; to each fire is a flue or chimney leading into the body of the kiln, but with perforations to admit the fire also to the bottom. With frequent replenishings of the fires the heat enclosed is rapidly increased, and in the space of 40 to 48 hours, according to the size of the kiln, a whitish heat is attained, and at about 1,900 degrees is the time for salting; the skill of the burner is proved by the fact that a few fires too many at this point would bring the whole to a melting state, whilst one or two fires too few would fail to form the glaze. The firing is then discontinued, and all access of air stayed, and in about the same time as that required to reach the heat the kiln becomes cool enough to draw.

Another mode of burning is in saggars, or circular boxes, made of fire-clay, which, being filled with ware, are piled one above the other, the bottom of one being the lid for the other beneath it, and thus forming so many tall columns of boxes. This mode is only well adapted for small ware.

The third kind is a recent invention, being patented in 1858, by Mr. John Cliff, of the Imperial Potteries, Lambeth. A model of it was shown last year in your Exhibition of Inventions.

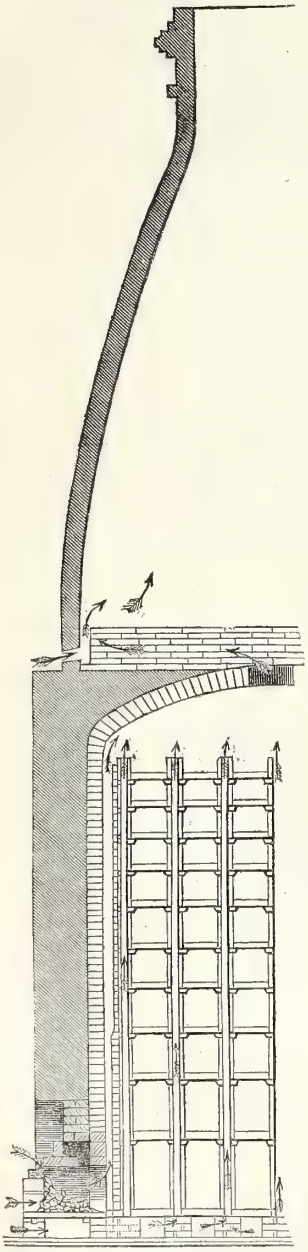
The invention has for its objects, firstly, great economy of space; secondly, economy of fuel; and thirdly,

the more thoroughly consuming of the smoke than by kilns of the ordinary kinds.

In the accompanying woodcuts, figure 1 is a vertical section of half a kiln of this kind, and figure 2 a plan.

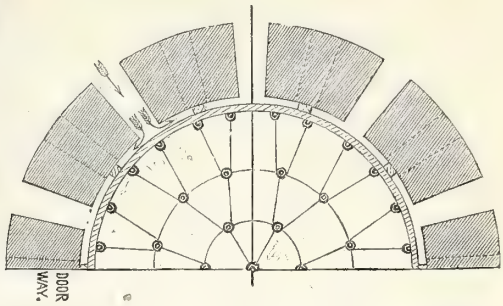
To effect the economy in space there is built within the lining proper of the kiln, and at various distances from it (according to circumstances), a second lining from the floor to the level of the commencement of the arch of the kiln, leaving an annular space round the entire kiln (supposing it to be circular), from the base or floor line to the spring of the dome; at the base of this circular flue, and at intervals, are holes to connect it with a hollow chamber under the floor

Fig. 1.



of the kiln, in which floor are left a number of holes at proper distances, over which are erected a series of perpendicular flues, terminating on a level with the before-mentioned inner lining or slightly above it by the means of variable lengths of hollow pillars and collars of larger

Fig. 2.



diameter, as shewn. These variable lengths of pillar and collar allow of constructing quarry floorings across the kiln at any desired height, and thus utilize a large amount of space hitherto impracticable. The floor of the kiln and the top tier are fitted close, so that during the burning no flame, smoke, or draught can approach the ware, thus effecting a rapid accumulation of heat within the kiln to the point required, and by the removal of one quarry opposite the door or entrance to the kiln, and four or five slabs from each tier of the middle row (supposing the kiln to be circular), the kiln can be filled and emptied with an amount of ease and rapidity not attainable in the ordinary mode.

To effect the combustion of the smoke, cold air is introduced by means of an opening from the front of and on the top of each fire arch behind the burning fuel. The smoke in its passage up the narrow annular flue, and up the hollow pillars, by being so much divided, and having to travel over so much more than the ordinary heated surface, is more efficiently consumed, and is again met at its exit into the funnel, by streams of atmospheric air passing in at openings through the base of the same.

It will appear by the above that the products of the fuel are more equally distributed through the body of the kiln, that the heat necessary is more rapidly generated than in kilns of ordinary construction, and a consequent reduction is made in the quantity of fuel used. The same means that admit of more rapidly heating the kiln apply also to the cooling of the same, thus allowing larger kilns to be filled and emptied within a stipulated time.

A kiln of this description, fourteen feet in diameter, will burn £100 worth of ware with about eleven tons of coals, whilst a man, with four boys in turns, may set, burn, and draw it once every week, at a breakage loss of about nine per cent.

The improvements in machinery, &c., made to meet the increasing demand for stoneware have of course helped its extension, and in the laboratory, for sanitary improvements, or domestic use, it plays an important part. I before remarked on the impetus the trade had received when drain-pipes in stoneware were adopted; now, as these have to conduct sewage containing the strongest elements of decaying and decayed matter, it becomes a primary necessity that the conduits should neither absorb, nor in any way retard the flow, accordingly, the first object of the Lambeth potters is to secure a thoroughly vitrified body with a perfectly smooth internal surface. Their system of glazing by salt had the advantage of securing these *desiderata*, inasmuch as no glaze could be formed if the heat was insufficient, therefore a pipe deficient in glaze would show that it was short of burning also. However, the mistake which in the trade is too likely to be made, of considering low-priced goods as cheap goods, has been the means of bringing inferior pipes into the trade, so that many with partial burning

and common clay are little better than a common redware pipe. Mr. Northen is admitted to be the original maker of pipes in Lambeth, and Messrs. Doulton, at the present time, are the most extensive. At one time there were forty kilns in Lambeth burning pipes; and allowing them to be filled with 9-inch, 6-inch, and 4-inch pipes, to the value in gross of say £50, these kilns would be turning out nearly 600 miles per annum.

The laboratory is supplied with stills, and jars from 1 to 300 gallons, condensers, worms, pipes and pumps for conveying acids, jugs and ladles for lifting, and funnels for straining. Candle makers are largely supplied with copper-shaped pans, and dyers with another kind. Electro-gilders and platers use baths of the same character. Export merchants are supplied with bottles, pickle jars, jam jars, air-tight and otherwise—articles of recent introduction, and very largely exported—also ginger beer bottles, pale ale and porter bottles, &c. Distillers, wine and spirit merchants, have barrels, bottles, or cans, flat bottles, &c.

The domestic uses are more numerous than select, Staffordshire ware being more approved, except for beer jugs, blacking bottles, warmers, butter pots, and others of a like character.

Druggist's pots, tobacconist's jars, insulators for telegraphic wires, and tanks for aquariums, are all made of stoneware, besides a numerous array of vessels and apparatus for individuals of all trades and requirements, sometimes the sport of over-sanguine speculators and inventors, at other times a cheap assistance to a valuable discovery.

The present state of trade in Lambeth, when contrasted with its position at the period I commenced, affords a satisfactory picture. In place of some sixteen kilns, turning out each under £20 per kiln, we have now about 70, turning out each perhaps on an average £50. They consume upwards of 20,000 tons of coals, paying a corporation tax of say £2,100 per annum. The law requires this quantity to be burnt without smoke, and after immense cost and labour, this difficulty may be called surmounted. Twenty-three thousand tons of clay are annually changed into useful articles, giving employment to more than 800 persons. The returns of the Lambeth potters cannot be estimated at less than £140,000.

Gratifying as these results may be, and forcibly apparent as is the progress made, it is equally certain that much more remains to be done. When in the short space of forty years so much has been accomplished, the trade as it were in its infancy, we have a right still to hope for greater things, not only in the new markets daily opening up in foreign countries, or in the new uses which may be suggested for the articles, but the manufacture itself is still in the land of darkness—the lamp of science does not shine in Lambeth. We hear of chemistry applied to the arts, but as yet stoneware is not among them. It is with the greatest respect that I assert that the potter knows little of the chemical constituents of the material he has to work and burn. The result of this ignorance is, that experiments are often failing from undiscoverable causes, glazes peel off, run off, fail to shine when they have been treated in the same manner as usual, the fault being in the materials themselves, the quality of which can be ascertained by a chemist only, and not by the potter until too late for remedy.

I maintain, then, that every potter should be his own chemist, so far as his trade is concerned. He should have at his fingers' ends the qualities and actions of each element he has to use, composed and decomposed, and when he is as perfectly *au fait* with his chemistry as he is at present with other branches, he will have added a new dignity to his ancient calling, and will enjoy his success all the more by having deserved it.

DISCUSSION.

Dr. Chambers, having been called upon by the Chairman, said that although he was not particularly acquainted with the manufacture of stoneware, he had placed on the table some specimens, one of which was a remarkable instance of the employment of that material. The specimen he held in his hand was probably made about 1,400 years ago. It was a stoneware pipe, taken from a villa at Ostia, of the time of Hadrian, and was used for conveying heat from a central stove over the whole house, which contained fourteen or fifteen rooms. In the specimen before them no glaze had been used, nor was it required for this purpose. From its appearance, he imagined the pipe had been similar to those which had been made by a method patented of late years, namely, that of squeezing the clay through an opening, similar to the mode in which macaroni was made into small sticks or pipes. The streaks upon the pipe were evidence, in his opinion, that that mode of manufacture was in common use in those days. Such a mode of heating houses was mentioned by Galen and other writers of his time. Mention was also made of a hearth tax, which, in fact, answered to the present house tax; the impost was placed upon the one hearth which formed the heating apparatus for the whole house. The other specimens he had sent were some dinner plates, in ordinary use in some of the Italian provinces, and showed the continuation of the manufacture of stoneware in Italy. In the present day, in that most benighted portion of Europe, the Papal States, a very good description of stoneware was manufactured, nicely glazed; and, what was important for the civilization of the people, decorated with good artistic etchings, which were different on every plate. This ware was exceedingly light and pleasant to the touch, and showed that the manufacture of stoneware was not extinct in a country to which Great Britain might be said to have been originally indebted for the manufacture of pottery.

Mr. Stephen Green could not add much to the information given upon this subject in Mr. Goddards paper. The outline given of the trade as it at present existed, and as it had been developed during the last quarter of a century, he believed was quite correct, and he thought did not admit of much addition. The Roman pipe which Dr. Chambers had spoken of, was made with a description of fire clay, and for the purpose for which it was employed required no glazing. The same quality of article was made at the present time in large quantities in different parts of the country. Better pipes than that exhibited were made at Lambeth.

Dr. Chambers inquired, whether in Mr. Green's opinion the lines upon this pipe indicated that it was made by being squeezed through an opening as he had suggested?

Mr. Stephen Green replied that the appearance of the pipe favoured that view, but it was difficult to say precisely whether it was so made or whether it was moulded. If it had been moulded, it had been finished off afterwards, and the rough edges removed; but he imagined that it had been made in the way Mr. Chambers had suggested. The machine usually employed for this purpose at the present day was simply a cylinder with a disc. There were various kinds of pipe-squeezing machines, but that most in use and most in favour, he believed, was the one patented by Mr. Spencer. Several of these machines were in use at Lambeth and elsewhere. He believed there were gentlemen present who had this machine in use, and who could describe it better than he could, as he had never used the machine himself. The apparatus he rather preferred was something like an Archimedean screw, divided into several parts, and did its work very well. The advantage of that plan he considered to be, that the operation was continuous. There was no stoppage to fill the machine with clay. The screw carried the clay down, and the machine worked as fast as the clay was put in. He, however, believed it was not generally considered to be so good a machine as that patented by Mr. Spencer.

Mr. John Doulton said Mr. Goddard had told them, in his concluding remarks, that as potters they were undeserving of success, unless they were not only potters, but also chemists. In no place, and especially not before this So-

ciety, would he wish to say anything to lessen the importance of bringing science, in all its branches, to bear upon every section of manufacture. At the same time, he thought Mr. Green, and other manufacturers of pottery, would bear him out, that the advent of an intelligent chemist into a pottery gave rise to the working out of some curious and interesting theories, though perhaps somewhat expensive. Mr. Goddard had differed from Professor Ansted as to the report he had made as a juror of the Great Exhibition of 1851. The Professor had been charged with not understanding the theory of the colouring of stoneware. As a potter, his (Mr. Doulton's) opinion was that they were both right and both wrong. The chemist's ladle which was exhibited had been brought forward as evidence. The statement of Mr. Goddard was that the colour was conveyed to the ware, and not drawn out of it. He thought the author of the paper was right in saying that the colour was sometimes conveyed to the ware, when the flame licked it and deposited a substance which gave the dark appearance; but he believed that he was wrong in saying that the colour was not also sometimes drawn out. Prof. Ansted did not say that the salt drew out the colour, and he (Mr. Doulton) contended that it was the heat, and not the salt, which produced this effect. Referring to the ladle exhibited, the bottom part was coloured by the flame licking it, and depositing a foreign substance upon it. The white side showed that where it was shielded from the flame, no colour had come out. But he imagined, if they looked into that, they would find that there was a foreign substance in the clay—for instance, iron—and the action of the fire brought it out, and that was doubtless what Professor Ansted meant; the heat brought out the iron in the clay and fused and fixed it on the ware, which gave colour to the surface. The question had been started, what was stoneware? Mr. Goddard had adopted the definition given in the official catalogue of the Great Exhibition, which said, "Stoneware is a dense and highly vitrified material, impervious to the action of acids, and of peculiar strength." He thought that might be taken as a just general definition of stoneware. But it went on to say, "It differs from all other kinds of glazed earthenware in this important respect, that the glazing is the actual material itself fused together." That referred to the *glazed* stoneware—one section only of the manufacture—and he thought Mr. Goddard was wrong in calling that only stoneware which was fused, in which a portion of the silica on the surface of the clay was fused by the salt. Stoneware was, in fact, a dense, impervious, sonorous material, and might be glazed or unglazed. He would put his hand upon three pieces of pottery on the table, all of which were, in his opinion, stoneware, and yet, according to the definition of Mr. Goddard, only one would be stoneware. [Mr. Doulton then pointed out three specimens upon the table, one of which was entirely unglazed, another was glazed by the action of salt thrown into the kiln, and the third by being previously dipped in a liquid glaze.] That which Mr. Goddard would consider as stoneware was the specimen in which the fumes of the salt had formed a salt flux with the silica, and thus put on a thin coating of glaze during the burning. But he (Mr. Doulton) said, whether unglazed or glazed by the fumes of salt, they all came under the denomination of stoneware, and hence they had stoneware of various characters. There was what was called the iron stoneware of Staffordshire, although there was no iron in the clay; but water-jugs (on which there was little or no glaze) were made of this ware in various colours, and they all partook of the character of stoneware. The difference was only in the colouring matter of the clay, or in the glazes which were applied. With regard to the date of the introduction of this ware, although pottery was of most ancient date, he thought this particular description of ware was of modern origin. Formerly our pottery was of a porous nature, and he believed, until within the two last centuries, no ware had been made in England except of that character. The rough description of ware was glazed with lead for a red colour, or with manganese for black; and no ware superior to that was made until the year 1788, when the brothers Elers came from Nuremberg, and settled in Burslem, in the Staffordshire Potteries. He thought the individuals previously referred to by Mr. Goddard brought the knowledge of delft-ware into this country, but the first introduction of salt-glazed stoneware was made by the brothers Elers, who commenced their manufacture at Burslem. It was true they met with difficulties in their manufacture, through the jealousy and suspicion of the people, and, perhaps, naturally so, for during the salting process the dense mass of white smoke was suffocating and hurtful to the chest, and the people, not being acquainted with the nature of the glazing, supposed it to be deleterious; consequently the brothers Elers left the neighbourhood, and came to London; but before this their secret of glazing had been discovered, and the trade was continued in the Staffordshire Potteries, and advanced in an important degree. He regretted that Mr. Goddard, having told them of the introduction of stoneware in 1688, had passed directly from that time to a period within the recollection of many present, some forty years back. He regretted that no reference had been made to that most interesting period which intervened, because they would find that for something like seventy years the manufacture of glazed stoneware had progressed to a wonderful degree in the Staffordshire Potteries, and great improvements were made by the introduction of a finer material, giving the article a lighter appearance. There was a well-known anecdote of Mr. Astbury, who, in travelling on horseback from Burslem to London, stopped at Dunstable to have something done to his horse's foot. Complaining of the state of his horse's eyes, the farrier said he could cure it; and thereupon he placed in the fire a flint-stone, which, upon being calcined, became white. Astbury at once saw that the material thus produced would be suitable for his manufacture, and he took to Staffordshire some flints, calcined them, introduced them into the clay, and produced a beautiful white ware. So the trade went on progressing for more than seventy years, and the ware was adapted to articles of domestic use—breakfast and dinner ware—and brought to a state of great perfection; it was, in fact, the perfection of stoneware. But when Wedgewood, a century ago, made his remarkable discoveries, and found that instead of this salt glaze, which must be given at a degree of heat which often warped and twisted the ware out of shape, he could get a better body, thin in texture, and coat it with a finer glaze applied on the surface, then a great stride was made in the history of earthenware. Very soon after that, most articles for table use were made of that ware, and the manufacture of stoneware was continued for articles for which it was better adapted. Just as upon the discovery of steel, one would not think of using iron knives and forks, so they adopted the Wedgewood ware instead of the ordinary stone ware for the lighter articles of domestic use, though the stoneware was still, like the iron, used for common purposes. He agreed with Mr. Goddard that a rapid advance in this salt-glazing stoneware in London had been made within the last 30 or 40 years. He, however, did not think that Lambeth had always been the principal manufactory of salt-glazed ware. It thrived in Staffordshire for a long period, and he believed that the brothers Elers had made their ware at Chelsea and Fulham, before it was made in Lambeth; but that locality had now become the centre of the salt-glazed ware, although it had been but little developed until within the last 25 years, in fact only since the absurd excise regulations had been removed. A duty was placed upon articles of a certain size, and it cost more to collect the duty than it realised to the Government. When these restrictions were removed, the trade made rapid advances. But there were other reasons for its advance. There was not only the introduction of spring wheels and lathes, but a great impetus was given to the trade by the manufacture of

stone ware drain-pipes, as mentioned by Mr. Goddard. Filters had been referred to as likely to give an impetus to the trade. He was delighted to hear that there was a probability of a still greater demand for filters than was occasioned by the late Mr. George Robins. They were told that a company was either formed, or to be formed, which was to introduce an article to supersede all the old filters, but this was all the information with which they had been favoured. Mr. Goddard had given a description of three kinds of kilns, which he termed the Staffordshire, or slab kiln, the saggar kiln, and the patent kiln. The kiln which Mr. Goddard had designated the old Staffordshire kiln, said to be a kiln with cupboards round it, made up of slabs, and the remaining space filled up with stoneware articles piled one upon another, was not the Staffordshire kiln, but was peculiar to Lambeth. They nowhere in Staffordshire placed their goods one upon another. It was going out of use, but it was the old Lambeth kiln. The next kiln mentioned was the saggar kiln, in which the goods were placed in saggars, or pans, to protect them from the flame. That was, in fact, the Staffordshire kiln; it was not much used in Lambeth, but was almost the only kiln in use in Staffordshire. But Mr. Goddard came to the climax in his description of a kiln patented and used by Mr. Cliff. There was one remark made by Mr. Goddard with respect to that kiln, which he thought would not make his brother potters anxious to use it, and that was that there was about nine per cent. of breakage. He thought they would prefer a kind of kiln which had not been described in the paper, which had slabs or cupboards throughout the kiln, from bottom to top, and which was the kind of kiln now principally used in Lambeth. He thought Mr. Goddard had been unfortunate in his statistics. He had stated 20,000 tons of coals per annum as the consumption of the Lambeth potters, but he (Mr. Doulton) found that his own firm used 9,000 tons, and considering there were eight or ten other firms, it was reasonable to suppose that they used more than 11,000 tons between them. Then as to the quantity of clay used, it was stated that 23,000 tons were used at Lambeth. His own firm used more than a third of that amount, and he thought that Mr. Goddard must have underrated the amount of trade carried on. As to the annual returns of the Lambeth potters, he considered £140,000 was quite within the mark. Mr. Goddard concluded his paper by remarking that the lamp of science did not shine in Lambeth. Perhaps it was not very bright, but they had made considerable progress, and if upon the first introduction of this branch of trade only idiots were employed in it, it was not to be wondered at that it had not progressed more rapidly, but he thought Mr. Goddard was in error with regard to those idiots. He believed the true state of the case was this. There was considerable anxiety to discover what was the process of glazing used by the brothers Elers, and one really sharp fellow put on a soft appearance, and was engaged in their works in an unguarded moment, and thus the secret was let out. The result was, the trade suffered in Staffordshire, and perhaps the manufacturers of Lambeth were somewhat indebted to that circumstance at the present time.

Mr. G. F. Wilson, F. R. S. would add one word to the remarks which Mr. Stephen Green had made upon this branch of manufacture. As a neighbour of that gentleman in the "land of darkness" he had the opportunity of hearing the opinions of two of the greatest chemists in Europe, Chevreul and Ebelmann, who went to this "dark" Lambeth with the object of going over Mr. Green's manufactory, and who stated to him, (Mr. Wilson,) that the perfection of the arrangements and the beauty of manipulation there put to shame the foreign manufacturers.

Mr. Robert Rawlinson said, having paid a good deal of attention to this subject, not as a manufacturer, but as a user of stone ware, he would offer one or two remarks. With the antiquity of pottery they were all acquainted, and they had been shown a specimen of hollow brick which was many hundred years old. He differed from the description given as to the mode of making it. He had seen examples of the same period, both in this country and on the continent. In most Roman remains were found more or less that class of hollow bricks. He claimed the merit of having introduced bricks of this character into the roof of St. George's Hall, at Liverpool. He believed the Romans made that class of brick upon a mandril, composed of three pieces—an outer mould, and an external core in two pieces, which was thus readily extracted. He believed that mode was adopted in Staffordshire down to a recent period. With regard to the method of mixing the clay, he had been through Staffordshire officially and non-officially, and he had observed what he considered the bad method of mixing the clay, and he was told that it could not be improved upon, and that no description of machinery would get the clay into so good a condition as the old-fashioned mode of slicing and wedging. With regard to socket-pipes, he dared say many people claimed to be inventors of earthenware socket-pipes, but he had been surprised, during his stay in Asia Minor, in 1855, to find Turkish and Greek workmen repairing an aqueduct leading to a hospital on the banks of the Bosphorus with this very description of socketed earthenware pipes, about four inches in diameter and 13 inches long. He found that description of pipe had been made there from time immemorial for water, and they were buried to the extent of thousands of miles in that part of the East, and probably in India. These pipes were exactly similar to the socket pipes now in use in this country. With regard to the use of pipe-making machinery, he thought they were upon the eve of great improvements. There were upon the table specimens of perforated bricks of various kinds, and he begged to draw particular attention to them, as suitable for architectural purposes, both for ventilation and ornament. He did not know why architects should care about having fret-work in perishable stone when they had a material like stoneware in which they could get ornamental forms, which, at the end of a thousand years, would probably be as perfect as they were at the present time. He also thought a great deal might be done with this material in Gothic tracery. He believed architecture had injured itself materially by the use of stone for purposes to which stone ought never to have been put; and one of the greatest mistakes of modern times was to be found in the use, in the Houses of Parliament, of stone cut into elaborate tracery, and exposed to the action of the elements on all sides, for it was already crumbling away. They had scarcely a building with florid tracery which had stood for a century. Henry VII.'s chapel had been once or twice restored. If architects would exercise a little more judgment in combining their materials, he maintained that by the use of earthenware, which was only another name for terra cotta, they might have the most elaborate and durable ornamentation, and they might put up buildings which Lord Macaulay's "New Zealander" might have a chance of seeing when he came over to this country. He begged to inquire whether any gentleman could inform him about what date the first earthenware drain-pipe was introduced?

Mr. Northen replied that, on the 9th September, 1845, he sent the first drain-pipe to the Board of Sewers.

Mr. Rawlinson added, that the form and quality of drain-pipes had been a battle-ground with engineers. The Big-endians and the Little-endians of Lilliput were as nothing to the wars respecting earthenware pipes for sanitary purposes. He had laid, or caused to be laid, between 100 and 200 miles of pipes, and he believed the advance of civilisation was in a great measure dependent upon the improved manufacture of earthenware, as applied to sanitary purposes. To show the extent to which this manufacture had grown, his friend Mr. Doulton told him, some time ago, that his make of pipes could not be less than from six to twelve miles per week, whilst some thousands of ordinary soil-pans were turned out from his manufactory in the same time. From this statement they might imagine what an extent of work was done. He held that, by the proper use of thirty or forty yards of this material, they had one house properly drained. He considered the

proper drainage of one house was the lengthening of one life perhaps ten years, and a saving of an amount of sickness which he would not attempt to estimate. Therefore, considering some twelve miles of pipes were made in one manufactory per week and used to advantage, he thought stoneware was playing a more important part in the progress of civilisation than rifled cannon—for which knighthoods and honours were conferred. As to the endurance of these works, it was truly asserted by archæologists that the extent of the Roman empire was better known by the remains of pottery dug up than by their works above ground. Some nations were known by the earthenware, in which they excelled; for instance, the Etruscans. He maintained that, in making earthenware, and especially in using it for sanitary purposes, they would write their history in far more indelible characters than if graven in brass or even incised upon granite—as was so eloquently advocated by Mr. John Bell a few weeks ago.

Mr. Newton remarked that attention had been called by the last speaker to the question who was the first maker of earthenware socket-pipes. He believed that to Mr. Northen that honour was due. But Mr. Goddard having alluded to the fact that machinery had not been applied to this manufacture to the extent that might have been anticipated, he would refer to the name of Spencer, which had already been mentioned in this discussion. That gentleman had introduced a machine for socketing the pipe at the time it was made. By means of machinery the pipes were made of uniform size and fitted accurately one into the other; consequently they were much superior to those made upon the mandril. By the same patent an improved quality of flower pots was manufactured, and pipes, three feet in diameter, were turned out by it, which had never been obtained by any other process.

Mr. Goddard, in reply upon the discussion, said that Mr. John Doulton had questioned the accuracy of his statistics, but he had furnished no positive statements of his own in lieu of them. Mr. Doulton had stated that, if 20,000 tons of coals was the annual consumption by the potters of Lambeth, his own firm used more than one-third of that quantity. All he could say upon this subject was that he obtained his statistics with reference to the quantity of coals from the person who supplied them, and his other statistics were obtained from reliable sources, and he believed them to be substantially correct. In saying that he was quite ready to accord to Messrs. Doulton the preeminence over all other potters. Mr. Doulton had stated that his consumption of coals amounted to 9,000 tons per annum, but this did not affect the correctness of the total. He (Mr. Goddard) certainly believed he was under the mark, because the progress in this manufacture had been very rapid during the last 40 years. He did not put forward the definition of stoneware referred to by Mr. Doulton as his own definition, but as the definition in the Jury Reports of the Great Exhibition; he certainly considered it was not sufficiently explicit. The specimens he had shown must not be taken as specimens of beauty. He could have sent numberless specimens much more attractive to the eye, but his object was to show the manufacture in its different stages. With regard to the term "stoneware," which might be misapplied perhaps, to some of the goods made in Staffordshire, he made it a point at the commencement of the paper to state clearly that he was going to treat of the Lambeth stoneware, and that he confined himself to the salt glazed ware, as that was the general acceptation of the term. He could have given all those particulars with reference to the Staffordshire potters, to which Mr. Doulton had alluded, but the time at his disposal did not admit of his doing so. With regard to the filter company, he had not intended to make that an important fact, nor did he mention it as an advertisement of the concern. He thought good filters at a small rent per annum, in lieu of a purchased filter which would get rapidly out of order, were worthy of consideration. He differed from Mr. Doulton as to the saggar kiln; it was used in Lambeth. As to the 9 per cent. of breakage in the patent kiln, that was perhaps an incorrect expression; he should have included bad and useless articles. He questioned whether Mr. Doulton turned out a £100 kiln of goods with less than that amount of breakage and bad articles. He was obliged to his audience for the attention which had been given to his paper.

The Chairman was sure he should have the sympathy of the meeting, when he said they were obliged to Mr. Goddard for his paper. They would also feel obliged to Mr. Doulton for his criticism of the subject, and for having contributed during the discussion an important amount of information. With regard to the term "stoneware" it was used locally to designate the Lambeth ware, and did not apply generally to the Staffordshire pottery. The fact was, all fictile ware was of two characters—glazed or unglazed, hard or soft, more or less sonorous, and more or less transparent; and when the vitrification was most perfect, all other conditions being equal, they had the highest quality of ware, as far as strength and durability were concerned. With regard to the materials used, decomposed granite was the constituent of which all chinaware was more or less made. The felspar formed the glaze, and the china-clay the body of the ware, flints being likewise used to give it consistency. Thus, in the cases of Chinese, Dresden, Berlin, and modern Sèvres china, there were hard porcelains so highly vitrified as to show on the surface of the fracture a semi-vitrified glaze. He had simply to add, that Mr. Doulton's definition of stoneware was right in one respect, in including both glazed and unglazed ware. He held in his hand a piece of Wedgewood jasper ware, not glazed, but very hard, and of beautiful quality. He thought if any men deserved to have their memories perpetuated by monuments, such men as Wedgewood, Minton, and others who had created so large an industry in this country, were specially worthy of that honour. They had conferred a national benefit by the art which they had created, which was one that gave the largest amount of industrial employment in proportion to the cost of the material used. He owned that this was a question which had been a very absorbing one to him. He had visited a great many factories in this country and in other parts of Europe, and the manufactures of Vauxhall he looked upon as inferior to many others, although for the purposes for which they were employed very suitable; looking at the price of coals and labour in London, and the price of the clay from Devonshire, the manufacturers of Lambeth must have a large amount of intelligence, industry, and machinery to enable them to compete with those parts of the country where they obtained coals so much cheaper. He begged to propose a vote of thanks to Mr. Goddard for his paper.

The vote of thanks was then passed.

The paper was illustrated by a collection of Lambeth stoneware, in various stages of its manufacture. The Chairman contributed some specimens of Delft, Dresden, Chelsea, and other kinds of ware, and Dr. Chambers laid on the table an earthenware hot-air pipe, found in a Roman villa at Ostia, built in the time of Hadrian, as well as some specimens of modern Italian earthenware plates.

The Secretary announced that on Wednesday evening next a paper by Dr. J. Forbes Watson, A.M., "On the Chief Fibre-yielding Plants of India; with Observations on the Measures required for the Encouragement of the Growth of these and other Indian Products, to meet the wants of Britain," would be read. On this evening Thomas Bazley, Esq., M.P., will preside.

ROYAL NATIONAL LIFE-BOAT INSTITUTION.

The annual report of this Institution has just been published. It begins by stating that the total number of life-boats, including those in course of construction, belonging to the Institution, amounted to 101. The life-boats of the Royal National Life-boat Institution had, at various points of our coasts been actively called into operation on sixty-one occasions during the past year. Two hundred and eighteen lives had been saved from 39 wrecks, and 5 vessels had been assisted safely into port. For these valuable exertions the total sum paid to life-boats' crews was £733 18s. 9d. On these occasions, and on those of quarterly exercise, the life-boats were manned by about 4,000 persons. Nearly all the services took place in stormy weather and heavy seas, and often in the dark hours of the night. The Committee lamented that the number of wrecks in the seas and on the coasts of the British Isles, and the consequent loss of life therefrom, had been unprecedentedly large during the past year, no less than 1,646 of our fellow-creatures having met with a watery grave. In the case of two wrecks alone, viz., those of the *Royal Charter* and the *Pomona*, upwards of 800 persons perished in the darkness of the night, without the possibility of any assistance reaching them. It was, however, consoling to find that the exertions which had been made during the past year to rescue life from shipwreck had been attended with great and encouraging success, as was shown by the official return of the Board of Trade, 2,332 having been thus saved. The services of a life-boat were usually only called into requisition when it would not be safe for any other kind of vessel to approach a wreck. The total number of persons saved from shipwreck, since the first establishment of the National Life-boat Institution, and for rescuing whom the Committee had granted honorary and pecuniary rewards, was 11,401. During the past year 1 gold medal, 20 silver medals, 13 votes of thanks, inscribed on vellum, and £1,108 15s. 3d. have been granted for saving the lives of 499 persons on the coasts and outlying banks of the United Kingdom. Many of these services had been of the most gallant and noble character. The gold medal had been presented to Joseph Rogers, the Maltese seaman of the *Royal Charter*, who, with a line round him, swam through the heavy surf to the rocky shore, when that unfortunate vessel was wrecked on the Anglesey coast in October last, which line was the means of saving many persons, and which, had not the vessel broken up in so short a time, would undoubtedly have been the means of saving most of those on board. The committee acknowledged the assistance which they continued to receive from the local committees; from the Mercantile Marine Fund, through the Board of Trade; and from the Commodore Comptroller-General, the Deputy Comptroller-General, and the officers and men of the Coast-guard service. The operations of the committee may be thus briefly stated:—Since the formation of the Institution it has expended on life-boat establishments £36,948 5s. 8d., and has voted 82 gold and 658 silver medals for distinguished services in saving life, besides pecuniary awards, amounting together to £12,750 15s. 3d. During the past year expenses had been incurred on either additional new life-boat stations, or the replacing of old boats, transporting-carriages, and houses, by new ones, repairs, stores, and alterations of boats, carriages, and houses, and for exercising the crews of life-boats, amounting altogether to £11,120 18s. 3d. This great and national work had, however, only been accomplished by the Society incurring liabilities to the extent of a further sum of £3,834. The receipts of the Institution, from all sources, amounted last year to £11,652 11s. 6d. Amongst the interesting incidents connected therewith, the committee gratefully acknowledged the accompanying gifts specially appropriated at the request of the donors themselves to the cost of the following life-boats: Exmouth (Lady Rolle), £375: Portheawll, Portrush (M. A. C. S.), £380; Kingsgate, St. Andrew's, Thurso (A. W. Jaffray, Esq.), £560; North Berwick (Messrs. Jaffray and Son), £380; Lizard (the Hon. Mrs. Agar, and T. J. Agar Robartes, Esq., M.P.), £269 13s. 7d.; Fowey (William Rashleigh, Esq., and the Hon. Mrs. Rashleigh), £100; Banff (Messrs. Macfie and Sons), £180; £150 was also received from the Shipwrecked Mariners' Society, chiefly collected in threepences from its seamen members in aid of life-boats. During the preceding year legacies had been left to the Institution by the late Miss Church, £100; George Biggs, Esq., Strand, £100; Edwin Cuthbert, Esq., Denmark-hill, £50; and from Mrs. Ann Thompson, £100. The Report concluded by alluding to the fact that not only was the National Life-Boat Institution now one of the most important benevolent societies in our land, but that its operations were known to all the maritime powers of the world. Some of these governments had had life-boats built under the superintendence of the Institution, which had already been instrumental in saving many lives. Englishmen resident in distant parts of the globe had also often sent tokens of their approval of its labours.

PURIFICATION OF GAS BY PEROXIDE OF IRON.

By Prof. S. Bleekrode, Delft.

The *Journal of Gas Lighting* (November, 1859, p. 598) mentions the importation of a native hydrated peroxide of iron into England from Denmark, for the purification of gas. This ore is used in the Danish gas works, and there exists in Sweden a patent for its preparation and employment, granted in 1859, to a gentleman of the name of Hovitz.

I was anxious to know the nature of this ore, spoken of as the cheapest known material for the purification of gas. I have analysed the sample sent to me by the kindness of Mr. Barlow, and compared the Danish ore with ores of the same appearance, of the province of Gelderland, in Holland.

Hydrated Peroxide of Iron.

	Danish Ore	Gelderland.	
		Apeldoorn.	Wormingen.
Peroxide of Iron	66·04	61·30	65·22
Clay, Silica	11·40	18·92	15 18
Water and Humid Substances	19·55	16.84	19·50
Alumina	1·80	2·82	...
Oxide of Manganese	0·85	...	...
Lime	traces.	...	traces.

The humid substances, soluble in potassa, are 8 per cent. nearly. It appears, also, that the Danish ore is a brown hydrated bog ore, or limonite, as found in several countries. In the Dutch province of Gelderland there is enough to meet all probable demands.

The peroxide of iron is remarkable for its power of decomposing hydro-sulphuric acid gas at the ordinary temperature. When the native oxide, as a coarse powder, is mixed with a strong solution of this gas in water, in the course of a few minutes the putrid smell ceases, and even the reaction on a lead solution, or lead test-paper, will no longer be observed. An experiment which shows this, may be made in a very simple way. The pulverised ore is laid on a common filter, and the hydro-sulphuric acid solution dropped upon it; the mass is afterwards washed with pure water. A milky-coloured fluid, without smell, will result, containing finely-divided sulphur and traces of sulphuric acid, under the form of sulphate of the protoxide of iron.

A large quantity of hydro-sulphuric acid may be decomposed in this way, ending by a state of complete saturation, which is evidenced by the black colour of the sulphuret of iron. As is well-known, the sulphuret of iron can be restored to the state of a hydrated peroxide. It may thus be easily revivified, and becomes again effective in decomposing hydro-sulphuric acid. By washing it after revivifi-

cation by the influence of the atmosphere, the milky sulphur-liquid and the sulphate of iron will again be formed.

This reaction, well-known to the students of chemistry, is likewise observed, whether the native hydrated peroxide (brown ore) or the native non-hydrated peroxide (red ore) is employed, even when the native hydrated peroxide is deprived of its water and changed into red peroxide.

But in every case the physical molecular condition of the peroxide is of great consequence. When the oxide is micro-crystalline, compact, micaceous, or fibrous, then the reaction on hydro-sulphuric acid will be either very slow or will cease. The same phenomenon will be observed when the precipitated hydrated peroxide of iron, as prepared by Hill's patent, is exposed to a red heat. Thirty years ago, M. Berzelius mentioned that the peroxide of iron, prepared by red-heat from the precipitated hydrated oxide, is very difficult to dissolve, even in strong acids. Now, what happens with hydrochloric acid will certainly follow with the more feeble hydro-sulphuric acid. When the peroxide acquires, by a stronger calcination, magnetic properties, it becomes, owing to its molecular arrangement, nearly inactive on hydro-sulphuric acid.

The presence of humid substances in the native ore is of secondary consequence; they have no reaction on the hydro-sulphuric acid, but they may assist the absorption of the ammonia. In every case, the porous earthy oxides are the most active, and, when mixed with chalk, they gain even in power by revivification. The revivification, by free exposure to the open air, or by ventilating the purifiers, produces sulphur, finely divided, and sulphuric acid. This sulphuric acid can be fixed by lime, and produces sulphate of lime, or gypsum, and this is now the principal substance used to convert the ammonia into a fixed and valuable salt of sulphate of ammonia. The revivification, by exposure to the air, assisted by washing, to remove the free sulphur and the soluble salt, is all that is wanted to restore the power of the peroxide of iron for the purification of gas, which is increased more than twentyfold. So by this elegant process the noxious sulphur is utilised in the production of sulphate of ammonia, and the mixture seems never weary of performing its duty.

That the saturated peroxide of iron, removed from the purifiers, cannot be revivified by calcining, seems not to be owing to the loss of its water, but to the finely-divided sulphur in the mass, which forms sulphuret of iron with the emission of sulphurous acid gas. The peroxide of iron mixed with lime will even gain in purifying property by revivification under the influence of the atmosphere and washing.

It is unnecessary to allude to the history of gas purification, and it is sufficient to say that several methods, given in the specifications of patents, show how the simplest phenomena of chemistry may be misunderstood. The long discussed question on the hydrated precipitated, the anhydrous, and the calcined iron oxides as purifiers, might be settled by a simple trial. It is not even necessary to explain it by a catalytic action, as given by Mr. Hill, to its precipitated oxide, nor to assume, with Messrs. Lowe and Evans, the "allotropic" condition of some native anhydrous ore as causes of their non-activity.

The phenomenon that the peroxide of iron furnishes oxygen to the hydro-sulphuric acid, belongs to the burning power, as called by M. Kuhlmann, the "propriété comburante" of the peroxide.

The purification of water from organic substances by filtration through the red hematite or Cumberland ore with coal, as advised by Mr. Thomas Spencer, is another example of the oxidising power of the peroxide of iron. This purification is certainly not conducted nor influenced by the magnetic property of the iron, but is owing to the power of the peroxide of iron to furnish oxygen.

Home Correspondence.

SUGAR AND ALCOHOL FROM SILESIAN BEET-ROOT.

Sir,—From the name of your Society I am in hopes the subject of my letter may allow it to be admitted into the *Journal*. It is on the introduction into England of the manufacture of sugar and distillation of alcohol from the Silesian beet-root, which can not only be grown as well in England as on the Continent, but much cheaper.

I am a retired farmer, and have cultivated 500 acres for nearly forty years. I came over to the North of France for my health, which, being renovated I thought I could make myself useful by pointing out to my brother farmers at home many Flemish customs of husbandry worthy of their attention.

I was greatly struck with the general growth of the beet-root here, all of which is for sale to the manufacturers and distillers, and is readily sold on an average of years at fifteen shillings per ton, at which price it is quite a golden crop to the farmer. The residue, after the juice is extracted, is nearly equal in quantity of nutritive matter to the raw root. How this happens I will mention presently. This may be bought back by the farmer at ten shillings or twelve shilings a ton and re-conveyed to his farm. His manure is not reduced; he keeps the same number of stock as before, and his land is not injured, while he retains in his pocket a balance of hard cash sufficient to pay the whole rent of his farm if a fourth is cropped with this "golden root."

All this appeared to me too good to imagine for a moment it was not well known in England, and that of course there was some impediment which prevented its adoption. I therefore took no further thought about it, but coming over to England some time since, to show my brother farmers a new forage plant — the "gorgho"—I found the beet-root had been introduced at home, our Government having given permission to ten gentlemen some years ago to distil from it; but sugar has not yet been tried. I heard that those ten distillers did not thrive, and wrote to one of these gentlemen to know if I could be of any service to him; he immediately came to me in French Flanders, and I was the means of his introduction to a practical French distiller, who has since seen his works, and proved they could be made to pay a profit, even when corn distilleries cannot.

Since that time, I have devoted myself to this subject, and have visited innumerable works, of both spirit and sugar, in France and Belgium. The owners have always received me politely, invited me to inspect their works, and never have I met with a refusal to answer my very many inquisitorial questions; and I have even written some 40 or 50 queries to perfect strangers, and they have returned me answers, for which I desire publicly to tender them my grateful thanks; and sincerely do I hope, if ever they should interest themselves in our English manufacture, as I have in theirs, and undertake a tour of inspection, they may meet with the same kindness as they have shown me. I cannot find that any other of my countrymen have devoted themselves to this matter, and, strange as it may appear, I believe very few of these ten gentlemen who are trying it have ever been here.

I believe I have now sufficiently investigated this subject, and only want the sympathy of our government, and societies like yours, as well as of the leading agriculturists, to induce my brother farmers to listen to my "plain, unvarnished tale," and investigate its truth.

This is all I ask. I have no other interest in it but a wish to deserve their thanks.

Never was there a more opportune moment to introduce it.* The disease among the turnips is making frightful

* This letter was written previously to the publication of the recent commercial treaty.

progress, and no new plant would be hailed with more pleasure by the farmer than one which could be (if only to some extent) a substitute for them, as the frequent repetition of them in the same land is supposed by some to be the cause or a great assistance to the malady. The prices of corn are bad. The prospects for the future of the corn grower are not very bright, but if this could (and of that I am positive, or I would not address you) be as generally grown and manufactured in England as abroad, a perfect revolution for the better must take place in the position of all those connected with the landed interest, and the corn crop would be (as it is considered here) thought quite secondary to the beet crop both in profit and benefit to the land. Spirit too is so low in England that I am informed some of the grain distilleries have ceased working, so that if it could now be manufactured at a profit—it always can. In France it is quite discontinued from beet (but that is all required for sugar), in consequence of government suddenly lowering the import duties on spirit, and the disease of the vines yearly becoming less.

Here is shown the advantage of combining the two manufactures, sugar and alcohol. Our grain distillers and rectifiers are dead against us, but we heed them not. Thousands of gallons have been imported into England for mixing, but it can be rectified so highly, that it can be made, as it is here in Belgium, of more market value than corn spirit. We must not look to any other but the landed interest to surmount these small difficulties. Here often the farmers get up conjointly a large factory and distillery, to obtain a near market for their roots (as they ought not to bear the expense of distant land carriage), and for the repurchase of the residue, and thus it must first be introduced into England; £10,000 will do this, and so long as the farmer obtains a profit on his roots, a small one on the factory will satisfy him. It is a winter work, and many farmers have small distilleries on their farms, which will operate on three tons of roots per day; but a large one requires 60 per 24 hours, as they work night and day. Not so the farmer, nor can he, for many reasons, do it so profitably as on a large scale—nevertheless, it is often done, and they save the carriage by it.

I will here state some of the facts and advantages connected with its cultivation.

All soils are suitable. It is of course quite fresh to English soils. It is not liable to "sicken" the land, if sown every third or fourth year. It is not sown till May, giving time to clean the land; and also, being drilled at 15 inch intervals, it is as good a fallow-crop as turnips, as not more than 20 tons per acre must be forced to grow. It does not require more manure than turnips. As drawn off in the latter end of September it does not cut the ground about like wurzell, which remains till November.

For the same reason, not being so long on the ground, it does not "draw" the land so much as swedes. It is sold directly, and thus turns the "ready penny." It is not liable to miss plant, nor has it any enemy among the worm or insect tribe. The residue do not scour like wurzell. All cattle and sheep eat and thrive on it. It is all ready "pulped" when it returns from the fabric, and it will keep for years, consequently the farmer is never placed in that awkward predicament of a stoppage of supplies.

The reason only 20 tons may be "forced" (as no doubt 30 may as easily be grown) is, strangely enough, that there is as much saccharine in a root of 4 lbs. as in one of double; and also, all that portion of a root growing above the ground has one-third less goodness in it than the part which pushes downwards, so that the choice of seed is an important part in the success of the crop.

Sometimes the manufacturer gives the farmer £8 an acre for his land, ploughed, manured, and ready to be sowed, after which all expenses and the crop belong to him. Thus the farmer makes a certainty of his profit, and has the money sometimes opportunely.

Guano is not objectionable as a manure for it.

After all, the most difficult part of this inquiry is—"Which is the best distilling process?" There are four principal ones:—the old grinding-mill and hydraulic-press, Le Play, and Champonnois; a Monsieur Cheval has invented a very ingenious small one, not yet sufficiently carried out to give an opinion on. The first of these leaves about one-fifth of refuse, the second about half, and the third about three-quarters. Taking the medium at half, thus would stand the farmer's account:—

	£	s.	d.
20 tons of beet delivered at 15s. ...	15	0	0

	£	s.	d.
10 tons refuse (brought back) at 10s.	5	0	0
Carriage of the 20 tons two miles, four journeys a day, three horses	0	10	0
Profit per acre	9	10	0
	£15	0	0

A bullock tied up to fatten on Swedish turnips only, and a little hay, as I have done frequently, will do well on them, but it would eat 2 cwt. a day of swedes. Here, from ½ to 1 cwt. of refuse with a little chaff, and some 3 to 6 lbs. oil cake is given. Thus 1 cwt. of refuse is equal to 2 of the swedes, less the cost of the oil cake, but of that less again the extra value of the manure. And again, nothing like 20 tons per acre are grown on all the turnip land in England, and none at all in heavy land, which is particularly adapted to the beet. And think of £9 10s. extra profit on the fallow crop, too; why it is more than the gross value of the wheat crop per acre.

Does not this appear too good to be true? But it is a fact, and I only wish my brother farmers would endeavour to disprove it, as by this means the truth would be arrived at, and that is all I want. Let them reflect that 50 years ago swedes were not grown, and now they would not be able to farm successfully on light land without them, nor would they but for such a substitute as this.

But let us calculate only on one-fifth of refuse being produced, they would then have 50s. more in their pockets, which would buy 4 cwt. of guano, which is supposed to be equal to an ordinary farm yard manuring (but, of course, not so lasting), and without any replacement of this cattle food at all they would have £14 10s. per acre, which would purchase 24 cwt. of guano, or sufficient to manure every acre every year of the whole farm (if on the four-course) with a dressing and a half.

The amount of alcohol extracted by the different processes is from 3½ per cent., the "pulped and press," to 5½ per cent. Let us take the average 4½ per cent. But we may do with this as we have done with all the clever inventions of our neighbours we have taken in hand, improve upon it, and before many years I should expect to see a great increase in the product of spirit:—

	£	s.	d.
The ton of beet-root		15	0
Every expense of manufacturing it ...		6	3
	£1	1	3

	£	s.	d.
10 cwt. refuse		5	0
16 gals. of spirit at 100°, at 1s. a gal.		16	0
	£1	1	0

Now, as regards sugar. Hundreds of cargoes have been bought at Antwerp by British merchants for refining in England. Luckily there is no prohibition to our manufacturing this if we please, and here again the same argument applies as to the spirit—we can surely save freight; and here would be a blow to the slave trade more severe than expensive ships off Sierra Leone, and losses of officers and seamen. The supply of West India sugar has gradually fallen off; it is said cotton and coffee can be more advantageously grown. However, we do not wish to take

any advantage of them; we will pay the same duty as others. We want no favours, only a fair field.

Sugar is the second necessary of life. If we can produce it at the same price as we pay for importing it, is it not better to be independent of the stranger for the supply of it?

Thus stands the account:—

	£	s.	d.
1 ton of roots		15	0
Expense of manufacturing		12	6
	1	7	6

	£	s.	d.
5 cwt. of residue, at 6d.		2	0
22 lbs. of molasses		1	6
129 lbs. of sugar, at 2¼d. per lb.	1	4	2
	1	7	8

But is not molasses worth rather more than this? However, this is a simple statement, and easily altered to the prices of different localities. This is the raw sugar, ready for refining. Our duty is a fraction under 2d. per lb.

No objection can possibly apply to the introduction of this manufacture, nor, fairly, to alcohol either. Though there is a feeling that cheap spirits lead to drunkenness, I doubt it. In this cold climate, colder than England in winter, sobriety prevails among all classes. I attribute the contrary to want of education, and somewhat to the high price, which makes it less attainable, and it is human nature to value that the most of which we can obtain the least. But it is not just that we should prevent the moderate enjoyment of a luxury to the sober man, because some who are ignorant and sensual choose to take it to excess. I am, &c.,

WM. HARTLEY.

Brussels.

PHOTOGRAPHS BURNT IN ON GLASS.

Sir,—Having read in your last number a communication from Mr. John Wyard, on "the production of photographs burnt in, by means of fluids, on glass," I beg to state, without offering any opinion upon Mr. Wyard's process, as described by him, that I took out a patent some months ago having for its object the "reproduction, in enamel colours, of photographs, drawings, engravings, &c., burnt in on glass and ceramic substances," some specimens of which are now exhibiting in the rooms of the Society of Arts.

I am, &c., F. JOUBERT.

36, Porchester-terrace, Hyde Park, W.,
April 10, 1860.

PAPER MATERIAL.

Sir,—Allow me to ask a few questions relative to the supposed deficiency of material for the manufacture of paper.

I will not refer to the 37,000,000 tons of straw annually produced from wheat, rye, barley, and oats; the ten millions of tons of flax waste, and other indigenous raw substances, all of which, when properly treated, are available for the best class printing and writing papers. It is not, perhaps, generally known that the paper on which the principal leading journals are printed does not contain rags, the composition being cotton waste and bagging. What becomes of the rags produced from the annual home consumption of over 250,000 tons of cotton goods—of the 50,000 tons of linen fabrics?

To what use is applied the enormous quantity of old rope, twine, and sails, from the government and commercial marine of the empire? Besides the many thousand tons of jute annually imported, there are numerous other materials which enter largely into the manufacture of paper.

As the consumption of paper has heretofore been under 100,000 tons, I cannot imagine how, in truth, it can be said there is a scarcity of material.—I am &c.,

ROBERT H. COLLYER, M.D.

Beta-house, 8, Alpha-road, S.W., April 7, 1860.

Proceedings of Institutions.

Portsea Athenæum.—An Industrial and Fine Art Exhibition has been recently held at this Institution, having been opened on the 30th January and closed on the 27th of February last. The Exhibition contained a fine collection of models of naval and military architecture, machinery, &c., kindly lent by the Government, Scientific Institutions, private friends, and the public. Messrs. Maudslay, of London, contributed a choice collection of models of machinery; the London, Brighton, and South-Coast Railway Institute also gave much aid in that respect. The Exhibition was opened by the President, Major-General Whylock, the mayor, the committee, and other gentlemen assisting on the occasion. During the four weeks that the Exhibition was open, upwards of ten thousand persons visited it.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Dr. F. W. Pavy, "On Experimental Physiology."
Medical, 8½. Clinical Discussions.

Tues. .....Royal Inst., 3. Dr. Spencer Cobbold, "On the Structure, Habits, and Affinities of Herbiverous Mammalia" (the Giraffe).
Civil Engineers, 8. Mr. W. Fairbairn, "On the Efficiency of various kinds of Railway Breaks, with experimental researches on their Retarding Powers."
Statistical, 8. "On Indian Currency and Banking."
Pathological, 8.

Wed. .....London Inst., 7. Convorsazione.
Society of Arts, 8. Dr. J. Forbes Watson, "On the Chief Fibre-yielding Plants of India; with Observations on the Measures required for the Encouragement of the Growth of these and other Indian Products, to meet the wants of Britain."
Geological, 8. 1. Mr. J. Prestwich, "On the Presence of the London clay in Norfolk, as proved by a Well at Yarmouth." 2. Mr. James Pilbrow, "On a Well in the Tertiary Sands and Clays at Bury Cross, near Gosport." 3. Messrs. T. Rupert Jones and W. K. Parker, "On some Foraminifera, from the Triassic Clay at Chellaston, near Derby."
Ethnological, 8½.

Thurs. ...Royal Inst., 3. Professor Ansted, "On some Recent Researches in Physical Geography and Geology—(the Atlantic Ocean)."
Royal Society Club, 6.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8.
Royal, 8½.

Fri.....London Inst., 7. Prof. Bentley, "On the Structure and Formation of the Nutritive Organs of Plants."
Royal Inst., 8. Dr. Spencer Cobbold, "On the Scope and Tendency of the Natural History Sciences."

Sat.....Asiatic, 2.
Royal Inst., 3. Mr. F. A. Abel, "On some results of the Associations of Heat with Chemical Force, Practically Applied."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April 6th*, 1860.]

Dated 30th January, 1860.

234. N. J. Holmes, Hampstead, and J. Cordon, Stoke-upon-Trent—An improved method of purifying fluids or substances by electro-magnetism.

Dated 23rd February, 1860.

486. D. M. Mapple, 1, Clark's-place, Bishopsgate-street Within, London—Imp. in electric clocks and electric batteries.

Dated 8th March, 1860

630. M. Barton, J. Shepherd, and T. Evans, Nottingham—Certain imp. in the method of and apparatus for supplying and heating air, the same to be used as a motive power for marine locomotive and stationary engines.

Dated 14th March, 1860.

672. J. Luis, 1B, Welbeck-street, Cavendish-square—A pneumatic telegraph. (A com.)

676. S. Hecht, 36, Gresham-street, London—A new mode of advertising on articles of earthenware, pottery, and the like, in general use.

Dated 16th March, 1860.

704. J. Nixon, St. Peter's-quay, Newcastle-upon Tyne—Imp. in the manufacture of hyposulphite of soda.

Dated 17th March, 1860.

708. R. A. Brooman, 166, Fleet-street—Imp. in machinery for dressing warp threads. (A com.)

Dated 19th March, 1860.

714. W. Hodgson and H. Hodgson, Bradford—Imp. in the means or apparatus for preparing and spinning fibrous substances.
716. T. Goldie, Airdrie, Lanark, N.B.—Imp. in looms for weaving.
718. C. F. Bielefeld, Gower street, Middlesex—Imp. in the fabrication of plastic materials pressed in moulds for building and ornamental purposes, and for statuary.

Dated 20th March, 1860.

720. P. M. Parsons, Arthur-street West, London-bridge—Imp. in fire-arms, and projectiles to be used therewith.
722. J. J. Cole, Essex-street, Strand—Imp. in chimneys.
726. A. Shand, Liverpool—Imp. in preparing or bleaching coir fibre and coir yarns. (A com.)
728. J. Brown, Norwich—Imp. in window-sashes, frames, and doors, in order to render them when closed, air, dust, and water-tight.

Dated 21st March, 1860.

729. J. Newhouse, Farnworth, near Bolton-le-Moors, Lancashire—Certain imp. in machinery for preparing, spinning, and doubling cotton, and other fibrous materials.
732. T. Sykes, and B. C. Sykes, M.D., Cleckheaton, and J. W. Crossley, Brighouse, Yorkshire—Imp. in apparatus for heating water, air, or other fluids, generating and superheating steam, preventing incrustation in steam boilers, and consuming smoke.
733. T. Richardson, 20, New Bridge-street, Newcastle-on-Tyne—Imp. in the manufacture of salts of alumina.
734. W. Spence, 50, Chancery-lane—Imp. in sewing machines. (A com.)
735. W. E. Newton, 66, Chancery-lane—An improved preparation or solution for toning photographic pictures. (A com.)
736. W. S. Macdonald, Manchester—Imp. in dyeing or printing woven fabrics of mixed materials.
737. A. V. Newton, 66, Chancery-lane—An improved construction of bridle. (A com.)
738. J. Blackwood, Banff, N.B.—Imp. in furnace or fire bars.
739. J. D. Phillips, Ghent, Belgium—Imp. in steam engines.

Dated 22nd March, 1860.

741. W. Turner, Hockley, Nottingham—A new mode or method of making or manufacturing bread and other articles of paste, and in the machinery or apparatus employed therein.
742. G. Crawshay, Durham—Imp. in the manufacture of iron pulleys for winding from coal pits and other purposes.
743. G. J. Calvert, York, and C. L. Light, Parliament-street, Westminster—Imp. in portable buildings and structures.
744. J. S. Bell, Newcastle-upon-Tyne—Imp. in steam engines and boilers.
745. J. Grainger, Handsworth, Staffordshire—An imp. or imps. in breech-loading fire-arms.
747. D. Millard, Liverpool—Imp. in sewing machines. (A com.)
748. G. T. Peppé, 8, Peak-hill, Sydenham, Kent—Imp. in the manufacture of thin sheet lead coated with tin.

Dated 23rd March, 1860.

749. H. Vigurs, Aston, near Birmingham—Certain imp. in the treatment of paper or cardboard, such paper or cardboard being used for cards, wrappers, or boxes for exhibiting and holding small articles usually sold on cards or in boxes, also in the form of such boxes and wrappers, and the manner of attaching specimens of contents thereto.
750. J. P. Jennings and F. S. Stott, Bradford—Imp. in singe plates.
751. J. Taylor, M. Taylor, and G. Taylor, Denton, Lancashire—Imp. in the manufacture of hats, or of giving the final shape to the brims thereof.
752. C. Prater, 2, Charing-cross—Imp. in ammunition, bayonet, and sword belts, and in pouches to be worn therewith.
753. I. Hayem, jun., 2, Rue Sainte Appoline, Paris—Certain imp. in making cravats and stocks, "magical cravats."
754. R. Harrison, D. Ashworth, and J. Lord, Burnley, Lancashire—A certain imp. in machinery or apparatus for preparing, spinning, and twisting cotton and other fibrous substances.
755. C. Ashworth, Fairfield, Lancashire—Certain imp. in power looms for weaving.
756. J. Watts, Clifton cottage, Sleaford-street, Battersea-park, Surrey—An improved safety valve.
757. F. C. Meyer, Prune-street, Philadelphia, U S.—Imp. in machinery for copying ornamental figures and forms.
758. W. E. Newton, 66, Chancery-lane—Certain imp. in looms for weaving. (A com.)
759. B. Cooper, Frome, Somersetshire—Imp. in sizing and drying yarns preparatory to weaving.
760. W. S. Lewis, Moseley-street, Manchester—Imp. in the manufacture of illuminating gas. (A com.)
761. S. C. Lister, Manningham, Yorkshire—Imp. in carding and preparing machines.

Dated 24th March, 1860.

764. H. V. Physick, North-bank, Regent's-park, London—Imp. in electric telegraphs and apparatus connected therewith.
765. H. Haywood, Birmingham—Imp. in machinery for the manufacture of buttons and other similar articles.
767. W. E. Newton, 66, Chancery-lane—Imp. in calendars for clocks or other timekeepers. (A com.)
768. J. Inglis, Glasgow—An improved artificial fuel.
769. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved means of closing or filling metallic joints. (A com.)
771. E. Abbott, 18, Manchester-street, Manchester-square, Middlesex—An imp. in steering ships and other vessels.
773. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the production of colours for dyeing or printing. (A com.)
774. J. B. Corry, Queen Camel, Somersetshire—Imp. in the manufacture of gloves.

Dated 26th March, 1860.

777. J. Ronald, Liverpool—Imp. in machinery for the spinning of hemp, flax, Manilla, or other like fibrous materials.
779. H. Gourlay and E. Kemp, Dundee—Imp. in steam engines and boilers.
781. H. N Nissen, Mark-lane—Imp. in the preparation of paper in order to prevent the extraction or alteration of writings thereon without detection.
783. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in shaping metals and in the machinery or apparatus employed therein. (A com.)
785. E. G. Renshaw, Little Nelson-street, City-road, Middlesex—A machine for cutting or producing from wood certain articles called machine lights or wood spills or lighters used for lighting pipes and candles, and other similar purposes.

Dated 27th March, 1860.

787. C. Gillespie, Manchester—Imp. in bedsteads.
789. E. Pohlman, Halifax—Imp. in those musical instruments known as "German concertinas."
791. M. Craufurd, Clay Pottery, near Poole, Dorsetshire—Imp. in blocks or bricks for building purposes.
793. J. Langstein, Charing-cross—Imp. in the manufactuse of tobacco pipes.
795. W. E. Newton, 66, Chancery-lane—An improved washing machine. (A com.)

Inventions with Complete Specifications Filed.

792. H. M. Clarke, Massachusetts, U.S.—A new and useful or improved machine for the making and sizing of pulp used in the manufacture of paper. (A com.)—27th March, 1860.
832. E. Stelzl, Nancy, France—Imp. in ornamenting surfaces of glass, wood, plaster, and other materials, and in protecting them from the action of fire and moisture.—31st March, 1860.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April 6th*, 1860.]

April 2nd.	*April 3rd.*
922. W. Hardman & J. Dugdale.	950. J. H. Johnson.
933. F. M. Baudouin.	*April 4th.*
1053. R. A. Brooman.	976. J. Robinson.
	1059. A. V. Newton.

[*From Gazette, April 10th*, 1860.]

April 5th.	*April 7th.*
957. T. Melling.	989. E. Edmunds & E. Beacher.
961. S. Clarke.	993. A. V. Newton.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette April 6th*, 1860.]

April 2nd.	*April 3rd.*
880. F. F. Verdié.	962. H. Carr.
915. J. B. Maniquet.	*April 4th.*
	887. G. Elliott and W. Russell.

[*From Gazette, April 10th*, 1860.]

April 5th.	890. J. Noble.
842. C. Nickels.	894. J. Noble.
852. G. Herbert.	

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,242	March 12th.	Safety Envelope	Arthur Granger	308, High Holborn, W.C.
4,243	,, 14th.	Sphere Joint Lever for Beer Engines	Birch and Mason	Birmingham.
4,244	,, 16th.	Sound-opening for the Violin, Bass Viol, or other description of Violin	John Tye	Agnes-street, York-road, S.
4,245	,, ,,	Lamp	William Bailey	Heneley Fields Chemical Works, Wolverhampton.
4,246	,, 17th.	Joint for Brooch-Pin	James William Lewis	Birmingham.
4,247	,, 19th.	Chadburn's Set of Distance-Guages	Charles Henry Chadburn	Liverpool.
4,248	,, 28th.	Muzzle Protector	Charles E. Hurst	Horsham, Sussex.

Journal of the Society of Arts.

FRIDAY, APRIL 20, 1860.

INTERNATIONAL EXHIBITION of 1862.

The following letter has been addressed to the Secretary of the Society of Arts, by command of his Royal Highness the Prince Consort, President of the Society, expressing the readiness of his Royal Highness to place his name on the List of Guarantors for the sum of £10,000, so soon as the sum of £240,000 has been subscribed:—

Windsor Castle, April 9th, 1860.

Dear Sir,—I am commanded by His Royal Highness the Prince Consort to inform you that His Royal Highness has given his best attention to the proposal made by the Council of the Society of Arts for the formation of a Guarantee Fund, in order to enable them to give effect to the wish of the Society to hold another Great International Exhibition in 1862.

As President of the Society, it is ever the wish of His Royal Highness to assist, as far as it is in his power to do so, any well considered plan, proposed by the Society, which has for its object the advancement of Art and Science as applied to industrial pursuits. But feeling at the same time that the favour of the public to any such plan should be due to the merits of the proposal alone, he has in general made it a rule to decline giving his name to any undertaking which had not already received such an amount of public support as would ensure its ultimate success.

In the present case, however, considering the conditions under which it is proposed to raise the Guarantee Fund—one of which provides that "no liability shall be incurred by any person subscribing the Agreement, unless the sum of £250,000 be subscribed within six calendar months"—his Royal Highness will so far depart from his ordinary practice as to intimate his readiness, when the public interest in the proposed Exhibition shall have manifested itself to the extent of subscribing £240,000, to contribute the further sum that shall be necessary to complete the full amount of the proposed guarantee.

I remain, dear sir,
Your's very faithfully,
C. GREY.

P. Le Neve Foster, Esq.

The sums already guaranteed for carrying out this Exhibition amount to £175,000.

The principal conditions of the Guarantee agreement are:—

1st. That no Subscriber will incur any liability until at least £250,000 have been guaranteed.

2nd. That no calls will be made unless it should happen that, contrary to the experience of the Exhibition of 1851, when there was a surplus of nearly £200,000, there should be a loss, when the call will be *pro rata*.

3rd. Any surplus will be at the disposal of the Guarantors, for the promotion of Arts, Manufactures, and Commerce.

4th. The Trustees and Managers of the Exhibition named, are:—

The Earl Granville, K.G., Lord President of the Privy Council, Vice-President of the Society of Arts.
The Marquis of Chandos, Chairman of the London and North Western Railway.
Thomas Baring, Esq, M.P., } Royal Commissioners
C. Wentworth Dilke, Esq., Vice-Pres. Soc. of Arts, } for the Exhibition of 1851.
Thomas Fairbairn, Esq., Chairman of the Manchester Art Treasures Exhibition.

The Council do not propose to limit the fund to the £250,000 named, but, having secured that sum, they will endeavour to increase it as much as possible.

A circular letter has been addressed to the Members of the Society, drawing their attention to the importance of filling up the Guarantee List as soon as possible, and those Members and their friends who are desirous of giving their assistance to this undertaking, are requested to send in their names to the Secretary of the Society of Arts as early as possible, with the sums they are willing to guarantee.

The amounts guaranteed by individuals vary from £10,000 to £100.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

The Council have it in contemplation shortly to hold an Exhibition of the Works of this Artist at the Society's House.

Her Majesty the Queen, and H.R.H. the Prince Consort, President of the Society, have graciously consented to contribute to the Exhibition from the Royal Collection. Any persons having in their possession works by Sir Wm. Ross, are earnestly requested to communicate immediately with the Secretary of the Society of Arts.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first on Saturday, the 28th April, at the Society's house, the card for which will admit the Member only; the second on Saturday, the 26th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

The cards for both these Conversazioni have been issued this day. Any member not having received them should communicate with the Secretary.

Secretaries of Institutions in Union who may receive applications from any of their members

desirous to attend either of these Conversazioni, can have a limited number of cards placed at their disposal on application to the Secretary of the Society of Arts.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th instant, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

NINETEENTH ORDINARY MEETING.

Wednesday, April 18, 1860.

The Nineteenth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 18th instant, Thomas Winkworth, Esq., Vice-President of the Society, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Mackintosh, Chas. Edward	Tennant, Rev. William
Norton, George Smith	Watson, William

Owing to the sudden and severe illness of Dr. J. Forbes Watson, the Paper "On Indian Fibres," announced for this evening, was unavoidably postponed.

The Paper read was—

ON PAPER MATERIAL.

By Robert H. Collyer, M.D.

The subject of paper material is now occupying the especial attention of civilised Europe and America, in reference to the supposed deficiency of meeting the increased demand for paper, consequent upon the progress of education among the people, and the use of this material in various branches of industry, for paper is now the great necessity of this comparatively intellectual age. Hitherto rags have been the great staple on which paper-makers have depended, and not without reason, for on the large scale, when hundreds of thousands of tons had to be produced, where could they expect to find a material so fitted, by its very nature, for their purposes, as the worn-out cotton and linen used in clothing?

The very wear-and-tear to which rags have been subjected renders them, as it were, particularly adapted for the purpose of the paper-maker; the treatment for their conversion into paper-stuffs is so simple, requiring the use of but a small quantity of chemical agents, that it is not surprising that the manufacturer should be so tenacious of what he deems his rights, and so sensitive to any supposed infringements of them. I am now of course referring to the best white rags. When, however, those of an inferior or second quality, or coloured rags, are used, they require much time in order to fit them for conversion into good white paper.

It must be remembered that the rags, as they are collected, are of all qualities—some new, some half-worn, while others are so injured by wear or other causes as to be merely "shreds and tatters." These have to be separated, as the treatment which would bring the one into a proper state would utterly destroy the other. They are also sorted according to their qualities—cotton from linen, hemp from flax, &c. Then there is the collecting, the sifting, the picking out of extraneous matters, so that even with rags a great expenditure of time and labour is required.

The materials are next subjected to long boiling in caustic liquor, in order to remove grease, dirt, and other foreign substances. This operation is most imperfectly performed, as I shall have occasion to show in a subsequent portion of these remarks.

The loss, in one way and another, before the best rags are converted into paper, is over 30 per cent. With those of coarser qualities it is sometimes as high as 50 per cent. This is an important fact, when taken in connection with raw materials.

The rags, when boiled, are washed for from two to five hours, according to their condition and quality. They are afterwards bleached, and cut into short lengths by the beating engine, which machine is intended to rub out the fibre, a duty which it but imperfectly performs. The paper maker is obliged to be very cautious, and not carry this operation of pulping too far, otherwise the paper would be "short," and lack strength.

I do not profess to be a practical paper maker, and therefore any error I may make in points of mere detail, will, I doubt not, be readily excused. My object is with principles, and here I am prepared to speak with confidence.

I feel certain that rags are the most expensive material that can be used, nor can they produce paper equal in strength and durability to raw materials, when these are treated judiciously.

I have a friend in the United States who is now manufacturing some 30 tons of paper each week, the ingredient being principally wheat straw. The process consists in boiling it, under a pressure of 200 lbs. to the square inch, in a large spherical boiler of 14 feet in diameter. In this vessel he acts on some 10,000 lbs. of straw at one operation; it requires some four to five hours to get the whole to the heat of 320° Farenheit, which he continues for some 24 hours. He then removes the man-hole of the boiler and injects cold water, so as to be able to remove the material which is by this time compacted into a large glutinous mass, raw materials having a tendency to this agglutination when boiled in bulk. The object of these operations is to get rid of the silica and gluten. As a like process is used in England by other paper manufacturers, possibly with some modifications, my description will equally answer for other cases. High-pressure boiling involves a great sacrifice of fuel, nor is the object attained, for though the steam in the boiler acquires a very high temperature, the liquor itself is much lower.

Now I ask any one who has seen these operations, can the alkaline liquor or the heat permeate a mass of material so matted and packed together? It is a well-known fact that this treatment is so unequal in its effects, that one batch or boil may turn out far better than the next, and also that those portions which come readily in contact with the alkaline liquor are sufficiently prepared, while those in the interior may be hardly acted on at all. The same objection exists in boiling rags. A paper maker of 40 years' experience told me the other day that frequently one portion of the rags was cooked when the rest was nearly in the same state as when first put into the boiler. This is particularly the case when over half a ton is boiled at a time. This statement has been corroborated by several of the most prominent makers, with whom I have lately been thrown into contact.

Surely, then, if rags, which are free from those glutinous and gummy matters which invariably accompany raw materials, are subject to this difficulty of imperfect boiling when acted on in quantity, how much more must this be the case with the raw material?

It is true that various contrivances have been adopted

for obviating these inconveniences. Some have revolving boilers; others cause the apparatus to perform a semi-revolution, but no practical advantage is obtained. I now refer to raw substances, for with rags, in consequence of their freedom from gummy and glutinous matter, the revolving boiler saves both alkali and time, and ensures more uniform results.

I now come, gentlemen, to that portion of my remarks in which I shall have to treat of processes which profess to remove all the obstacles attendant on the use of raw substances. I will show that what now requires from 8 to 14 hours to accomplish can be effected in two, and that what now takes from 2 to 3 days may be perfectly well managed in 6 hours. Such a revolution in the preparation of paper material I did not in the least anticipate, when I commenced my experiments five years since. If my observations do not appeal to your judgment as being based on correct chemical and mechanical principles, I must not expect to receive your assent or approbation. But I have done more than theorise on the matter, having erected machinery in my garden on a scale of sufficient magnitude to prove the process capable of being carried to any required extent. I should be happy to be visited by any of my audience or their friends, when I think it will be in my power to convince them that paper of every quality can be made quite independently of rags—at less than half the cost—of this fact I am certain. My process consists, first in passing the straw or other material between two rollers—running at different speeds—this produces a trituratory action, which in the case of straw, rubs out the knots and ears; these have always formed an insuperable obstacle in the case of straw, producing specks in the paper; the knot in particular is most difficult to bleach. So also is the ear. I am aware that those who make straw paper attempt to get rid of these by cutting the material into short lengths and winnowing them out, but it can easily be imagined how imperfectly this process must effect the object in view. The rollers also prepare the straw by opening it out into a partially fibrous state, so that it occupies only half the space it would take up in its natural condition, and besides the alkali has a more ready access to the fibre. In this condition it is packed in sieved trays, about one foot and a-half in depth; these are placed in an apparatus to be operated on in detail. That is, each layer is supplied independently with a current of steam and alkaline liquors.

In lieu of filling, for instance, with alkaline liquor a vessel of 8 × 8 feet, having a capacity of about 400 square feet, or 2,500 gallons, I only employ 500 gallons, of a strength of two degrees, or about three ounces of caustic alkali to the gallon—in fine, not over 1 cwt. of soda or potass to the ton of straw, whereas at present few makers use less than from 4½ to 5 cwt. This is effected by using a reservoir at or near the bottom of the apparatus or vessel in which the materials are treated. From this reservoir the alkaline liquor is pumped to one above, from which the distribution takes place uniformly to each layer or stratum to be acted on. When perfectly saturated, the superheated steam acts under each stratum by an independent supply. The excess of alkaline liquor falls over the sides of the tray down to the bottom of the apparatus. In this manner a system of percolation and circulation is kept up for 40 minutes to one hour, when the spent liquor is drawn off, and the reservoir is refilled with fresh liquor, for it must be borne in mind that by this time the alkali, though not chemically neutralised, has lost the power of acting on the silica. I could enlarge, if time permitted, on this topic, as illustrating one of the principal causes of failure in the modes now in use.

The escape steam is not lost, for it enters tanks in which the alkaline liquor or water for washing is first boiled, for it is most important in the treatment of raw material, that cold should not be brought in contact with it until the operation is complete, so far as the removal of gluten and silica is concerned. The paper now supposed to be made of straw, which in most cases is a mixture of cotton-rags, is condemned as being brittle, harsh, and having an unpleasant rattle. These faults arise from the silex being only partially removed; this circumstance has caused a great prejudice against those papers.

When the alkaline liquor has been drawn off, after one hour-and-a-half's treatment, the material is next washed, without removing it from the apparatus. This is effected by turning certain cocks which communicate with the lower reservoir, and admit the hot water. The straw is agitated by a simple contrivance, which causes every part to be repeatedly turned over. This washing process takes from 30 to 40 minutes; this is determined by the escape water running clear. The analogous operation occupies several hours at present, and is, after all, but imperfectly performed.

The fibre is now clean, but to ensure a certain result I fill the reservoir with cold water, slightly acidulated with hydrochloric acid, the cover of the apparatus having been previously removed. This cold solution is now mixed thoroughly with the material for about ten minutes; it is then washed away with extra cold water.

I now come to that portion of my invention which is attended with the greatest economy of bleaching material.

The solution of chloride of lime is completely mixed and incorporated with the straw, after which the superheated steam is let in at a pressure of from 30 to 40 lbs. It permeates the whole mass under treatment, the agitators being kept at work the same time.

The bleaching is effected at once and more perfectly than if the material remained in a solution of chlorine for a whole day.

This is easily understood, when the process or chemical change is analysed. It seems the chlorine combines with the hydrogen of the water, forming hydrochloric acid, while the oxygen attacks the vegetable fibre. The principal obstacle has been the deposit of the lime on the surface of the fibre, preventing in a great degree the further action of the bleaching process. By the employment of great heat, suddenly applied in the manner I have patented, the best and most uniform results may be relied on.

Instead of washing out the acid formed, I prefer neutralising it by the addition of chalk or other substances, extensively used to give weight and opacity to the paper.

The pulping operation is now to be performed. I would here state that for this purpose the present appliances are most rude and inefficient, there being no uniformity of result; some portions are thoroughly reduced, while others are hardly touched. Too much importance cannot be placed on this particular part of the process of preparing materials for the paper machine. I propose using an apparatus which rubs rather than cuts, so that with raw fibres which are tender in the humid state, the greatest length is obtained. This object it is impossible to attain with the beating engine now in use.

It is not a little surprising that, in the manufacture of paper alone, no marked improvement has taken place for the last fifty years. I refer particularly to the correct chemical treatment of the material used. True it is, that nearly every substance has been tried—their enumeration would include nearly every tree, shrub, plant, grass—even stone—and many animal products. In fine, there is no want of paper stuff—it abounds everywhere; but the great and only difficulty has been the want of a treatment which would convert it, economically and expeditiously, into that state which will uniformly ensure to the manufacturer a good strong paper, meeting all the various requirements, from the finest writing to the commonest packing.

Among the old worn materials, bagging and sail-cloth take the most prominent place. It is these, with the waste from the cotton mills, that constitute the paper on which the leading journals of the country are printed.

I have for some years endeavoured to introduce a material—though not in itself new, still, under the conditions claimed, entirely so, as forming a cohesive ingre-

dient, which, combined with the fibre from other materials would form the strongest paper. The mere felting or interlacing of fibrous substances will not, without the aid of other materials—as vegetable and animal size—produce strong paper.

For this purpose, the residue of the beet-root, when not pressed in the raw state, but macerated, in order to extract the saccharine matter, forms one of the best and most available materials, as it not only forms a component part of the paper itself, but carries sizing with it, and imparts a beautiful vellumy feel and ivory surface, not to be obtained except by passing paper several times between glazing rollers, and afterwards submitting it to great pressure between plates or sheets of metal; this is called "plating." The residue of the beet-root can be obtained in large quantities, at a low price. It also possesses the advantage of not losing over ten per cent. in the conversion into pulp. My beet-root patents are in the hands of Messrs. Grosvenor, Chater, and Co., who have a large stock of the prepared material on hand. With this as with other raw material, it would be absolutely fruitless to attempt treating it in the ordinary mode adopted for the conversion of rags. In fine, each substance will demand a modified form of preparation, in accordance with its properties.

I must, in justice to myself, state, that it was only late on Monday last that the Secretary apprised me of Dr. Forbes Watson's illness, and inability to read his paper "On Indian Fibres," advertised for this evening; therefore any deficiencies which may exist in this sketch of "Paper Material," must be attributed to this cause—that of being comparatively unprepared. On some future occasion I hope to have the pleasure of addressing you on some other subject.

DISCUSSION.

The Chairman said it now became his duty to invite them to discuss the observations which had been made by Dr. Collyer upon a subject which was one of considerable interest at the present moment. How far the process which had been brought before them by Dr. Collyer was practically valuable, it was not for him to say; but he saw gentlemen present who were capable of giving them a great deal of information on the subject.

Dr. Riddell said he believed the paper that evening had been undertaken by Dr. Collyer upon a very short notice. He had hoped to have heard a paper by his friend Dr. Forbes Watson, upon Indian fibres, and their capabilities for textile and other useful purposes; and as he probably might not be able to be present when Dr. Watson's paper would be read, he would take the present opportunity to make a few statements with regard to the fibres which he considered might be useful and serviceable in the manufacture of paper. With regard to the paper which Dr. Collyer spoke of as being made from common straw, the great objection raised against it was its brittleness, and this arose from the quantity of silica it contained. He held in his hand a specimen of fibre which contained no silica, and which might be prepared in any quantity at, he believed, one-third less than the present price of rags. He would also show them some paper which was made from the fibre of the *Hibiscus esculentus*, which grew to a height of eight or ten feet. It yielded a nourishing food for cattle, and the bark contained the fibre which was available for paper making. Whilst he was in India he turned his attention to every article he could put his hand upon to turn into paper, and he found, wherever he travelled, either the exogenous or the endogenous plants he met with yielded fibres adapted for that purpose. He selected the *Hibiscus esculentus* for his first experiment, and having collected about 40lbs. weight of the fibre, he submitted it, rough and dirty as it was, to an ordinary workman, who made paper for the natives. His instructions were to make as good paper from it as he could. The fibre cost him somewhere about one shilling for the 40lbs. The manufacture of a ream of the paper cost him about two shillings, and giving the man about sixpence extra for his trouble, he had a ream of excellent paper, weighing 17lbs., for a cost of 3s. 6d. Dr. Collyer had introduced a specimen of paper adapted for the making of cartridges. He (Dr. Riddell) had brought the description of paper which he had just referred to before the proper authorities for the same purpose in India. Toughness was no doubt very essential in paper for cartridges, and this paper possessed this quality in a remarkable degree. It might be interesting to them to know that the substance from which the paper he exhibited was made was never boiled. It was merely beaten into a pulp by a large wooden beater. The pulp when prepared was placed in a bamboo sieve for a short time, and then stuck up against a wall, and the action of the sun completed the process. He begged, also, to introduce to their notice a specimen of fibre prepared from the *Agave Mexicana*. It consisted of the refuse after the fibre had been cleaned for rope or cloth making. They knew that silica was a great obstacle to the making of paper, but some of the Indian fibres contained no silica. Lately he had been trying to introduce some of them into this country, and in one description of fibre, the *Sorghum Saccharatum*, he found he had been forestalled. It was one of the largest kinds of millet, the stalk of which grew to the height of ten feet, and yielded from 8 to 10 per cent. of sugar. When cut green it furnished a nutritious fodder for cattle. They did not require the straw of that plant to make paper. The roots, which contained no silica, were capable of making a paper as fine and as soft as any he had ever seen. As much as 70 tons of this grass might be grown per acre. He merely threw out this hint for the benefit of gentlemen who might be disposed to grow it. The seed was to be sown about the middle of May, and by the end of October they would have a grass from eight to ten feet in height. This was principally grown in the south-western districts of India. He was not prepared to state what would be the cost of a ton of the fibre of the *Hibiscus esculentus* in this country; but his proposition was to prepare the material in India, and send it over here in large blocks to be re-manufactured.

Dr. Watts remarked that they had been very truly told by Dr. Collyer that, at the present moment, the question of materials for paper-making was a very important one. A few weeks ago, after eleven years of labour, he had congratulated himself that he had entirely done with agitation for the repeal of the paper duty; but at the present moment a movement was being made by a few of the largest paper manufacturers, who, professing to be free traders, wanted to retain an import duty upon French paper; and that circumstance, if there were no others, would make it very important that they should understand what materials there were in the world which were available for this manufacture. His own interest in the matter was entirely an educational one. It arose from the fact that paper was the raw material of knowledge; it was the means by which intellect was elaborated, and for eleven years past he had been connected with a society which had succeeded—first, in repealing the duty of 1s. 6d. upon advertisements; secondly, in removing the compulsory stamp upon newspapers and the necessity of registering them; and thirdly, they hoped to effect the removal of the grip of the exciseman from the shoulders of the paper maker, so as to enable him to follow his occupation unfettered. He had no doubt, from what Dr. Collyer had stated, a fair quality of paper might be made from straw. He had seen paper made of that substance, in which the silica had been, with tolerable perfection, removed; and about that time last year a patent had been taken out for converting the refuse of flax into half-stuff for paper. They had been told that evening that the silica was easily removed from flax-straw. That was quite true; but when that was done it was not available for the paper-maker. It was worth more for other purposes than the paper-maker could afford to give for it. But when they had taken out of it all the flax yarn and all the tow yarn, and when there appeared to be left only little pieces

of straw and stuff, which looked like dirt, if they took that and placed it in a closed boiler, something similar to that described by Dr. Collyer, and sent into that boiler super-heated steam, with a strong alkali, and raised the heat to 380 degrees, then the silica dropped to the bottom of the boiler; and after washing, the material came out as perfect half-stuff as any paper-maker could desire. There was in England and on the Continent as much of that refuse of flax burned as would double the whole produce of paper which was made annually in the British Islands. That refuse was now to be had at ten shillings per ton. The value of straw was from a guinea to thirty shillings per ton, and therefore flax refuse was more available. But, doubtless, straw, treated in the same manner, would come out a perfect fibre; and they did not need to be told that the supply of straw in this country was practically illimitable. They found a great rag panic now frightening the paper-makers of this country, and it had set them canvassing Liberal Members of Parliament, and made them talk about its being a great iniquity that the Emperor of the French would not let us have French rags without an export duty being paid to his Government. To him (Dr. Watts) this was the dying effort of the monopolist. What did it all amount to? If they would not let us have their rags—they would let us have their paper. It seemed to him as if there were two things in this attempt to retain an impost duty upon French paper. It looked—first, like an attempt on the part of England to legislate for France in England; and it looked, at the same time, as if they were really afraid of the French manufacturer. If they looked into the subject, they would see that the English manufacturer of paper possessed great advantages over the French with regard to the supply of the material of rags, our manufactures of cotton being much larger than those of France. We had a much larger amount of cotton waste to be used up for paper. We had as many linen and cotton clothes as they had in France; and we had, therefore, in proportion to our population, quite as much rags to dispose of as the French people had; besides having a great deal more cotton waste. Both Dr. Collyer and Dr. Riddell had shown that in India, and in all tropical climates, there was a superabundance of all kinds of fibres applicable to paper making to be had for the cost of collection and freight home. In a great many cases it would be the waste of fibres which had been utilised for other purposes which would be available for paper-making. He had recently had a correspondence with a gentleman formerly long resident in India, in which he offered to import into Liverpool Indian fibres, as good for paper-making as linen fibre, at a cost of 1d. per lb. That offer was made before they saw their way to the repeal of the excise duty upon paper. The reply to it, made in various quarters, was:—"We have tried so many experiments and have undergone so many annoyances, that we have come to the conclusion not to introduce any new material for paper so long as the duty on paper is unrepealed." He thought they were quite right. It was complained of in some quarters that the French not only withheld their rags from us, but that they competed with us for rags in neutral markets. They imported rags from the same countries as we did. If they did that, they must pay English prices for the rags, and if they did so, rags could not be so much cheaper in France than in England. Therefore, he was not frightened at the idea of being overwhelmed with French paper; but even if this were so, his faith in the doctrine of political economy would not be shaken, and he felt, now that they had virtually got rid of the excise duty, there would be as much progress made in the manufacture of paper as had been the case with glass and other branches of industry from which fiscal restrictions had been removed.

Mr. William Hawes thought it was a pity, that when any principle good in itself was advocated, every opportunity should be taken to complain of the conduct of those who were engaged in the particular manufacture which the carrying out of that principle might seriously affect. He did not believe that the paper manufacturers of this country were so ignorant or so prejudiced as the gentleman who last addressed them wished to make out. He believed the paper trade of England was conducted by men of intelligence and skill, who would soon overcome any temporary difficulties which were thrown in their way by a change such as that which was about to take place. They had been told that this was an attempt to legislate for France. He was sure we were above any such attempt. We had offered to France a great boon, in the belief that free trade would do more to encourage the principles of peace and amity than restriction. But whilst we were doing that, we had a right to ask the legislature to look at the special circumstances of the case, and to see that a treaty which produced so great a change in our commercial relations with France, should be so framed as to injure as little as possible any particular branch of our home manufactures. The gentleman who last addressed them appeared to suppose that the fibres of which he had spoken were all ready at hand for delivery, and that the paper-maker had nothing to do but to desert the rag trade and take up the fibre trade. Fibres were at present, to a certain extent, a theory; rags were the practice; and until the time arrived when the price of one material would be assimilated to the price of the other material, and until the manufacturer was fully convinced that paper of the same quality could be produced from the new material as from the old material, the argument of the gentleman who last addressed them was defective. There would be little doubt that rags were cheaper in France than they were in this country, and if the low price was occasioned by the excess of rags in France, the prices would ultimately assimilate in the two countries, and then the English manufacturer would have the full advantage of his intelligence and his superior machinery. But the gentleman who last addressed them had put this as an excise question. There was nothing in the excise law to prevent improvements in the manufacture of paper. The excise was taken after the paper was made. It was not the same as in the case of glass and soap, where the excise interfered at every step of the process. Who could doubt that the English paper machinery was the most perfect and beautiful in the world? It was sent to all parts of the world, and they had our machinery in France to make paper from their cheap rags, to be exported into this country. It was not therefore a question of excise on the manufacture; and the indignation of the last speaker with reference to excise rescrictions was thrown away as applied to the question of paper. The discussion that evening was not one of political economy or of excise. It was as to how far other substances than rags could be brought to bear upon the paper trade. He (Mr. Hawes) was incompetent to give an opinion upon that subject; but the statements they had heard were highly interesting; and if this paper did no more than direct attention to these new substances and lead to inquiries as to how far they could be used as substitutes for rags, the time they had devoted to the subject would not only be beneficial to the trade but to all who were interested in the production of paper, which must be looked upon as an important element in the progress of civilisation.

Mr. J. T. Norris, M.P., remarked that there were many great difficulties which beset this question. Experiment after experiment had been tried, and in some cases failure after failure had dismayed those who had experimented. Expense upon expense had accumulated, until, in many cases, he had known enterprising men exhaust their resources without achieving success. Although ingenious men, combining their chemical and mechanical knowledge, had succeeded in producing paper out of substances which appeared to be most unpromising, it had, nevertheless, been found that although the manufacture was successful as an experiment—showing what could be done—yet it had not been a commercial success. The reason, in many of those cases, would be the same as

would render ineffectual the effort to make paper out of some of the materials which had been brought under their notice that evening. They had heard of the fibres of India and the grasses of Spain. No man could say that they were to be had for the mere fetching, and that shipowners would bring them home without charge for freight. On the contrary, all such material must have a definite cost price, and this cost price came into competition with that of the rag material of the country, which being a constantly produced refuse, continued to exist whether it was of value or not. The rags had served the purpose for which the raw material was brought into the country. It was thrown away as rags, and then the paper maker took it up and converted it into paper; and that material would still abound, notwithstanding they obtained these grasses and other fibres. If therefore these other materials were brought into the market at a price under that of rags, the rags would still exist, and would go down in price; and thus enterprising men who wished to produce a material for the paper-maker would always have a fluctuating market, or, what would be still more alarming, the production of the new material would cease to go on, and the paper-maker would have to resort to rags again. The gentleman who spoke last but one had told them that straw everywhere abounded, and could be obtained at a cost of 20s. or 30s. per ton. He (Mr. Norris) knew something of agricultural pursuits, and he could say that in all the Midland Counties, and in most of the corn growing districts, straw not only did not abound, but for paper-making purposes there was a strong prejudice on the part of the agriculturists against parting with their straw, and if they did part with it it was only done in an excited market. Thirty shillings per ton was about the lowest price at which straw could be had for agricultural purposes, and when the paper-maker competed with the farmer or stable keeper the price went up very considerably. It was within his own knowledge that several mills in Gloucestershire and Oxfordshire, which were devoted to the manufacture of paper from straw, had proved lamentable failures, owing to the inability to obtain the straw at prices which left a remuneration to the manufacturer. They were all aware that the spirit of enterprise amongst farmers of the present day was such that they did not depend upon their crops of corn for their profits so much as upon the fattening of cattle for the meat market. Hence the necessity for their keeping the straw produce of their farms for their own purposes. He therefore, with all deference, denied the statement that straw everywhere abounded; but on the contrary, it was difficult to produce. Dr. Watts had stated that the French manufacturers were importers of rags from the same markets as those from which the English paper-maker obtained his material. Those who were acquainted with the trade well knew how this occurred. The clothing of the French, like that of the English people was, compared with that of some other nations, of a thin and fragile character. Cotton material, when worn as clothing, was not sufficiently strong to make, by itself, a tough thin class of paper, and the excise-duty upon paper had driven the manufacturer to experiment upon thin rather than upon thick paper, to make it cheap. The cotton waste was of itself not sufficiently strong for the purpose without the admixture of a fibre of a stronger texture. The class of clothing which contained this abounded in Russia. The coarse linen rags of Russia, added in the proportion of 20 to 30 per cent., as the paper was required to be thicker or thinner, gave a stronger character to the paper; and it was for that reason the English and French manufacturers must have, and did have, the Russian material, notwithstanding there was an export duty of £6 per ton upon it. But it was said the paper-makers were frightened by a shadow, and that, when they saw the approach of free trade, they asked for protection of their interests. He did not so understand it. On the contrary, he understood it that, when Lord Cowley and Mr. Cobden sat down with the French minister to discuss the question of what articles were subject to mutual export and import duties which were injurious to the trade of both countries, he could readily understand that the Frenchman would say, "There is the article of paper for hangings. We send to your country the most beautiful productions in the way of painted paper for the decoration of your rooms. We want to know why you should place a considerable duty upon that article when it is imported into England." Mr. Cobden would reflect that England had all the elements within herself of producing that class of article as well as the Frenchman. The paper itself was not the thing which created the cost of production, but the design and the painting upon the paper after it was made. Mr. Cobden could have no answer to give to that argument, and therefore the paper was to come into this country at a duty equivalent to the duty upon paper manufactured at home. There was the principle of free trade, and no English paper maker's voice was raised against the arrangement. But whilst that was going on, and unknown to Lord Cowley and Mr. Cobden, the Government at home resolved that the paper duty should not be looked upon as a permanent source of revenue, and the Chancellor of the Exchequer announced to the House of Commons that the excise duty upon paper in this country would be taken off. Mr. Cobden would hear of that with surprise, for he would find that no advantage was gained to either by what he had previously insisted upon with regard to paper-hangings. When, however, he heard that the duty was to be taken off paper at home he would go into the question of the raw material, and would find there was a prohibitive duty upon the exportation of French rags, and he would then try to induce the French Government to relax the impost upon that article. They agreed that instead of a prohibitive duty there should be what they called a moderate fixed duty upon the exportation of rags, which was, however, equivalent to a prohibitive duty, as £10 per ton on rags would make £15 per ton on the paper. It was the French manufacturers who looked for protection. If they could maintain a protective duty upon rags they could make paper a penny per lb. cheaper than the English manufacturer. There was not so much justice in this arrangement as that it should have been assented to by Mr. Cobden or adopted by the House of Commons. Recurring to the subject of vegetable materials grown in this country as a source of supply to the paper makers, he would say that in so precarious a climate as that of England such a supply could not be depended upon. The variable weather of the last winter had operated most prejudicially upon the staple food crops for cattle. Hence the increased price of all kinds of fodder throughout the country. If beet-root were produced to enable an experimentalist to make paper from that material, the farmer would outbid the paper manufacturer, and that class of material, like so many others, would not be found available. But it was said that although the French had a great abundance of rags, how it was they did not want the rags as much as the English paper maker? The answer to that was, that the great cause of the enormous consumption of paper in this country had been the cheap morning newspapers and the weekly literature for the lower classes. These were numbered by hundreds of thousands of impressions and kept the printing machines in London in operation night and day. There was nothing of that kind in France. They had not the free press in which this country rejoiced. Besides this, they used more light cotton clothing in France than in this country. Whilst the Englishman wore his woollen coat, the Frenchman wore his cotton blouse, consequently, there was a greater abundance of cotton rags, and the price in France, as compared with that in England was as 12 to 20. If the English paper makers could have a fair opportunity, by the extension of free trade, not only to what they sold, but also to what they bought, he (Mr. Norris) would say that they did not fear competition either in France or Belgium, so long as the raw material was freely opened to them.

Mr. John Evans had attended for the purpose of hearing what might be advanced by Dr. Collyer upon the subject of converting straw into a useful fibre for the manufacture of paper, and he must say the apparatus described that evening for the preparation of the straw seemed remarkably ingenious, and he thought very possibly Dr. Collyer might produce a better material by that means than had hitherto been produced. He thought, however, even the most strenuous advocates of the use of straw would be of opinion that it could never be made available for the manufacture of a good quality of paper. There must be a certain amount of rag fibre added to it; and, of course, however cheap they might get the straw, this would tend to raise the price of the paper. Moreover, he doubted whether (assuming straw to be at the price of £4 per ton), even with the improved means of bleaching adopted by Dr. Collyer, the loss in weight would not be so enormous when the straw was freed from silica, that the cost would come very near to that of rags in England. He felt confident it would exceed the cost of rags in France at the present moment. With regard to the other fibres introduced to their notice by Dr. Riddell, it appeared to him that some of them were applicable to other purposes than that of paper-making. He was in the habit of having various fibres brought under his notice, but when he gave an order for 30 or 40 tons of a material which he fancied was suitable for his purpose, the order was never executed. He could only suppose that a better price was obtained for the material to be applied to some other purposes of manufacture. The object of the paper maker was of course to get a material which, when converted into paper would pay him for his outlay, and those who had had the greatest experience with fibres as a substitute for rags had been the most unfortunate of that unfortunate race, the paper-makers. There were several fallacies in the speech of Dr. Watts, which, if time permitted, he should have pleasure in replying to, but at that late hour he would not attempt to do so. He would content himself by alluding to one or two points. With regard to the term "monopolists," it was very easy to use it. When an act of injustice was about to be committed, it was easy to use hard words. As to paper making being a monopoly, he thought the number of houses which had been unsuccessful was greater than in almost any other branch of industry. A paper-maker from Bristol had told him that, of twenty-two mills along the Devonshire coast, twenty-one had stopped payment, which had been laid to the interference of the excise. He was himself connected with a large paper-making firm, who had four mills for the manufacture of paper, and two mills used exclusively for the preparation of the material called half-stuff. He had been engaged in the business for more than twenty years; and with regard to the latter mills, he had never known an instance of the premises having been entered by the officers of excise. It was said that they were frightened at the free introduction of paper from a country which would not permit the exportation of rags. He begged to say that prohibition was not limited to France alone. A duty of £9 per ton upon rags was equal to 1¼d. or 1½d. per lb. upon paper. The export of rags amounted to between 20,000 and 40,000 tons a-year, which was more than sufficient to make half the weight of paper that was annually consumed in this country. The Government virtually said, "We will give you £360,000 a-year to keep these rags at home, and instead of sending us the rags you shall send us the paper." He appealed to the meeting whether that was fair. It was said that in course of time this would right itself. That could only be by the price of rags in this country falling to the level of that in France. It was next to impossible that the price could fall materially. The export of rags from this country was free, and directly the price of rags fell here, they were sent off to America, where the demand for them was greater than in this country, and the price of paper was a penny per pound higher than it was here. In America they protected themselves by an *ad valorem* duty of twenty-four per cent. All he said was, if the rags were taxed, let the paper be taxed too, and if the paper was free, let the rags be free also.

The Chairman said that whatever might be the merits of the precise mode of manufacturing paper from straw or other materials which Dr. Collyer had so ably explained to the meeting, but upon which the Society did not pronounce an opinion, it had been the means of inaugurating an interesting discussion, from which much instruction might be derived. To some extent the theory of free trade had been impugned, for to make any exception in its application was to place it again on trial. He (the chairman) however had never swerved from his faith in the principle, although the branch of manufacture in which he had spent a large portion of his business life had been exposed to its operation in all its intensity,—he meant the silk trade. He had known it when foreign silks were absolutely prohibited, when they were admitted at a duty of 30 per cent., when that duty was largely reduced, and now when it was entirely removed. Of the past he could therefore speak from experience, and from that he could venture to augur favourably for the future. All the original prophecies as to the annihilation of the silk manufacture in this country by foreign competition, had not only been falsified by the result, but the consumption of the raw material had been more than quadrupled, thereby requiring a corresponding increase of operatives to manufacture it. Besides this, the importation of foreign made silks had become a most important branch of trade, and they were paid for by British made goods of some sort or other. Now he could see nothing in the paper trade which should take it out of the category of other manufactures; and Mr. Norris might think him rather obtuse, after the elaborate statement with which he had favoured the meeting, but he (the Chairman) could only say that he had failed to convince him that, because for the moment there might be some difficulty as to foreign rags, we were to wait till it was removed. Dr. Watts had very ably addressed himself to this point, and it could scarcely be doubted that the same sources from which rags had been forthcoming in this country, to supply the enormous demand for paper which had sprung up during the last few years, were not dried up, but would prove sufficient to supply any emergency or increase that might arise. If however, after all, it should turn out that paper can be produced cheaper abroad than at home, we ought, and doubtless should, whatever might be the consequences, purchase in the cheapest market. But he had no such chimerical apprehensions, and was quite sure that the paper makers in this country would maintain their present proud position against any foreign competition. The Chairman concluded by proposing that the thanks of the meeting be given to Dr. Collyer, for the acceptable manner in which he had supplied the vacancy created in the programme of the evening's business, by the unfortunate illness of Dr. Forbes Watson.

The vote of thanks was then passed to Dr. Collyer.

Dr. Collyer said he would offer one or two remarks in reply upon the discussion. With reference to straw, although in some cases he granted that an increased demand for it in particular localities might enhance the price, yet it was to be remembered that thirty millions of tons of that commodity were produced annually as the refuse of the necessaries of existence—wheat, barley, and oats. There could be no difficulty if it were used, as it might be used, without the mixture of other substances, and paper would be made at one-third of the price at which it was made from rags. This was no speculative assertion. It was being done in America, where Mr. Nixon, near Philadelphia, was making 40,000 tons of paper per annum from straw, and realising £10,000 a year profit. He supplied the paper for the *New York Sun*, which printed 90,000 copies per day; also for the *Philadelphia Ledger*, printing 75,000 copies per day. That paper was sold at a cost of five cents per lb., and was manufactured at a cost of two and a half cents per lb. Such pape

could, however, be made cheaper in this country than in America, because the whole of the alkali used was sent from Scotland to America, and on its transmission thither it lost some of its strength. One word as to the beet-root. He did not refer to beet-root as grown in this country, and Mr. Norris was in error in the remarks he had made on this part of the subject. He spoke of the refuse of beet-root, after it had been used for the production of sugar or spirit. This was totally unfit for cattle, and even useless as manure, therefore the position taken by Mr. Norris with reference to beet-root was untenable.

The Paper was illustrated by specimens of paper and paper material in various stages of manufacture, and by experiments explanatory of the processes described by the Author.

The Secretary announced that on Wednesday evening next a paper by Dr. Dauglish, "On a New System of Bread Manufacture," would be read. On this evening Edwin Lankester, Esq., M.D., F.R.S., will preside.

The following letters have been received since the meeting:—

Sir,—I presume it may be considered true of all commodities that price is the measure of scarcity, and when paper manufacturers assert that their ordinary materials are scarcer in England than in France, they mean that the market price of a ton of the same description of rags is (some 50 per cent.) higher in England than in France. No theories or explanations of abundance can get over the stern and unpalatable fact of market price.

The papermakers, therefore, demand of a Free Trade Government to use its power to enable them to act upon the Free Trade principle:—"Buy in the cheapest market."

It is simply absurd to say this has been done by the removal of a prohibition and the imposition of an enormous duty instead. As well might it be said that a man is free who, although released from the stocks, is turned adrift heavily ironed and handcuffed. With reference to certain points raised by Dr. Collyer, I may remark that the old rope and sails of the Royal and Commercial Marine are employed in the manufacture of paper, and it would not be difficult to show that upwards of twenty tons of these articles frequently pass through the hands of individual dealers in the course of a month.

How many tons in the aggregate in the course of the year may be thus employed it is almost impossible to estimate.

The oft-repeated assertion that straw is capable of making the best-class printing and writing paper may be thus answered:—Several mills have been working this material in England during the last eight or nine years; and I shall be happy to be corrected if I am wrong in stating it as a fact that in not one is straw used alone, but all find it necessary to mix paper shavings for the express purpose of improving the tenacity of the paper. In fact from this cause the price of paper shavings has increased nearly 50 per cent. during the last few years; yet they all started with the intention of using nothing but straw. And this result harmonises with the experience of the world in all times and places.

Wool, silk, cotton, flax, and hemp, in their varieties have been the fibres chiefly used by all nations for spinning, weaving and all textile productions, and, setting aside wool and silk as inapplicable by their nature for general paper purposes, cotton, flax, and hemp, have been found by the experience of all paper-making communities as the most suitable for their purposes.

Why has not straw been employed in the preparation of garments for human wear? Surely prejudice has not prevented (as is asserted against the makers of paper), but inherent unsuitability, except for articles of a peculiar character; hence it is largely used in a plaited form, for hats and bonnets, cases in which easy folding and flexibility are rather undesirable,—the very qualities which a good paper should possess.

What becomes of the rags produced by the home consumption of linen and cotton goods, opens up another large subject of discussion. It will be admitted that the poorer a country is, the more important relatively is the small amount received from the saving of its waste rags, but the wealth or poverty of a nation is constituted of the wealth or poverty of individuals, and in a rich country the population is more wasteful.

On this principle the higher classes, the employers of servants, heed little what becomes of their worn and discarded garments, and as the condition of the employed improves, this item becomes relatively of less importance to them. For instance, a servant who 20 years ago received from £6 to £10 per annum wages, thought more of the perquisite of 20s. receivable for the contents of the rag bag than a female in a similar position does now, her wages having nearly doubled during the period named. Economy is not suggested, and therefore not practised. Her power of purchase has thus largely increased, while the price of the articles she requires has diminished. Therefore we may safely assume that the crop of suitable material existing in this country is not half harvested, certainly not gleaned, and my reason for once more troubling your readers with this "old clo" business is to throw out a suggestion which has been brought under my notice. It has been proposed that all large towns should be divided into districts, and every house willing to receive such visits should be periodically waited upon by boys belonging to the Ragged Schools, or societies under supervision, as the Shoeblack Brigades, and the worn-out clothes of all kinds be received and paid for at fixed rates.

There seems to be some value in the idea, and though many difficulties would present themselves in its working out, nevertheless, if not ridden to death, many philanthropists might find it a practically useful hobby.—I am, &c.,

WILLIAM STONES.

Sir,—The discussion upon Dr. Collyer's paper last evening diverged rather extensively into the politico-economical branch of the question, and the alleged injustice about to be inflicted on the British paper manufacturers, and hence the main and most important subject of what materials, other than rags, can be brought to the aid of the paper-makers, was rather lost sight of. It will not, I think, be for one moment asserted that rags, with the growing demand for paper, and the difficulty there is in collecting them, will very long suffice to meet the wants of the manufacturer and the public. What other materials, then, can be looked forward to for a supply? It is true there is an abundance of both wild and cultivated plants, in both temperate and tropical regions, which may be obtained, but can a large and cheap supply be obtained continuously, and will they stand the cost of freight? Moreover, they must be fibres unsuitable for the rope-spinner and cloth-weaver, or they cannot be brought in at a low price.

Passing over many of the plants and substances which have been merely experimentally tested, and can never be obtained in quantity, let us glance at a few which seem promising as regards quality, price, and quantity. That there is an abundance of fibre-producing plants throughout the world, all are ready to admit, but it was urged that they were not available at all seasons, like rags, and one crop only per year could be obtained, so that the mills, if waiting for this alone, must stand still. This, however, is not the case, for paper pulp, and fibres fit for pulping, could be obtained all the year round from one quarter or another of the globe. Indeed so numerous is vegetation in the tropics that many plants almost spring up faster than a mill, if at hand, could keep working upon them.

Besides cheapness, abundance and readiness of supply, ease of preparation, little loss in the process of conversion and facility of being bleached, are essentials of a good paper material. Allusion was made to the waste of fla x

of which there is no doubt much on the Continent, in France, Russia, Austria, and the Zollverein, but it is a difficult thing to collect, and the collection and transport would, I think, scarcely pay for shipment. Professor Lindley, in a recent letter in the *Journal*, alluded to many useful materials. I also took occasion, in my paper on the Utilization of Waste Substances, and in a previous one on some undeveloped products available for commerce, to draw attention to several which might be employed with advantage. For present available purposes, until the special cultivation shall be entered upon, I believe there are only two or three that could be obtained in quantity cheap. These are the stalk of the sugar cane after the juice has been extracted, "megass," as it is termed; the plantain stems, and a few of the wild, coarse grasses which abound on many coasts, and might perhaps come over as dunnage from some of the sea ports. The cost of freight is the main obstacle to the importation of many of these bulky articles; and the question arises whether it might not be better to transport the paper-making plant to some good locality in India, or Ceylon, or Demerara, where paper material abounds, instead of bringing over the raw fibre, or the prepared pulp, in the shape of half-stuff. The machinery and appliances of a paper-mill, I believe, are not very expensive, and it appears that we already supply our machinery to different countries.

If it be true, as stated by Dr. Collyer, that it requires five cwt. of alkali to bleach one ton of fibre, this forms a very heavy item in the proposed manufacture, and one which must be greatly reduced before it can be carried on with profit. From many of the West India Islands, from Brazil, Louisiana, and Mauritius, large quantities of this cane stalk could be obtained, and made available, if practically pulped, so as be compact for shipment.

The plantain stalk would require to be similarly prepared, as it is so succulent and bulky a stem. I doubt if the *Hibiscus esculentus* and *Sorghum saccharatum*, alluded to by Dr. Riddell, could be obtained in sufficient quantity, and neither of them furnishes a large amount of fibre. Some others of the Hibiscus species are more promising, but they are in two good repute for cordage, &c. If potato stalks could be obtained in quantity, as a waste substance, they might be useful. The bamboo is much used in the East for paper, and very abundant, but, from the silica and woody texture, it would be found too expensive to macerate and operate upon.

The refuse of the beet root, to which allusion was made by Dr. Collyer as a paper material, is certainly not to be despised, and only those who have looked into the statistics of the progress of beet-root sugar manufacture of late years on the continent, can form any idea of the quantity of the material available. At what price it could be obtained, and whether there are any difficulties as to its shipment, or more pressing claims for local consumption, I can form no opinion. The specimens shown of paper made with 90 per cent. of beet-root pulp prove its adaptability and usefulness.

I have not heard that it is much used on the continent for paper-making, except perhaps for coarse packing-paper and paper-waste.

In the season of last year there were used in the Zollverein about 1,850,000 tons of beet-root for sugar making. In Poland the weight of beet-root used for sugar making in 1858 was 350,000 tons, while in the rest of Russia it was about half as much more. In Austria 300,000 tons. At the Baden sugar manufactory of Waghausel, near Bruchsal, alluded to by Dr. Collyer, one of the largest in the Zollverein, more than 75,000 tons of beet-root are annually used.

In France, 1,250,000 tons are used, to say nothing of Belgium and other districts, of which I have not the statistics before me; but in those enumerated we have about 4,000,000 tons of raw material operated on annually, the dry refuse from which must be very considerable and very cheap, and, what is more to the purpose, collected in bulk at large centres, where is is easily procurable, either for bleaching, starch manufacture, replacing rags, or for transport here.

The United States have double the number of paper mills in operation that we have, and their manufacture and consumption of paper are very large. Not only do they make for their own use, but they supply the South American market, the West Indies, and British North America. The newspaper press in our colonies, and book-printing, is extending year by year with the growth of population; and there are large demands also for paper for correspondence, for packing purposes, &c. If we wish to keep our ground in the manufacture and foreign supply, we must do as the Americans have done, look about for some new auxiliary product to help out our rag supply. There is still too much prejudice existing against a trial of anything new, because it is not adapted to existing machinery. New materials have, however, made the fortunes of many who had the judgment and forethought to adopt them, such as alpaca, jute, Mexican fibres, and such like. The importance of the subject under notice, in a national and civilizing point of view, must be my excuse for enlarging upon it, and I trust it will have free and full discussion.—I am, &c.

P. L. SIMMONDS.

8, Winchester street, S.W April 19, 1860.

FLAX AND ITS PRODUCTS IN IRELAND.

By William Charley, J.P., Seymour-hill, Belfast.

Letter XVI.

The old-fashioned orthodox notions about weaving have been sorely tried by the success of the power looms, but progress is not confined to this department; indeed, there is almost no limit to human ingenuity, and attention has lately been directed to the introduction of machinery as a substitute for fingers in the operation of sewing. I must confess I have a little of the old-fashioned prejudice in favour of the poor needlewomen, and do not grudge them their scanty pittance, but I am told the wages for these once badly-paid workpeople are rapidly becoming enhanced, not only in London and Glasgow, but also about our Ulster town of Londonderry, where many of the employers have branch establishments, having been tempted over by the cheap labour that existed a few years ago.

As one of these new inventions is a kind of loom, it should, perhaps, be mentioned, before proceeding further. It is thus noticed in one of the provincial journals, published a few years ago:—

"Loom for Manufacturing Shirt Fronts.—We are rejoiced to find that the inventor of this ingenious and useful machine, Mrs. Elizabeth M'Cracken, of Dromore, specimens of whose manufacture were brought under the notice of the late Lord Lieutenant, the Earl of Eglinton, and also of Lord Naas, by Professor Hodges, at the meeting of the British Association in this town, has received five pounds from Lord Naas for a model of the loom, which has been forwarded to Palmerstown. Lady Naas expressed great interest in the work which this miniature and elegantly finished loom is capable of producing."

The spinning wheel alluded to in former letters is still occupied in producing a few very fine yarns. That some of the hands have not "forgot their cunning," may be inferred from the following extract from the report of the jury, class xiv., Great Exhibition of 1851:—"The specimens from Ireland are also very creditable; that spun by Jane Magill, 84 years of age, being the finest (760 leas), and that by Ann Harvey (about 600 leas) being the most perfect in quality and spinning. The jury recommend the award of money premiums to these individuals, &c." They received £10 each.

The sale of brown manufactured linens, formerly conducted in the market towns of Ireland (especially in Ulster) in halls set apart for the purpose, is now effected generally by private contract, or through the agency of com-

mission houses in Belfast. A few of the old linen halls and markets still exist, but "the glory is departed," and the course of trade is gliding past them through other channels. Those still in existence are Armagh, Ballymena, Coleraine, Ballymoney, and Lurgan. Of course, these are exclusively for hand-loom goods, as the power-loom productions are sold direct to the merchant. The sale of brown linen is made by the illegal measure of 37 inches to the yard. This custom arose from the habit of giving 36 inches and the width of the thumb in former days, when there was a larger margin of profit on the linens than at present, and "good measure" was considered a point of honour.

I can see no valid reason for continuing this practice, either in brown or bleached goods, now that all business must be done at a minimum rate of profit, in order to succeed at all. The legal yard of 36 inches is the correct standard for commercial transactions, and is, I believe, now in general use in cotton and woollen fabrics. Why should linens be an exception? The custom only exists in what is styled the home trade, and the sooner it is abolished the better.

It is very difficult to quote prices for Irish linens, owing to the immense variety of "sets" representing the fineness, and, again, the variety of quality and weight in the yarns used for the "set." In fact, every large firm has a standard of its own on these points, very intelligible to themselves and their correspondents, but to "outsiders" like an unknown tongue.

This want of a fixed standard is certainly open to many grave objections, but as business increases and comes into the hands of more extensive establishments, the standards of manufacture will very likely become more regular, and approximate more closely to each other.

Leaving the question of prices, and supposing the brown goods to be purchased by certain parties, let us trace what becomes of them. The majority of the goods certainly go to the bleach-greens; a large portion of the remainder are finished brown; some are coloured before being finished, others are partly bleached and dyed, and recently a great many have been first bleached and afterwards printed with fancy patterns, forming a kind of dress, half-way in appearance between cotton and silk.

As bleaching is the most important of these operations, as well as the most difficult, it will naturally receive the greatest amount of consideration, and be placed first.

Bleaching is defined by Dr. Ure to be "the chemical art by which the various articles used for clothing are deprived of their natural colour, and are made white." I have already pointed out that many years ago Mr. Lee proposed several alterations in the existing system, and although few of his suggestions were adopted, there was certainly one improvement he brought forward that is at present in use, and highly beneficial. I mean the extensive use of soap in bleaching. The oil in the soap restores to the fibre much of the tenacity and softness that the continued boiling and chemical operations it undergoes have a tendency more or less to reduce.

Mr. W. Higgins, M.R.I.A., sixty years ago, recommended sulphuret of lime as a substitute for potash, in a clever pamphlet, but without any practical result. Lately, hypo-sulphate of soda has been suggested as a safeguard after using chlorine. It is, I believe, used in blanching paper, and is worth a trial in linens, though, like all chemical experiments, it should be tested over and over again before adoption on a large scale.

A Mr. George Leuchs, of Nuremberg, in Germany, informs me that he has just discovered a substitute for chlorine, much safer and quicker in its operation; but of the merits of his discovery I have not been able to form any opinion, and unless his financial views become greatly modified it is unlikely ever to have a fair trial in this country.

Mr. Robert Neill, who for thirty years has been managing director of large bleaching establishments in Ireland, has, during that time, assisted very materially in promoting practical improvements in the bleaching process. We have heard so much of fine theoretical schemes, that turn out eventually to be only castles in the air, that a really practical mind deserves the more commendation. It is singular that the fine bubbles of theoretic plausibility, which float before our vision for a short time, and finally burst almost unnoticed, are generally, so far as the chemical part of bleaching is concerned, the production of foreigners, or persons not conversant with the details of the business, while the genuine improvements are almost invariably carried to perfection by men whose minds have from youth been accustomed to the subject.

To my readers who have never seen an Irish bleach-green, any description I could put upon paper would, I fear, neither be very interesting nor very intelligible. I shall therefore content myself with a brief outline of the existing system.

The boiling is conducted in large iron vessels, with lids secured down tight, so as to retain all the steam, and thus prevent loss of heat, air, and reduction in the amount of liquid which with open vessels must occur.

The liquid used in the boiling process is alkaline lye, generally prepared from soda ash now; in old times, barilla and potash were mixed, and a very good combination they were, but too expensive, and no better than the soda, which costs very much less.

After boiling, the linens are washed and exposed to the action of the atmosphere on the grass for two or three days, according to the season and weather and quantity of goods.

These processes are frequently repeated, and go on till the goods are half white; the straw of the flax, which can not be perfectly extracted in the scutching and cleaning, now shows greatly, and demands a new application.

This consists in giving a bath of water, having in solution chloride of soda, or potash, or lime. I prefer the former as the safest, and it is now generally adopted.

The action of sulphuric acid, reduced to two or three of Twaddel's alkalimeter, is also beneficial, though it is a question whether this should be used after the chloride, as in old times, or before it.

The breaking and whitening of the straw or sprit is greatly facilitated by what is called "rubbing;" this is, in fact, an imitation of hand-washing by machinery, and with plenty of soap is an excellent part of the bleaching process, contributing to increase rather than diminish the strength of the fibre.

When the linen is quite white it is starched, and afterwards dried on steam-heated rollers; it is then ready for what is called the "finishing" process, given to it by machinery called "beetles." The whole time required for the bleaching is from four to seven weeks, according to the season and the weight of the fabric.

Damasks, and many linens for export, receive a very high finish, or glaze, which prevents them looking rough, but if linen is soon to be in the hands of needle-women, this glaze is worse than useless.

I may also remark that the fancy for extremely white linens has lately made the business of a bleacher very risky, as, in the endeavour to please the eye, it may easily happen that he may be tempted to go too far, and thus impair, to some extent, its durability—in fact, wear it out prematurely. A fair, even colour, without injury to the fabric, can be attained by intelligent bleachers, and beyond that they should allow no pressure to urge them.

The introduction of soda ash, and the centralizing of business in large concerns, has wonderfully cheapened the cost of bleaching. Not very many years ago, a piece of light yard-wide linen would cost the merchant, probably, 3d. per yard to bleach, which is now done for 1¼d., and in one-third the time. Fifty years ago 2,000 or 3,000 pieces of linen would be a trade for one establishment for a whole year; now it would not satisfy a large concern for a week.

It cannot be said that the apparently high price of linen, as compared with cotton, is attributable to the bleaching expense, as the rates appear very moderate in proportion to the value of the material.

In order to show the difference between the bleaching of cottons and that of linens, I extract the following Table of operations from a memorandum book, by a working man:—

Cottons.

		Minutes.	Days.
1. Lime boil for twelve hours	wash	40	1
2. Sour in muriatic acid for ten hours	,,	40	1
3. Boil in lye for eight hours, 2 degs.	,,	20	1
4. Boil in lye for eight hours, 1½ degs.	,,	30	1
5. Dip for twelve hours in alkaline, 40 to 1 strength,	,,	30	1
6. Sour for twelve hours in vitriol, 2 degs.	,,	35	1
			6

If the above process does not make them white, give another light dip, and sour.

Now ready for beetling.

For bleaching one parcel of light linens, say 150 double pieces:—

		Minutes.	Days.
1. Steep for twenty-four hours	wash	15	2
2. Boil for seven hours in lye and rosin, 2½ degs.	,,	15	1
3. Boil for nine hours in lye, 2½ degs.	,,	30	1
4. Grass for three days			3
5. Boil for ten hours in lye, 3 degs.	wash	30	1
6. Grass for three days			3
7. Boil for eight hours in lye, 3 degs.	wash	30	1
8. Grass for three days			3
9. Rough sour for ten days in vitriol, 2 degs.	wash	40	1
10. Scald for four hours in weak lye	,,	30	1
11. Grass for two days			2
12. Dip for ten hours in alkaline, 40 to 1 strength	wash	30	1
13. Sour for twelve hours in vitriol, 1½ deg.	,,	45	1
14. Scald for four hours in lye and soap	,,	20	1
15. Rub with brown soap	,,	35	1
16. Grass for two days			2
17. Dip for ten hours in alkaline, 30 to 1 strength	wash	20	1
18. Sour for twelve hours in vitriol, 1 deg.	,,	45	1
19. Scald for three hours in soap and lye	,,	30	1
20. Dip for ten hours in alkaline 45 to 1 strength	,,	20	1
21. Sour for twelve hours in vitriol, 1 deg.	,,	45	1
22. Rub with soap	,,	20	1
Time taken			31

The goods should now be white and ready for beetling.

I will not certify that the above is the very best kind of treatment, but it is substantially correct, and shows how much more difficult and tedious the bleaching process is for linens than for cotton, and how much more the atmosphere affects the bleaching of linen.

Ireland possesses the best climate in the world for linen bleaching, and it is this local advantage—this gift of nature—that has gradually given to her, and secures to her still, the almost exclusive possession of this branch of commerce.

As flax is not an exotic, but is grown largely in Ireland, the products of that fibre are more purely national than either cotton or silk; and, in this respect, the Irish staple trade somewhat resembles the national woollen manufactures of Great Britain.

Cotton, however, is somewhat like flax in its composition. Pure lignine is the essential constituent of both.

For many years, the want of chemical knowledge among the foremen and managers of bleaching concerns, made the operations very uncertain and irregular. Lately there has been much improvement in this respect, and Professor Hodges, of Belfast, a first-rate chemist, has had many young men educated and employed in his laboratory at practical chemistry, so as to train them for the post of superintendent in these works.

Mr. H. S. Tremenheere, a gentleman sent as Commissioner at Lord Shaftesbury's desire, made a report, in 1856, as to the propriety of placing bleach-works under the Factory Acts. He found very little to say against those in Ireland; in fact, out of 47 works, I believe he could only find one open to the slightest censure, yet he recommended they should be swept in with the cotton bleach-works of Lancashire. The bleaching of linen is about the very healthiest employment in the world, and the men often reach a great age. The only heated atmosphere is in finishing stoves, of which there are nine or ten altogether in Ireland.

With respect to finish, I may mention what is called the patent finish. The linens are placed on frames in a stove-house, through which a current of air is kept passing, and are gently stretched and carefully handled. The result is a nice open clear finish, very agreeable to the eye, and to some extent very like the ordinary finish of linen pocket handkerchiefs. Indeed, the handkerchiefs undergo a very similar process in the stove-house, only that girls are employed to stretch and manage the goods instead of machinery. I have no doubt, however, that before long machinery will be introduced as a substitute for female labour, and thus the agitation for a bleach works bill to regulate it and that of boys under 18 years, so determinedly urged forward in England and attempted by some British agitators unsuccessfully in Ireland, will result here in the gradual release from labour of the very classes they profess to be so anxious about.

The boys who were formerly employed at the beetling engines have had their places occupied by simple and effective machinery. The women will, in all probability, also be released from their attendance at the stove-houses; so that, as far as Ireland is concerned, there will be every day greater difficulty in persuading the British Parliament that any legal interference between free employers and free employed is at all necessary in a healthy business like linen bleaching. I presume, however, from the fact of the Irish work-people having sent forward petitions against the Bill, and the select Committee of the House of Commons having investigated the subject so thoroughly in 1857 and 1858, and reported against any necessity for legislation, that in future the minds of the work-people will not be agitated against their masters. Supposing employers had no right principles and no feelings of sympathy whatever for their fellow creatures, as a mere matter of self-interest they would see the wisdom of keeping their work-people in good health and spirits; for surely sick, crushed, oppressed work-people would not turn out well executed work. Unless a serious risk or some abuse exists, the state has no right to interfere with the ordinary hiring of servants. I am not about to argue whether such abuses did exist in spinning mills or not before the law interfered. I presume there was a sufficient cause shown for the Ten Hours' Bill to satisfy Parliament. I know nothing whatever of the system of management pursued in the cotton bleach works, but uselessly to impede trade and harass the employers with restrictions in a trade or business of a healthy character, such as linen bleaching, linen weaving, or even farming, would be an innovation quite absurd, and contrary to the common sense of the nation.

I cannot believe the employers of labour in Great Britain are the tyrants and despots described by interested parties. Let any one who wishes to discover the simple truth inquire for himself, and, at least, so far as Ireland is concerned, I shall be greatly mistaken if he do not report that the masters are not only not devoid of religious feelings and good principles, but, on the contrary, may perhaps

excel their detractors in the amount of the "milk of human kindness" in their veins; and that instead of being arbitrary tyrants they in general possess the affection and respect of their work-people, who often look to them as their best friends in the difficulties and dangers of life. But in spite of all I may say, I know that the novelist must have his exciting materials to work on the feelings of his readers, and the orators' "occupation would be gone" if a grievance could not occasionally be found for a telling phillippic.

I will conclude this paper by quoting the decision of the Select Committee of the House of Commons already referred to:—

Bleaching and Dyeing Works.

The Select Committee appointed to inquire into the circumstances connected with the employment of women and children in the bleaching and dyeing establishments in England, Scotland, and Ireland, and to consider how far it may be necessary or expedient to extend to those establishments provisions regulating such employment, and to report their observations thereupon to the House, state in their report that after fully weighing the evidence laid before them, they concur in thinking that the circumstances connected with the employment of women and children in bleaching and dyeing establishments are deserving of consideration, and that the grievances alleged are in part susceptible of remedy. The committee, however, are of opinion, that the labour of women and children in bleaching, dyeing, finishing, making up, and packing, should not be restricted by legislative enactment, for the following reasons:—1st. That great dissimilarity exists between the case of factories and bleach works. The spinner, dealing with his own material, has means of of ensuring regular employment, which the bleacher, receiving only the property of others, does not possess in the same degree. 2nd. That the operatives are not employed in bleach works during the whole of the time they are on the premises, as is invariably the case in factories, periods of interruption being inevitable from the nature of the employment. 3rd. That the nature of the occupation of women and children in the establishment is, with some exceptions, healthy, light, and cleanly, and is preferred by them to that in factories, though the latter is restricted by law. 4th. That although objections arise to calendering, making up, and packing departments, and to the high temperature of the stoves and finishing department, where women and young persons and children are principally employed in connection with bleaching and dyeing works, yet, as finishing, calendering, making up, and packing are frequently carried on in warehouses, any restrictions placed on the former should, in fairness, be applied to the latter—a measure which the Committee are not prepared to recommend. 5th. That linen-bleaching, which is chiefly carried on in the North of Ireland and the East of Scotland, is a very healthy occupation, conducted very much in the open air, and materially influenced by the seasons; that, consequently, under favourable circumstances, the operatives occasionally work extra hours—but, on the other hand, in time of frost, midwinter, and when water is scarce, they often do not work ten hours a day; but as (in conformity with the wishes of the working people, and many of the masters) the hours of work for young persons, females, and children, have been of late reduced—in many instances by voluntary arrangement—the Committee earnestly recommend the bleachers and dyers of the United Kingdom to consider whether such arrangements might not be more generally adopted, to the advantage of all parties concerned in the various processes of their business.

Home Correspondence.

MR. GODDARD'S PAPER ON STONEWARE.

Sir,—Having been obliged to leave early on Wednesday evening, I was unable to make an observation as to the desirability of stoneware or earthenware of suitable character being used in the construction of gas stoves and other close stoves, in substitution for iron.

It appears to me, after having practically tested my ideas on the subject, that the great objection to close stoves for warming apartments is in general the ill-effects of the use of a surface of hot iron, though the defective circulation of fresh air into and through such stoves is no doubt also a disadvantage. Although it may be practically desirable that a supporting framing of iron be used in such stoves, the principal portion and heating surface might be of earthenware. I have myself a gas stove, which (whilst requiring no flue externally to the apartment, provided there be sufficient top ventilation of such apartment) is constructed of iron and stoneware; indeed, the iron-work might be wholly dispensed with. It was exhibited in the Society's Exhibition of Inventions last year, and there seems to be no insuperable obstacle to the adoption of earthenware in many other descriptions of close stoves. I cannot say but that I have the Englishman's preference for the open fire-grate, but there are many places where this is inadmissible.—I am, &c.,

F. W. CAMPIN.

156, Strand, 13th April, 1860.

Sir,—The late hour at which the discussion closed on the 11th inst. did not admit of my fully explaining the lengthened speech of Mr. Doulton, and therefore I trust you will allow me to add a few lines to the reply. I am reported to have said that "I was ready to accord to Messrs. Doulton the pre-eminence over all other potters." I did not say so, or, at least, this was not my meaning, since if I had made this assertion, the certificates of the Great Exhibitions of London and Paris would have contradicted me. My object was to give a truthful account of the stoneware manufacture in Lambeth, not to make invidious comparisons. The point in question was this, that out of the more than 20,000 tons of coals used in Lambeth, Mr. Doulton said his firm used eight or nine thousand. There must be, I fear, some mistake in this statement, for I have the supply of 1859 lying detailed before me, and that does not credit Messrs. Doulton with anything like the quantity. In reference to this statement, I said "I was willing to allow that his firm consumed a greater quantity of coals and clay than any other potter in Lambeth, but this would not affect my totals." The clay used for drain pipes being of a commoner description than that for chemical or general goods, a larger quantity would, of course, be required by "the most extensive drain pipe makers." I am, &c.,

EDWIN GODDARD.

Imperial Potteries, Lambeth, April 16, 1860.

Sir,—In your report of my remarks on Mr. Goddard's paper "On Stoneware," in the last number of the *Journal*, page 392, col. 2, near the bottom, there is an error. I said, or I intended to say, that "Mr. Doulton had informed me, some three years ago, that in the *whole trade* some twelve miles of sewer and drain pipes were turned out per week, and about 1,000 soil pans." I am, &c.,

ROBERT RAWLINSON.

34, Parliament-street, S.W.

Proceedings of Institutions.

Working Man's College, and Young Woman's Institute, Haley-hill, Halifax.—The annual meeting of this institute was held on Tuesday, the 10th April, in the All Soul's School-room. The principal proceedings were the distribution of prizes to the successful competitors at the recent examinations. E. Akroyd, Esq., principal of the college, presided, and amongst the large company present were J. Stansfeld, Esq., (Judge of the County Court), the Rev. F. H. Sidebottom, the Rev. C. R. Holmes, the Rev. J. H. Gooch, the Rev. F. Musson, &c. The

report for the past year was read by the Rev. C. R. Holmes, who prefaced it by a few observations, stating that the college had now entered upon the sixth year of its existence, and was never in a more prosperous state than at present, both in regard to numbers and efficiency. The report commenced by congratulating the meeting on the increased efficiency of the Institute, the number of students being considerably larger at present than at any other period. The subjects studied in the classes were more practical, and better adapted, in the opinion of the Committee, to the men and women for whose benefit the college was intended. Such studies as Algebra and higher Mathematics were now discouraged, it being thought they were not of such practical use as Geometry, Mensuration, the English Language, Political Economy and History. If the working men were to make themselves worthy of being entrusted with the responsibility of aiding in the election of their country legislators, surely the study of political economy and history was essential to render them so. Sixteen candidates had been passed as qualified for the Society of Arts' Examination, to be held in May next. No better system of examination could, in the opinion of the Committee, possibly be devised, and the report protested against the insinuation contained in the report of the Yorkshire Union of Mechanics' Institutes, that those Examinations were not "a practical fact." Allusion was then made to the presence of Sir T. Phillips, chairman of the Council of the Society of Arts; Sir J. Kaye Shuttleworth, Bart.; Sir A. Page Wood, and others, well known in the cause of popular education, at the distribution of certificates to the students of the college, in October last. It was gratifying to hear the strong approval of their system expressed by men who were competent to give an opinion on the subject. Mr. Bohn, the publisher, was so gratified, that he presented them with one hundred volumes of his best books, for which they begged to thank him. The Young Women's Institute, though the numbers were slightly below the average, was as efficient as ever. Since Christmas, thanks to Mrs. Akroyd, who was president of that branch of the Institute, the classes had been more flourishing than ever. The class for domestic cookery answered the expectations formed of it, and that for vocal music was also in a highly efficient state. A flourishing branch of the West Riding Penny Savings Bank had been established in connexion with the Young Woman's Institute. In the college there were 200 students on the books, and the number admitted since Easter, 1859, was 123, the average nightly attendance being 78. In the Young Women's Institute there were 103 on the books, 48 being the average nightly attendance. The detailed reports of the various masters were included in the general report. The library had 250 subscribers, and 150 volumes had been added to it during the year. Books on natural history, geology, and natural history were much sought after. — The Chairman said that the report drawn up and just read by their indefatigable president, Mr. Holmes, was one that gave them much room for congratulation. He called attention to the results of the recent examination, as evincing that the students themselves were in earnest to follow in the paths of learning. The report had alluded to the value of the certificates of the Society of Arts, and it very properly protested against the stigma cast upon them by the Yorkshire Union of Mechanics' Institutes. Now those certificates had a current value in England. The certificates of any local institute might have a certain value in its own immediate district, but the one was like a county note, of use only in its own district, while the other was like a Bank of England note, and might be carried everywhere. As no one could foresee the future career of many of the young men in that college, it was desirable that they should have with them something that would be recognised not only in all England, but even in the colonies. He did not wish to see the certificates undervalued, and considered that all ought to be sensible of their value. He concluded his address by expressing the interest he took in the welfare of these institutions.—The distribution of prizes then took place, the principal subjects in which they were awarded being, Mathematics, English Literature and Grammar, English History, Geography, Theology, French, and Chemistry. In the Young Women's Institute, prizes were given by Mrs. Akroyd, for needlework, &c. Those who excelled in athletic exercises, such as cricket and bowls, also obtained prizes. Several votes of thanks were then passed, and the meeting concluded with a concert.

To Correspondents.

Erratum.—In the last number of the *Journal*, page 397, col. 1, line 20 from bottom, *for* "ten millions of *tons* of flax waste," *read* "ten millions of *pounds* of flax waste."

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Antiquaries, 2. Anniversary.
Philosophical Club, 6. Anniversary.
London Inst., 7. Rev. Henry Christmas, "On Eminent Personages of English History living between the years 1640 and 1660."
Brit. Architects, 8.
Geographical, 8½. 1. Sir G. R. Macdonnell, "Expedition into the Interior of S. Australia;" Mr W. R. Randall, "Voyage up the Darling and Barwan Rivers." 2. Mr. W. Spottiswoode, "On Typical Mountain Ranges; an application of the Calculus of Probabilities to Physical Geography."
Medical, 8½. Dr. Thudichum, "On intravasation, embolia, and cytastasis, as causes of cerebral and other paralysis."

Tues. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbiverous Mammalia in the Zoological Gardens—Deer."
Civil Engineers, 8. Mr. E. Leader Williams, "Account of the Works recently constructed on the River Severn at the Upper Lode, near Tewkesbury."
Medical and Chirurg., 8½.
Zoological, 9.

Wed. .....Roy. Soc. Literature, 4. Anniversary.
Society of Arts, 8. Dr. Dauglish, "On a New System of Bread Manufacture."
Archæological Assoc., 8½.

Thurs. ...London Inst., 12. Anniversary.
Royal Inst., 3. Professor Ansted, "On Physical Geography and Geology—the Atlantic Ocean."
Royal Society Club, 6.
Philological, 8.
Royal, 8½.

Fri.....London Inst., 7. Prof. Bentley, "On the Structure and Formation of the Nutritive Organs of Plants."
Royal Inst., 8. Mr. F. A. Abel, "On Recent Applications of Science to Military Forces."

Sat.....Royal Inst., 3. Mr. F. A. Abel, "On Heat and Chemical Force—the Non-metallic Elements and the Metals."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April 13th*, 1860.]

Dated 3rd March, 1860.

594. C. Schiele, Lower Bebbington, Cheshire—Imp. in obtaining and applying motive power from ocean or other waves.

Dated 8th March, 1860.

627. C. F. Delabarre, Neuilly, France—Improved apparatus to be used in propelling gases and forcing liquids.

Dated 14th March, 1860.

684. J. E. F. Ludeke, Wolverhampton—Imp. in obtaining motive power by means of certain fluid bodies, and in the apparatus connected therewith.

Dated 20th March, 1860.

724. E. Gardner, Maidstone, Kent—Imp. in apparatus for the manufacture of paper.

Dated 21st March, 1860.

730. J. I. Taylor, the Cottage, Botanic Gardens, Sloane-street, Middlesex—Imp. in apparatus for the manufacture of gas from oil and oleaginous substances.

Dated 26th March, 1860.

778 J. A. Maxwell, 53, Chancery-lane—Imp. in hydraulic engines, to act either alone or in combination with steam and steam engines.

780. J. Mitchell, Sheffield—An imp. in pullies applicable for raising and lowering window-blinds, maps, and other articles mounted upon rollers, and retaining them in a given position.
782. H. Bowen, Spring Bank, Cardiff—An improved standard gas meter.
784. J. Church, Upper Kennington-lane, Vauxhall, Surrey—Imp. in the manufacture of coke.

Dated 27th March, 1860.

786. A. R. Le Mire de Normandy, Odin-lodge, King's-road, Clapham-park, Surrey—Imp. in obtaining fresh water from salt water.
790. J. R. Hunt, Chichester-place, Wandsworth road, Surrey—Imp. in tobacco pipes.
794. D. Millard, Liverpool—Imp. in sewing machines. (A com.)

Dated 28th March, 1860.

796. J. Weems, Johnstone, Renfrew, N.B.—Imp. in steam boilers or heat and steam generators, and in the application of heat.
798. J. L. Hancock, Pentonville-road—An improved apparatus for working and shaping butter, and for separating it from the buttermilk.
799. J. A. de Maniquet, Paris—Imp. in winding, doubling, twisting, and spinning silk, cotton, wool, flax, hemp, cord, and other filamentous materials.
801. A. P. P. Dagron, Paris—An improved microscope to be used for exhibiting photographic views and productions.
802. J. Leonard, 4, Skinners-place, Sise-lane—Imp. in apparatus used when weaving. (A com.)
803. G. F. Wilson, Belmont, Vauxhall, Surrey—Imp. in treating fatty and oily matters.
804. R. H. Collyer, Beta House, Alpha road, Regent's-park—Imp. in manufacturing pulp for paper, papier maché, and other similar uses, and in apparatus employed therein, part of the invention being also applicable to other operations in which materials have to be subjected to the action of liquids, steam, and other fluids.
805. S. R. Smith, Hanover-terrace, Cumberland-road, Bristol—Imp. in vessels and apparatus used for raising sunken vessels and other bodies in the water, and for lowering materials for structural purposes in the water.

Dated 29th March, 1860.

805. C. Stevens, 1B, Welbeck-street, Cavendish square—Imp. in steel-yards and scales. (A com.)
809. J. Farmer, London—Imp. in the manufacture of cocoa and chocolate.
811. J. Norris, jun., Birmingham, and T. Till—Imp. in machinery to be used in the manufacture of wrought and horse nails.
813. J. Monks, James-street, Bethnal-green, Middlesex—Improved machinery for manufacturing chenille.
816. E. B. Sampson, Stroud—Imp. in condensing apparatus of carding engines.
817. J. Hamilton, jun., Liverpool—Imp. in constructing and propelling vessels.
819. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in chronometers. (A com.)

Dated 30th March, 1860.

821. W. Richardson, Dudley, Worcester—Imp. in apparatus for the production of coal-gas.
823. P. A. A. Beau, Porchester-terrace—A neomonoscope, or apparatus for viewing photographic and other like pictures.
825. A. Crosskill, and J. G. Crosskill, Beverley, Yorkshire—Imp. in reaping and mowing machines.
827. S. B. Haskard, Wollaton-street, Nottingham, and J. Dean and Dean, Radford—Imp. in machinery for the manufacture of looped fabrics.
829. H. Eschwege, Mincing-lane, London—Imp. in the manufacture of gin or geneva.

Dated 31st March, 1860.

830. D. K. Clark, 11, Adam-street, Adelphi—Imp. in steam engines and boilers.
831. J. Sheridan, 55, John-street, Dean-street, Commercial-road East—Imp. in the manufacture of sheet metal casks and other vessels.
833. G. H. Farrington, Cross-lane, Cannon-street—An imp. in the manufacture of envelopes.
834. E. J. Hughes, Manchester—Imp. in the manufacture of oil of turpentine and resin, and in the apparatus connected therewith. (A com.)
835. W. Clapham, and J. H. Clapham, Wilsden, Bradford—An imp. in spinning, applicable to various kinds of yarns.
837. T. F. Edgeworth, 147, Park-road, Toxeth-park, Liverpool—Imp. in obtaining light.
838. H. Jones, Old-street, St. Luke's, and J. Jones, St. Paul-street, New North-road, Middlesex—Imp. in wet gas meters.
839. F. Jaburek, Vienna—An improved pipe for smoking.

Inventions with Complete Specifications Filed.

863. E. H. Ashcroft, Boston, U. S.—An improved hand drill stock. (Partly a com.)—4th April, 1860.
888. G. Biebler, Salins, France—An improved apparatus to be employed for blasting rocks, and the application of the same to the formation of tunnels.—9th April, 1860.

Patents Sealed.

[*From Gazette, April 13th*, 1860.]

April 11th.
2307. J. L. Tenting.
2308. J. L. Tenting.
2311. J. Smith.
2317. G. Scott.
2320. J. Garrick.
2323. T. Rothwell.
2327. C. H. Southall.
2328. C. P. Moody.
2330. H. Bright.
3331. T. Twells.
2336. W. Burgess.
2344. J. Varley.
2345. J. Jack.
2351. F. A. Leigh.
2355. J. Echard.
2360. J. Elder.
2363. L. Vidie.
2368. W. Norton.
2370. J. Thom and A. Kennedy.
2271. D. Jones.
2372. R. A. Brooman.
2374. W. Tillie.
2401. R. A. Brooman.
2403. F. Nivelle.
2406. J. Musgrave.
2408. J. T. Pitman.
2420. W. Thorold.
2432. W. E. Newton.
2438 J. M. Napier.
2433. W. Clark.
2503. C. W. Siemens.
2513. C. Brook.
2600. T. Greenwood & J. Batley.
2689. E. H. Bentall.
2723. J. Paton.
2384. W. Hulse.
2859. D. J. Fleetwood.
23. M. A. F. Mennons.
149. F. J. J. De la Fertè.
266. M. A. F. Mennons.
280. A. Watkins.
292. M. A. F. Mennons.
325. W. E. Newton.
359. D. Auld.
445. P. Lavenas.

[*From Gazette, April 17th*, 1860.]

April 17th.
2369. J. Bernard.
2380. J. Higgins and T. S. Whitworth.
2396. J. Bruckshaw, H. Bruckshaw, & W. S. Underhill.
2397. W. Warne, J. A. Jaques, and J. A. Fanshawe.
2400. E. T. Hughes.
2402. P. A. Godefroy.
2405. C. Hanson.
2417. R. A. Brooman.
2441. E. S. Tebbutt.
2346. W. W. Kennedy.
2448. J. W. Hackworth.
2478. I. Brown.
2542. J. H. Johnson.
2690. E. H. Bentall.
2760. J. Jones and J. Hilton.
2775. C. C. Simmonet de Changy.
8. T. Hardy.
328. J. R. Cooper.
430. J. H. Johnson.
438. J. H. Johnson.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April 13th*, 1860.]

April 9th.
1028. T. N. Pengelly & G. Potter.

April 10th.
1039. W. E. Newton.
1103. C. B. Normand.

[*From Gazette April 17th*, 1860.]

April 12th.
1046. P. McFarlane.
1047. J. Ramsbottom.
1051. J. Rubery.

April 13th.
1049. P. Wicks & T. G. Ghislin.
1054. B. O. Stratford.
1067. B. F. Brunel.
1077. R. Hindle.
1078. T. L. Scowen.
1141. G. Welch

April 14th.
1070. J. Safran.
1081. J. Hands.
1082. J. Warburton.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, April 13th*, 1860.]

April 9th.
872. R. A. Brooman.
874. H. W. Harman.

April 11th.
895. C. Clifford.

[*From Gazette, April 17th*, 1860.]

April 12th.
886. N. Clayton and J. Shuttleworth.
889. T. Edwards.
986. J. W. Duncan.
917. W. Wilkinson.
943. F. H. Smith.

April 13th.
927. I. Simpson.

April 14th.
1010. J. Hetherington.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,249	April 5th.	An Adjustable Stove Register	Joseph Mills	40, Gt. Russell-st., Bloomsbury, W.C.
4,250	,, 10th.	Neal's Improved Regulated Silent Albert Gas Burner	George Neal	104, Gt. Charles-street, Birmingham.
4,251	,, 17th.	Riflemans's Knife	Holtzapffel and Co.	Charing-cross, S.W.
4,252	,, 17th	The Cover and Stopper of a Tobacco Pipe	Joseph Bernays	Mayence, Germany.

Journal of the Society of Arts.

FRIDAY, APRIL 27, 1860.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William Ross, R.A., will be opened at the Society's House, on Monday next, the 30th inst.

The public will be admitted on payment of one shilling each person.

Members of the Society of Arts will have free admission, and may *personally* introduce one friend.

CONVERSAZIONE.

The First Conversazione during the present Session will take place to-morrow (Saturday) evening, the 28th April, at the Society's house, the card for which will admit the Member only. The Collection of Pictures by the late Sir William Ross, R.A., will be exhibited.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council that the amount of the Guarantee Fund promised, up to the 25th April, was £190,000.

The Council directed that the following letter should be sent to the Institutions in Union:—

Society of Arts, Manufactures, and Commerce,
John-street, Adelphi, W.C.
April, 1860.

Sir,—I am directed by the Council of the Society of Arts to request you to lay the accompanying papers, relative to the International Exhibition of 1862, before the Committee of Management of your Institution.

The Council have reason to hope that in many ways the proposed Exhibition will be both useful and interesting to the various Institutions throughout the United Kingdom which are in union with the Society; and they consider it to be of great importance, in order that each Institution should have a voice in the disposal of any surplus that may result from the Exhibition, that every Institution in union should have its name connected with the preliminary organisation, and on the guarantee deed.

The Council are well aware that the corporate funds of many of the Institutions are of a very moderate character, but they can hardly doubt that at least one member of each Institution could be found who would be willing to become the representative of his local Institution, and to be associated in the list of guarantors with a large number of the members of the Society of Arts, and thus establish the claim of the Institution, according to the provisions of the deed, to take its part in the appropriation of any surplus arising from the Exhibition.—I am, &c.,

P. LE NEVE FOSTER.

The following letter has been addressed to the Secretary of the Society of Arts, by command of his Royal Highness the Prince Consort, President of the Society, expressing the readiness of his Royal Highness to place his name on the List of Guarantors for the sum of £10,000, so soon as the sum of £240,000 has been subscribed:—

Windsor Castle, April 9th, 1860.

Dear Sir,—I am commanded by His Royal Highness the Prince Consort to inform you that His Royal Highness has given his best attention to the proposal made by the Council of the Society of Arts for the formation of a Guarantee Fund, in order to enable them to give effect to the wish of the Society to hold another Great International Exhibition in 1862.

As President of the Society, it is ever the wish of His Royal Highness to assist, as far as it is in his power to do so, any well considered plan, proposed by the Society, which has for its object the advancement of Art and Science as applied to industrial pursuits. But feeling at the same time that the favour of the public to any such plan should be due to the merits of the proposal alone, he has in general made it a rule to decline giving his name to any undertaking which had not already received such an amount of public support as would ensure its ultimate success.

In the present case, however, considering the conditions under which it is proposed to raise the Guarantee Fund—one of which provides that "no liability shall be incurred by any person subscribing the Agreement, unless the sum of £250,000 be subscribed within six calendar months"—his Royal Highness will so far depart from his ordinary practice as to intimate his readiness, when the public interest in the proposed Exhibition shall have manifested itself to the extent of subscribing £240,000, to contribute the further sum that shall be necessary to complete the full amount of the proposed guarantee.

I remain, dear sir,
Your's very faithfully,
C. GREY.

P. Le Neve Foster, Esq.

The principal conditions of the Guarantee agreement are:—

1st. That no Subscriber will incur any liability until at least £250,000 have been guaranteed.

2nd. That no calls will be made unless it should happen that, contrary to the experience of the Exhibition of 1851, when there was a surplus of nearly £200,000, there should be a loss, when the call will be *pro rata.*

3rd. Any surplus will be at the disposal of the Guarantors, for the promotion of Arts, Manufactures, and Commerce.

4th. The Trustees and Managers of the Exhibition named, are:—

The Earl Granville, K.G., Lord President of the Privy Council, Vice-President of the Society of Arts.
The Marquis of Chandos, Chairman of the London and North Western Railway.
Thomas Baring, Esq, M.P., C. Wentworth Dilke, Esq., Vice-Pres. Soc. of Arts, } Royal Commissioners for the Exhibition of 1851.
Thomas Fairbairn, Esq., Chairman of the Manchester Art Treasures Exhibition.

The acceptance of the trust by the above-mentioned noblemen and gentlemen will depend upon the amount guaranteed, and also upon

the character of the guarantee, as evincing the extent of public interest.

The Council do not propose to limit the fund to the £250,000 named, but, having secured that sum, they will endeavour to increase it as much as possible.

A circular letter has been addressed to the Members of the Society, drawing their attention to the importance of filling up the Guarantee List as soon as possible, and those Members and their friends who are desirous of giving their assistance to this undertaking, are requested to send in their names to the Secretary of the Society of Arts as early as possible, specifying the sums they are willing to guarantee.

The amounts guaranteed by individuals vary from £10,000 to £100.

EXAMINATIONS, 1860.

C. H. Pearson, Esq., M.A., Professor of Modern History, King's College, London, has been appointed by the Council Examiner in English History, in place of Sir Edward S. Creasy, now Chief Justice of the Island of Ceylon.

Returns have been received up to this date from sixty-three Local Boards. The total number of candidates examined at the Previous Examinations this year is 668. The number returned as qualified for and desirous to be examined at the Final Examination in May, is 624, including some who, having obtained Certificates from the Society of Arts in former years, were not obliged again to undergo the Previous Examination.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th instant, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

TWENTIETH ORDINARY MEETING.

Wednesday, April 25, 1860.

The Twentieth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 25th instant, Edwin Lankester, Esq., M.D., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Addison, John	Goodchild, Thomas
Brook, Henry	Webber, Henry.

The following Institution has been taken into Union since the last announcement:—

South Staffordshire Local Board.

The Paper read was—

ON A NEW SYSTEM OF BREAD MANUFACTURE.

By John Dauglish, M.D.

I feel that the importance of the subject of bread-making is a sufficient apology for my asking your attention to some remarks which I am about to make on a new system lately introduced, which I am sanguine enough to believe possesses many and great advantages over any hitherto practised.

Two years ago, Dr. Odling read a paper at a meeting of the Society of Arts, "On some Points in the Chemistry of Bread-making;" from that paper, those who are not practically acquainted with the working of the old system, will at once perceive that nearly, if not quite, all the evils at present complained of, viz., the spoiling of the flour, the necessity for using alum, the long hours of labour, and the consequent unhealthiness of the trade of the baker, arise out of the employment of fermentation for the raising of bread. The new process removes the whole of these evils at once, by effecting the raising of bread by purely mechanical means.

Bread-making essentially consists in completely incorporating flour, water, salt, and carbonic acid with each other, in such a manner as that they shall form a tenacious, elastic, and bulky mass, in which the aëriform constituent bears to the solid a proportion of about three or four to one, and which, on being placed in the oven and thoroughly baked, shall swell to about double this proportion.

Until very lately the mixing and incorporating of the solid constituents have been performed by the hands and arms, sometimes assisted by the feet; but during the last few years, especially in France, there have been some very ingenious kneading and mixing machines introduced for this purpose, that of M. Boland being of especial merit. The mechanical part of bread making is very easy of accomplishment, and its results, like all mechanical processes, can always be relied upon with certainty. It is the chemical part out of which all the difficulties and uncertainties arise, and which has presented the only obstacle in the way of bread manufacture participating in that marvellous progress of the industrial arts which is the distinguishing feature of the present age—and of its taking that position as a manufacturing institution of the country which its magnitude and importance really deserves.

The chemical changes within the substance of the dough which it is the object of the baker to effect, are those which shall result in the alcoholic fermentation of transformed starch or glucose, whereby these bodies are broken up into alcohol and carbonic acid, which latter is the only product desired, but which cannot be obtained without the previous transformation or degradation, more or less, of the constituents of the flour. It is not necessary for me here to give an account of all those complex changes which constitute the chemistry of bread-making, as this has already been so ably done by Dr. Odling in the paper before referred to, but I will simply mention those which are the source of so much uncertainty and variation in the preparation of bread.

In the first operation of bread-making—the preparation of the sponge—the baker mixes up together, into a soup-like paste, flour, warm water, and yeast or leaven; this he allows to stand for some hours, during which active fer-

mentation is set up, and bubbles of carbonic acid are rapidly formed, and rise to the surface. In fact the prolonged action of warmth and moisture combined with that of the yeast or leaven, change the whole body of paste into a ferment sufficient to affect a very large quantity of flour when incorporated with it. You will hence perceive that by thus forming a sponge, the necessity to use large quantities of yeast is avoided on the one hand, and on the other the length of time that would otherwise be required for putting the whole of the flour into a state of active fermentation is considerably shortened, and the deterioration of the flour, which is caused by the prolonged action of warmth and and moisture, is proportionally lessened.

The advantages thus obtained will be more readily seen when it is remembered that the true alcoholic fermentation is only the later stage of what is termed the panary fermentation. It is that stage wherein the metamorphic nitrogenous body or yeast acts directly upon glucose or grape sugar, breaking it up into alcohol and carbonic acid. But before this can take place, since in sound flour there is very little, not more than a trace, of sugar, and the gluten is wholly or almost wholly unaltered, certain portions of the gluten and starch must have passed through the necessary changes for the alcoholic fermentation to act. This then is done in the sponge; when the mixture of flour, yeast, and warm water is made, and the temperature is maintained at about 84 deg. Fahr., the gluten, by virtue of its own spontaneous tendency to change under these conditions, assisted by the yeast, becomes metamorphic and immediately acts upon the starch, changing it into dextrine and grape sugar; whilst at the same time the yeast plant is propagated at the expense of a small portion of the changed gluten, &c. Thus we have in the sponge all the materials, the dextrine, and glucose, the diastase and the yeast, in a state ready to pass into active alcoholic fermentation, and to give out the necessary bubbles of carbonic acid, immediately their complete incorporation with the flour is effected, so that the least possible injury to the bulk of the flour is secured.

But when unsound flour is used in bread making, we have a very different state of things. Unsound flour is flour in which some of the changes on which panary fermentation depends have taken place to a greater or smaller extent, and which are somewhat analogous to malting. The gluten has already become metamorphic, and the starch partially or wholly changed into dextrine or glucose. The gluten has lost more or less of its elasticity, and is ready immediately on the application of warmth and moisture, not only to pass rapidly into a state of solution, as Liebig has termed it, but to act with the greatest energy on the partially changed starch, completing its alteration into glucose, so that a running, sticky mass results from the attempt at fermentation. Such a state of things, however, may be and is frequently brought about, even when good sound flour is used, either by inexperienced persons, who do not understand the management of fermentation, and the length of time and the temperature necessary, or by peculiar states of, and changes in, the atmosphere, by which the fermentive operations are so rapidly hastened in the earlier stages as to become almost or quite unmanageable.

Between perfectly sound flour and that which runs in the manner above referred to, on the application of a ferment, there are indefinite shades of variety; and between the temperature and the state of atmosphere least liable to produce derangement and that which is most, there are also indefinite varieties. Now, it is these liabilities to derangements and irregularities which have rendered the preparation of bread so precarious, and, going along with the absolute necessity to have the article ready always at the same hour of the day—an article which, in the event of its spoiling, cannot be reprepared under 8 to 12 hours—have raised an effectual barrier to its becoming an extensive manufacture in large establishments, employing large capital, and deriving the peculiar profits arising out of the division of labour.

Having thus pointed out the distinctive features of the ordinary process for obtaining the complete incorporation of the essential materials of spongy bread, I will proceed to describe the process which it is proposed to substitute for it.

It essentially consists, as I have said, in doing away entirely with fermentation, and with all those chemical changes in the constituents of the flour which are consequent upon it; and, having obtained the necessary carbonic acid independently of, and separate from, the flour, incorporating the materials, including the carbonic acid, wholly by mechanical means, so as to secure the bulky elastic mass which is capable of being baked into light spongy bread.

When wheaten flour, salt, and water are thoroughly incorporated in due proportions, we have a heavy, soft, tenacious substance, called dough or paste, the tenacity of which is wholly dependent on the mechanical condition or properties of the gluten of the flour, the starch, when in a sound state, possessing of itself no cohesive properties whatever, which is easily demonstrated by kneading a mass of dough carefully in a small stream of water, when the starch granules will be carried away by the water, and the gluten will remain behind in a tough, tenacious, semi-transparent mass. The process of kneading or incorporation, then, consists in mixing the materials together in such a manner as that the gluten, becoming well saturated with water, shall form a soft, adhesive mass, as a matrix, in which are embedded and bound together the minute particles of starch, and if the kneading is carried on in a very thorough manner, and for a prolonged period, the dough becomes tough by the particles of gluten being driven close together, and forming a kind of sticky coat or shell around the particles of starch which thus adhere firmly to each other. When this mass is obtained, the point afterwards to be effected is the liberation of minute bubbles of gas within each sticky coat, surrounding each granule of starch.

We have seen that in the ordinary process of bread-making by fermentation, the carbonic acid, which is the agent of distention, is obtained from the decomposition of the starch or glucose, by the action of a ferment, which being thoroughly incorporated along with the other materials, into the dough or paste, is thus brought into contact with the starch and with the gluten with which the starch is surrounded. It is easy therefore to understand, how, when a mass of dough thus constituted is left for a time in a temperature suitable for the fermentive change, each of the minute particles of starch imprisoned in a covering of gluten, is made the centre of a distinct chemical action, and yields up its bubbles of carbonic acid to distend its gluten coat, and how, by the aggregation of such particles, a mass of spongy dough is formed, and how, also, when the materials have not been thoroughly incorporated, and the action of the ferment is not uniform, or when the gluten is not of a firm yet elastic quality, the generation of the gas will be unequal—the minute bubbles will be burst into large ones, and the texture of the dough be impaired accordingly, rendered, as it is termed, "full of eyes"—instead of being dispersed in minute bubbles, as numerous, or nearly so, as the particles of starch from which it is given off. In the new process, as the gas is not given off by the particles of starch within the gluten coat, it has to be obtained from another source within the mass of dough, in order that the minute spongy texture may be secured, and this source is the water with which the gluten which envelopes the starch is saturated, and which is held, as it were, by capillary attraction also, around the particles of starch.

It has been long known to chemists that water will absorb its own bulk of carbonic acid, whatever the density, with great readiness when agitated with it; that is to say, supposing you placed water in a closed vessel, along with carbonic acid—in a bottle for instance—filling it half with water and the other half with the gas, then corking it up; if the water and the gas be pure, and both at a temperature

of 62° Fahr., and at the atmospheric pressure of 30 inches of mercury, when the bottle is thoroughly agitated, the gas will be immediately diffused through, or absorbed by the water until there is an exact balance between the quantity of gas held in solution by each cubic foot of water and that contained in each cubic foot of space within the bottle not occupied by the water; so that, supposing the bottle at the commencement of the experiment to have been exactly filled, half with water, and half with gas—after complete agitation the barometric pressure within the bottle will have fallen to 15 inches of mercury. This law of aborption is persistent at all pressures, so that by increasing the density of the gas, the quantity absorbed by the water will be increased in an equal ratio, and so long as the water is retained under the pressure due to the density, so long will it hold the gas in solution, but whenever it is released from the pressure the gas will escape from it with effervesence, a familiar example of which is that of a bottle of soda water when the cork is withdrawn.

It will now be apparent that if water, holding in solution the necessary quantity of carbonic acid gas, could be used to incorporate with flour, &c., in the preparation of dough, without any of the gas being allowed to escape from it until after the paste is fully formed, but then allowed to escape, it would cause the formation of the necessary minute bubbles of gas, which would distend the dough into a perfect sponge, even more perfect than that which is obtained by fermentation, since every atom of water would yield its atoms of gas, not only between the particles of starch and their gluten coat, but also within the substance of the coat itself, rendering that porous.

Now, since the water will retain the gas in solution so long as it remains in an atmosphere of the necessary density, it is evident that if the materials of which the dough is to be formed can be brought together in a closed apparatus in an atmosphere superior in density to that at which the water has been saturated, and then thoroughly incorporated, the gas will remain in the water during the incorporation, and until such a time as the dough is released from the pressure, but that directly it is released from the pressure due to such density, the gas will escape from the water, and in so doing will distend the dough into a perfect spongy mass. This, then, is the new process of bread-making.

I do not propose here to enter into the details of the mechanical arrangements which are necessary to reduce such a process to one sufficiently simple and practically workable, so that it may be carried on by journeymen of ordinary intelligence. But I may state, that so successfully has this been accomplished, that it is found there are few workmen who, having given their hearty attention during a week's instruction and observation of the working of the apparatus, are not competent to take the whole charge of the process. The baking of the bread, like the baking of any bread, of course requires the managenent of a man who has the necessary judgment and knowledge for the task.

The apparatus essentially consists of a gas holder and a generator, similar in construction and principle to, but larger in size than, what are used by the makers of aërated waters; of pumps, suitable for pumping elastic fluids, and of a mixing vessel, and a water vessel in connection, both made so that they can be tightly closed to sustain an internal pressure of from 100 to 200 lbs. on the square inch. The mixing vessel is supplied with flour through a shoot, passing from the floor above, and the water vessel with water, through a pipe from a cistern at the top of the building.

The mixer is capable of being closed perfectly tight, and opened, by means of a proper mechanical contrivance, with the greatest facility, by one man in a few seconds.

The order of working, and the time required for making a sack of flour of 280 lbs. into dough is as follows:—

Opening lid of mixer and fitting within the neck the end of flour shoot, and turning water cock to fill water vessel	1 minute.
Passing from top of machine to floor above, and shooting down a sack of flour	3 ,,
Returning, closing water cock, removing end of shoot, and closing mixer	2 ,,
Withdrawing atmospheric air from mixer	3 ,,
Pumping gas through water into mixer, &c.	10 ,,
Mixing	7 ,,
Total	26 minutes.

At the end of which time the dough is ready to be drawn into loaves, from a nozzle or mouth, through which it is forced by the pressure within the mixer, and as it expands or rises in the act of leaving the mouth, it is ready to be baked immediately. One boy is capable of drawing the dough from one sack of flour into loaves in fifteen minutes, as fast as they can be weighed and placed in the oven.

Thus in the short space of 26 minutes, which is subject to no variation, the baker can always rely upon having his dough ready for the oven, and this with a certainty (when the labour is well organised) which is nearly mathematical.

Hence this process at once removes all the obstacles which have hitherto rendered a perfect system of machine bread manufacture an impossibility, which obstacles I will definitely state as follows:—

1. The length of time (from eight to twelve hours) required by the process of fermentation to prepare dough for the oven, and the great space required for storing the masses of dough whilst undergoing the process.
2. The uncertainty of its results, and the many vicissitudes arising from susceptibility to delicate influences.
3. The degradation or spoiling of the flour produced by fermentation, which is equal to a money value of three to six shillings per sack.
4. The necessity for the use of alum with poor flours, and the temptation to use it with all.

In comparison with the above, the new process shows the following:—

1. It reduces the time necessary for the preparation of the dough from eight to twelve hours to less than thirty minutes, and requires no space whatever for the storeage or keeping of dough larger than the mixers themselves.
2. The results are absolutely certain and uniform.
3. No spoiling or degradation of flour taking place, the quality of the bread produced is equal to that made by the old process from a flour three to six shillings per sack dearer.
4. As no change in the flour takes place, against the evils of which alum has hitherto been used, there is no gain whatever by the use of alum. Indeed, alum is absolutely prejudicial, by destroying the cohesive properties of the gluten. Even flour which is made from wheat harvested in bad weather makes a most delicious bread without any addition of alum.

In order to estimate the probable influence which the introduction of such a process is likely to exert upon the baking trade, I have endeavoured to obtain from reliable sources some account of the method, if method it may be called, on which the trade is at present conducted.

In the baking trade, as in most trades, there are different grades of respectability and credit, but there are two great divisions—the high-priced, and the low-priced, or "cutting," as they are called. In each of these two divisions there are, of course, many sub-divisions. There are some, but these are comparatively very few, who are men of substance, possessing considerable capital of their own, and are perfectly independent of any system of credit allowed by the millers. They are consequently in the most favourable position possible for the purchase of their flour, both cheap and good. But by far the greater number of bakers trade almost entirely with the capital of the millers, through a most vicious system of credit, which

operates most prejudicially in their purchases of flour. It is this system of credit that has given rise to, and perpetuates, most of the commercial evils of which the baker has to complain, and which, whilst it exists, will ever oppose the most effectual obstacle in the way of permanent amendment.

In England, where the trade of the baker is not interfered with by legal restriction, any man is at perfect liberty to commence it whenever he pleases, and as the article bread has not only become the essential want of every individual, but a daily one also, a single addition to the enormous number of bakers engaged in the production of small quantities increases the total of production so imperceptibly, that a new beginner has but comparatively little difficulty in finding, where every man is a consumer, an immediate market for his commodity among that large class of persons who are always ready to patronise the last new comer.

The question of connexion, as bearing upon obtaining customers, need not trouble the man who proposes to commence the trade of a baker; the one which he has to consider is, whether sufficient means can be scraped together to rent and fit a shop, and to build an oven and furnish the necessary utensils of a bakehouse. If this can be done, any journeyman baker may marry and commence business on his own account, as the working capital for his business is readily found by the miller, who will supply him with the necessary flour upon credit, taking for security a bill of sale on all that his premises contain, which is not only sufficient to protect the miller from loss, but it secures to him all the baker's future orders for flour, since, should any one deliver flour to the premises of the baker, the miller can immediately take possession of it, should a debt be owing to him, by virtue of his bill of sale. I hope that the trade in London is not thus carried on; but that such a system is practised, and increasingly so in many provincial towns, I have been assured by several respectable millers.

The facilities of credit afforded by the millers have, probably, chiefly arisen out of the excessively keen competition between millers themselves, which the introduction of steam for the purposes of grinding has given rise to, by destroying the virtual monopoly which the limited amount of available power previously existing created.

If we consider the chief causes that operate to render trades, handicrafts, and manufactures prosperous, we shall find them to be the following, viz:—1st. Improvements in the methods of manufacture, by which production is greatly enhanced in value, or greatly lessened in cost. 2nd. Great capacity of increase, in the ratio of consumption of the article produced. 3rd. The protection afforded to a trade against a rapid increase of competitors, from the difficulty of new ones engaging in or entering it. Now these are altogether wanting in the baking trade. In the first place, the method of manufacture has remained common handicraft, in which there has been no substantial improvement since it was first begun. In the second, bread is an article the consumption of which is incapable of being increased in the same ratio as nearly every other commodity; and thirdly, we have seen that the facilities for entering the trade are so great as to lay it open to the very keenest competition. When a trade is labouring under such disadvantages, it must necessarily follow that the public supplied by it suffer accordingly. For when remuneration cannot be obtained by fair means, the dishonest in the trade will use foul, and in the long run the honest men will become fewer and fewer, until there be few left, when the race will remain to those who can bring the greatest keenness and the least conscience to bear in accomplishing the most dishonest thing with the least prospect of detection. It is not for me to point out what description of dishonesty is mostly prevalent in the baking trade, this has been most fully done by the public press, and consists in supplying bread deficient both in quality and quantity, exposure of the one being prevented by the use of deleterious drugs, and of the other by the excessive trouble which an efficient means of detection would impose on the consumer. The new process of bread making promises to effect a complete change in this unhealthy state of things. 1st. Because by improvements in the method of manufacture, and in the value of the article produced, it promises good remuneration to and necessitates the employment of capital; and 2nd. Because, such employment of capital as well as the protection afforded for several years by patents, give the necessary security against excessive competition. But whilst it will prevent excessive competition it will produce none of the evils of a monopoly, because it leaves the consumer at all times in possession of his former means of supply, to be resorted to immediately the monopoly becomes prejudicial.

By erecting then the preparation of bread into a system of wholesale manufacture, not subject to the vicissitudes and evils of fermentation, but exact and certain in its results, the trade can be raised from its present degraded and unsatisfactory state to one that will be worthy of engaging the capital, energy, and talent of our best men of substance and enterprise. Nor will the manufacturer alone reap the benefit, for the public and the journeyman will be even more benefited. As the trade itself will be rendered commercially healthy, there will not be the same inducements to resort to fraudulent means to obtain a profit; and as journeymen will be employed in large numbers under masters of capital and social standing, they will be in a far more independent position than at present, whilst the nature of the process will relieve them from those necessarily long hours of labour which the present system necessitates.

I say the journeyman will be in a more independent position, but as among workmen generally there is an impression that capitalists and the owners of large works are grinding taskmasters, who tyrannise over their workmen, and grasp an unfair proportion of the profits of their labour, I wish to speak of what has come under my own observation in the machine biscuit bakery of Messrs. Carr and Co., of Carlisle, as a practical illustration of the benefits to be derived from conducting baking in large works. In this bakery the welfare of the working man is an object of great care to the proprietors. The head of the firm is a man of much kindly feeling and benevolence of heart, and has studied to make arrangements that will conduce to the comfort of his men, which, whilst not destroying the spirit of self-dependence and self-help, shall assert the principle that the men should share each other's burthens, by making the prosperity of one department the prosperity of all, and the depression of one the depression of all. The consequence is that the material well-being of the workmen is such as to remove them entirely from that class which excite our sympathies for their sufferings, and call forth our efforts for their amelioration. Now, I was in direct personal contact for nine months with the whole of these men, conversing with them in periods of leisure, and during working hours drawing upon their knowledge and experience, and I must say that in no class of society with which I have happened to mix have I met so much quiet, kindly feeling toward one another, or so much substantial respect for superiors.

On comparing such a state of things with what Dr. Guy has described of the condition of the journeymen employed by small masters in London and the provinces generally, I think that workmen will admit that the argument from experience is all in favour of the capitalist, nor is the above a solitary instance of the advantages accruing to the working man from large factories, and the employment of large capital in the baking trade.

I don't know from personal observation, but I am told that in the great bakery of Messrs. Huntley and Palmer, of Reading, the condition of the operatives is equally an object of solicitude on the part of the firm, and that they are generally in a most comfortable and prosperous condition. And what is likely to perpetuate this favourable state of things is, that such firms find that the taking care of their workmen, and making them happy, and prosperous, and contented, is a good paying speculation. The work is

better and more heartily done, first because good masters and comfortable works necessarily attract the best workmen, so that the master has always the greatest choice of workmen from whom to select, and secondly because justice, righteousness, and mercy, more especially when administered by a superior, will rarely fail, in the long run, to beget honesty of purpose and of feeling in subordinates. I am happy to say that masters are now generally beginning to discover that the prosperity and well-being of their workmen are essentially bound up with the prosperity and well-being of the employer, so that before long we may expect to see that practical Christianity will be recognised as sound commercial policy.

In the admirable lecture of Dr. Guy, delivered now nearly twelve years ago, on the condition of the journeymen bakers, bearing upon the efforts that were then being made to secure for them some amelioration by State legislation, the arguments then put forth, justifying the interference of the State as not opposed to the principles of free trade, have proved to be peculiarly sound, by the experience since obtained of the working of the Factory Acts, which were framed on the principles of State protection to certain defenceless classes, principles which have lately had a fresh expression, by that mouthpiece of public feeling and intelligence, the *Times*, on the subject of the bill before Parliament for limiting the hours of work in bleaching and dyeing works. The revelations of the hours of labour, and of the physical state of the operatives in these works, are not worse than were made by Dr. Guy of the condition of the journeymen bakers generally; and it would appear a monstrous anomaly, that one trade should be protected by legislation which is refused to another; but in framing legislative acts, it is necessary, above all things, first to consider the possibility of enforcing their provisions, otherwise they will prove sources of weakness rather than of strength. I fear that it would be next to impossible to enforce by legislation any rules as to hours of labour, &c., in the baking trade as at present conducted, without producing a state of things worse than now exists; for it is evident, that if it is now really necessary that a man should labour 18 to 20 hours a day, to get through a certain amount of work, it will be necessary to have two men to get through the work when it is to be done in ten hours only, and this will increase the cost of production, which will have to be paid by the consumer. But, as baking can be, and is, carried on by some masters themselves, without the employment of any journeyman at all, and as I am not disposed to think that any Act of Parliament could interfere sufficiently with the liberty of the subject to prevent a baker working for himself as long as he likes, it is evident that the master baker employing operatives would be put to great disadvantage in competition, and would be beaten from the field by the little baker who employed no operatives; so that, in course of time, we should find the whole of the baking trade in the hands of men of this description, a consummation not devoutly to be wished in the interests of the consumer.

It would appear, then, that legislation in these matters can only be applied when any industrial pursuit is raised from a handicraft to the dignity of a manufacture, employing operatives; and in proportion to the magnitude of the works, and the number of hands employed in each, is the ease with which the provisions of any act can be carried out.

In the lecture of Dr. Guy, above referred to, there is an intimation of another remedy for the journeyman bakers' evils than that of legislation, in the following passage:—"I should be the last person to interfere between the League Bread Company and the Carlisle Biscuit Manufactory—or any other association for converting the baking of bread and biscuits from a handicraft—which I think it ought not to be—into a manufacture, which I think it might be, and the single-handed master baker. If such a change could be brought about it would be cheaply purchased by some present inconvenience and suffering." I believe myself, that there is no other way possible of raising the condition of the journeyman baker, than by converting bread-making into a system of machine manufacture, which will necessarily, in a natural and healthy way, at once effect the object.

In considering the obstacles to the rapid adoption of the new process, and the establishment of wholesale bread manufacture, the first that presents itself is the fact that a class of manufacturers will have to be created specially for the purpose, since the existing bakers possess neither the capital nor the qualifications necessary; whilst the millers, the parties next most deeply interested in the baking trade, are for the most part too closely interwoven with the welfare of the smaller bakers to admit of their becoming manufacturers of bread, because in doing so they would provoke so much hostility among their present customers as to risk the entire loss of their existing trade, and along with it a large proportion of their capital now in the hands of the baker, under the system of credit before named. I am happy to say, however, that in one or two instances I have found millers who, having satisfied themselves as to the extraordinary advantages to be derived from the new process, are sufficiently far-sighted to see that these advantages must inevitably attract the attention of capitalists to establish a new trade, and they have preferred themselves to take licenses for their own districts, for the purpose of establishing, with their own capital, bakeries capable of being worked either by themselves, or by an association of their present customers, the small bakers. I fear, however, that such men of foresight and enterprise bear but a very small proportion to those who are incapable of passing beyond the very narrow circle of their own limited experience and immediate wants.

I am, therefore, disposed to think, from the experience I have already obtained, that the new process, so soon as its advantages, and the profits to be derived from working it, are more generally known, will create an entirely new class of manufacturers, more especially, since the several years' protection afforded by a patent presents a security and freedom from competition enjoyed by no other article approaching to bread in importance and magnitude of consumption.

There is another method of bringing the new process into general operation, which I think would accomplish it most satisfactorily, and with the least injury to existing interests, and that is by the formation of a large central joint-stock company, whose operations should consist in organising a perfect system of wholesale bread manufacture and delivery, and carrying that system by simple multiplication into every important town in the kingdom. Such a company would become a far more substantial customer for the flour of the miller than the present small baker, whilst the small baker might become a bread seller, instead of a bread maker. It is commonly urged that public companies can never enter into competition with private firms in trading operations, and this is true decidedly when individual management and skill play the most important part in the determination of profit and loss, but I am prepared to maintain that the manufacture and supply of an article of such extensive and universal consumption as bread, reduced by the new process to one of so much certainty and extreme simplicity, should be undertaken by a public company, in the same manner as gas and water are supplied. In Birmingham there already exist two public companies for the supply of both flour and bread. These pay excellent dividends, the smallest being equal to nearly double the dividends paid by our most prosperous railway companies, and this notwithstanding the difficulties arising from working without machinery and by the old method, difficulties which are felt most severely by the companies, on account of one of their fundamental laws being that they must not use alum to secure to the bread the colour and appearance which the small baker's bread possesses, with which they have to compete. This exclusion of the use of alum from the bread made at large establishments has hitherto been the chief obstacle to the suc-

cess of most of the co-operative bakeries that from time to time have been started to compete with the small baker, and this has been shown by evidence given before committees of the House of Commons.

The steadiness of the consumption of bread also renders it an article peculiarly suitable to be prepared and supplied by a public company. And since the new process removes all the vicissitudes of manufacture, and the expense of the plant required gives a comparative monopoly, the supply of bread is placed at once in the same category with gas and water.

It now remains for me to speak of the comparative value of the new bread in a chemico-physiological point of view, and of the effects upon the public health and the economy in diet which it is likely to produce.

Some few years since, an American invented a machine for removing the outer seed coat of the wheat grain, without injuring the grain itself, by which he proposed to save that highly nutritious portion which, adhering to the bran in the ordinary process of grinding, is torn away and lost to human consumption. It is stated that by this means ninety per cent. of fine white flour was obtained from the grain instead of about seventy-four or seventy-five, as by the old method. The invention was brought under the notice of the French Emperor, who caused some experiments to be made in one of the Government bakeries to test its value. The experiments were pertectly satisfactory so far as the making of the extra quantity of white flour was concerned, but when this flour was subjected to the ordinary process of fermentation, and made into bread, much to the astonishment of the parties conducting the experiments, and of the inventor himself, the bread was brown instead of white. The consequence, of course, has been, that the invention has never been brought into practical operation. About four years since a French chemist. M. Mège Mouriès, directed his attention to the subject of utilising, for the purpose of white bread-making, the nutritious substances ordinarily thrown away with the bran, and the results of his inquiries were communicated in a memoir to the Academy of Sciences, on the 9th of June, 1856, and have since been reported on by MM. Dumas, Pelouze, Payen, Peligot, and Chevreul.

These results are extremely interesting, and bear with considerable importance on the subject immediately before us. They explain most satisfactorily the cause of failure of the flour prepared by the American method to make white bread.

Before the publication of M. Mouriès's researches, the nutritious substance attached to the bran was considered by chemists to be a portion of the gluten of the grain, but it now proves not to be gluten at all, but chiefly a new nitrogenous body analogous to gluten, which the discoverer has named cerealine, with a portion of another well known nitrogenous body, vegetable caseine. The properties of this body cerealine are given as follows by M. Mouriès:—

"It is soluble in water, and insoluble in alcohol. It acts as a ferment on starch, dextrine, glucose or grape sugar.

"Its aqueous solution loses its activity at a temperature above 140 Fahr., and, when precipitated by concentrated alcohol or by acids, even carbonic.

"A liquid formed of 9 parts of water and one of alcohol precipitates without destroying its activity.

"Diastase loses its action at 194° to 212° Fahr.; in this respect it differs from cerealine.

"Cerealine changes starch paste into dextrine, dextrine into glucose, and glucose into lactic acid, and even into butyric acid, when the action is much prolonged.

"When starch is in globules and in water, the action of the cerealine will not commence below 122 deg. Fahr.

"Cerealine, in reacting on starch, not giving carbonic acid, is incapable of raising the dough, and it would not act alone in panification.

"It gives to milk of bran the property of becoming sour, and colouring under the influence of the air.

"It alters gluten extremely; this, as well as other products, gives ammonia, and a matter whose brown colour recalls the appearance of those matters called ulmine, and a saccharine product capable of changing sugar into lactic acid."

That the peculiar action of this body, cerealine, when brought into contact, in the process of fermentation, with the ordinary constituents of fine white flour, is the true cause of the dark-brown colour, is demonstrated by the experiments of M. Mège Mouriès, as well as by the effects of my own process, in which the fermentive changes are never allowed to take place. M. Mouriès, having satisfied himself as to the properties of cerealine, adopted a method by which its peculiar action was neutralized, and then made bread in which the whole of the bran containing the external coat of the grain was allowed to remain. The result was a loaf having merely an orange colour, but none of that dark-brown colour which always results when the whole of the grain is used to make bread by the ordinary method. In like manner, bread made by the new process from whole wheaten meal, when mixed and baked with the speed of which it is capable, is so free from the dark-brown colour that it is difficult to persuade people that it is made from wheaten meal at all. Some time ago I forwarded to the late Professor George Wilson, of Edinburgh, two loaves made exactly of the same shape, the one from fine white flour, the other from wheaten meal, from which a portion of the coarsest bran only had been taken. No distinction was pointed out when they were sent, and the only one noticed by Professor Wilson was, that "one of the loaves did not appear of such fine white colour as the fine white bread sold in the shops of Edinburgh." The fact is, the particles of bran had simply imparted that orange tint which appeared in the bread of M. Mouriès, in which he had neutralised the action of the cerealine.

These demonstrations regarding this substance, cerealine, are the more interesting because they bear upon a subject which has of late years excited considerable attention among physiologists, viz., the part which bodies termed ferments play in the processes of digestion and assimilation. Certain of these bodies are known to be provided by the animal economy itself for the processes of digestion, such as ptyaline and pepsine, others are furnished by nature along with the elements of the food itself, of which cerealine would appear to be the most important.

When we consider that the animal kingdom is entirely dependent on the vegetable for the preparation, from the simple elements, of those complex substances from which alone it can derive nutrition, we shall be able to understand how important a part such bodies as ptyaline, pepsine, and cerealine play as a connecting link between the two kingdoms.

Food has been divided into two sections; the sanguigenous or nitrogenous, or that portion which nourishes the forms and substance of the body—and the respiratory or the carboniferous, or that portion which sustains the animal heat and respiration. The chief forms in which the nitrogenous food is presented for ingestion to the animal, are those of albumen, caseine, fibrine, gelatine, and gluten—and those of the carboniferous are starch, sugar, and fatty and oily matters. Before these substances can enter the circulating system, they have to undergo what is termed the process of digestion, or, in other terms, of reduction from a higher stage of organic composition to a lower, and since the process of absorption from the alimentary canal into the blood vessels is one of election, the reduction of these substances must always take place in a definite manner, in order that the elective affinities upon which absorption depends may be duly established and harmonious.

It is scarcely necessary to assert that there is a natural instinct in all animals, man included, which, when they are in a state of health, leads them to select the form of food best suited to the wants of the economy. And we find that this instinct gives expression, so to speak, in its selection, to that need for a relationship more or less perfect

between the properties of food selected and the functions of digestion and assimilation properly belonging to, and exercised by, the body to be nourished.

Taking as an illustration man and his ordinary food, bread and the flesh of animals,—in the one case, we have gluten and starch chiefly, in the other fibrine and fat presented for solution, or reduction for assimilation, and we find that the means of their reduction are in some instances provided through the agency of glands within the body itself. Of these, ptyaline and pepsine present an example of the order above alluded to. Of late years, however, it has been surmised that these bodies are types of a most extensive class of substances, which play an essential part in the digestion and assimilation of food, some by acting as ferments, or degrading substances, in the manner of ptyaline, pepsine, cerealine, &c., and others by the contrary operation, elevating the character of the ingesta, and so restoring the standard essential to the elective affinities of absorption—a remarkable example of which is found in the influence of a minute portion of fresh meat juice, in causing the assimilation of gelatine—a substance very low in the scale of organic compounds, and one which alone is incapable of being assimilated, or of affording nourishment to the body.

I think then that this substance, cerealine, which has hitherto been almost entirely thrown away, or the action of which it seems to have been a special object of the baker to neutralise or destroy, will prove to be the most important agent in the digestion and assimilation of wheaten and other food. It is a well-known fact that dogs will flourish well upon biscuit made from the coarsest portion of the wheat, in which the chief constituent is small bran, and the nitrogenous matter attaching to it; whilst they will lose flesh and health if fed on the finest flour, which, though rich in gluten, has little or no cerealine to act as a solvent. Again, I have the assurance of one of the most eminent physicians in London, that he has seen the most extraordinary results follow the administration of bran tea with the milk to children who were poorly nourished, though plentifully fed; and who, from being thin and pale-faced, have become plump and rosy.

It is to the action of the cerealine, which is to be found in minute particles in most flours, that I attribute chiefly the remarkable results which have followed the constant use of the new bread, in several instances which I have been able to watch and others which have been mentioned to me by friends. These results being a feeling of lightness, and the absence of that consciousness of the presence of food in the stomach which is felt when the stomach has more than it can manage, an increased appetite for bread and a considerably decreased appetite for meat; whilst the muscular strength has been better sustained, and the general health materially improved. Indeed several of my professional brethren have mentioned to me cases in which some of the most distressing forms of dyspepsia have disappeared as if by magic under the use of the new bread, whilst in almost every instance in which it has been administered to persons suffering from irritable stomach, and the consequent heart-burn and acid eructations, immediate relief has followed.

I have said that hitherto it seems to have been the great object of both the miller and the baker to get rid of the cerealine and of its especial action on the flour. The miller has so contrived to grind and dress the flour as to secure, when it is made into bread, the whitest possible loaf; and the baker by the use of alum has sought to check that action of the cerealine during the early stages of fermentation, which is the chief cause of the loss of whiteness; whilst in the later stage of fermentation—the alcoholic—the action of the cerealine as a solvent becomes entirely neutralised and lost. This latter effect of the alcoholic fermentation in neutralising the action of the cerealine, is taken advantage of by M. Mège Mouriès, in his new system of panification, which he has introduced into some of the public institutions in France, and by which he is enabled to utilize the cerealine and caseine attaching to the bran in the preparation of perfectly white bread.

By the new process of bread-making, however, the action of the cerealine in destroying the colour and elastic properties of the bread, is prevented by the extreme rapidity with which the manufacture is conducted, and the lowness of the temperature at which the materials are used; thus there is no necessity for neutralizing its action in any other manner, and its valuable properties as a solvent in digestion are retained, until required in the stomach to assist in preparing for the functions of assimilation. That the office of cerealine in the process of digestion of the other materials of the flour, especially of the gluten, is a most important one, may be easily understood from the account given of its action on the starch and gluten, by M. Mège Mouriès. It is the most active of all the constituents of the grain in transforming the starch into dextrine, glucose, and lactic acid, which latter, acting along with the cerealine, effects the entire and rapid solution of the gluten in the stomach. From experiments which have been carefully conducted by Mr. Stephen Darby, of Leadenhall-street, it appears pretty certain that the cerealine, along with the lactic acid which it produces from the starch, is the true solvent prepared by nature for the gluten of wheat for its assimilation in the system, in the same manner that pepsine is shown to be the true solvent, along with lactic acid, for the fibrine of meat. If such is proved to be the case by farther experiments and research, how fearful has been the waste of the most valuable portion of our food by the old process of preparing our daily bread, and what may we not expect from the general introduction of a system which shall not only secure to us the economical and cleanly advantages of a machine manufacture, and the elevation of the journeyman baker in the social scale, but by enabling the whole of the cerealine and caseine of the wheaten grain to remain unchanged in the preparation of bread shall add to its quantity, and at the same time raise its nutritive value as an article of diet so high, as to enable it to take the place of meat.

That wheaten bread has not hitherto entered so extensively into the diet of the poor man in England as oatmeal has done in Scotland, is not to be attributed to a deficiency of nutritious matter supplied by wheat, but to the method of preparing and grinding it, for the wheaten grain prepared by simply taking off the external coat by the American process will present a larger amount of nutritious matter than oatmeal, and in a form infinitely more fit for digestion by delicate stomachs. Oatmeal, as you are probably aware, is prepared for food by simply boiling it in water in the form of porridge, so that all the elements are presented to the system uninjured by chemical processes, and the system accordingly assimilates them with ease; whilst our bread has been prepared in a manner which robs it of those essential elements which are necessary to enable the system to appropriate the nutriment which it offers.

Before concluding, I would just touch upon the much-vexed subject of adulteration by alum. In all the discussions that have taken place as to the injurious effects of alum upon the system, I think the most injurious have been overlooked, viz., its effect upon mucous secretions, and its preventing the action of solvents in the process of digestion. Its peculiar action on mucous secretions leads me very much to doubt whether it is capable of being absorbed from the alimentary canal into the circulation at all, except in quantities so small as to produce no recognisable physiological action. Its effect in the system is principally as a topical astringent on the surface of the alimentary canal, producing constipation and deranging the processes of absorption. But its action in neutralising the efficacy of the digestive solvents, is by far the most important and unquestionable. The very purpose for which it is used by the baker, is the prevention of those early stages of solution which spoil the colour and lightness of the bread whilst it is being prepared, and which it does most effectually, but it does more than is needed, for whilst it

prevents solution at a time when it is not desirable, it also continues its effects when taken into the stomach, and the consequence is that a large portion of the gluten and other valuable constituents of the flour are never properly dissolved, but pass through the alimentary canal without affording any nourishment whatever.

It has been both asserted and denied that alum produces an effect upon the gluten of wheat analogous to tanning, so that it is rendered very difficult of solution. Now, I am disposed to believe that the alum does really produce a kind of tanning effect upon gluten. In some of the experiments conducted by Mr. Darby, flour was washed in the ordinary way to obtain the gluten; after the gluten was obtained it was divided into equal parts, from each of which the water was well pressed; to one part was afterwards added alum, and thoroughly kneaded; after a very short period of time the alum caused the gluten to shrink and to give off water, and it became hard and tough, like a piece of india-rubber, losing its elasticity, and breaking short when pulled with violence. After the gluten and alum were kept in contact for several days, the gluten became so altered in character that it could be rubbed down in a mortar.

In another experiment alum was mixed with the water used to wash the flour for the gluten, and its effect in this case was so completely to destroy the adhesive properties of the small particles of gluten, that they formed no cohesive mass at all, and could not be separated from the starch by washing, but passed away with it.

It is scarcely necessary for me to point out the advantages to society which would follow the establishment of an extensive system of machine-bread manufacture by the new process. I would mention among the first and most important, that of the restoration to the wheaten bread of that most valuable substance cerealine, and the sweeping away of all those evils which the necessary use of alum entail. If the extraordinary value of cerealine, and the evils of alum are such as I have stated, the absence of the one, and the presence of the other, must not only lie at the root of nearly all the diseases which are the result of malnutrition in the poor, but of those multitudinous forms arising out of dyspepsia in the more comfortably circumstanced, so that it would probably not be too much to say that disease would be lessened one-half in all our large cities and towns, by supplying a bread that is perfectly free from alum, and contains the due proportion of the necessary solvent cerealine.

Arising out of the sanitary and physiological advantages of the new process, is the economical, as tending to substitute wheaten grain for animal food. When we consider the extraordinary and steady increase in the price of meat relatively to that of grain, which has taken place of late years, and that in the very nature of things this increase must continue so long as they bear their present proportion to each other in human diet—the importance of the new process in an economical point of view can scarcely be overrated. Of late I have been told that in some districts meat has fetched so high a price, and wheat has been so cheap, that it has paid to fatten cattle with the corn in preference to selling it for human food. In order that the waste attendant upon such a practice may be understood, I would merely point out the fact that the whole of that portion of the food—amounting to some 70 per cent.—which undergoes combustion in the animal, and passes away from the lungs and skin in the form of gas or vapour, is so much absolute loss, which taken as human food, in the form of wholesome bread, might have been saved.

I have now given you a very imperfect outline of what I believe the new process is capable of effecting. I have felt that in speaking of a process which has originated with myself it has become me to speak as modestly as possible of its value; but I fear, notwithstanding, that there may be many who will think that I am too sanguine as to its merits. It may be I am. But I would offer as an excuse, that I have been made sanguine by what others more able than myself, and totally disinterested, have expressed regarding it.

DISCUSSION.

The Chairman said he might be allowed to suggest that the paper divided itself into two important subjects—first, the question of the advantages of manufacturing by machinery generally, and, secondly, the question of bread-making in particular. He thought, perhaps, the feeling of the meeting would be with him if he suggested that they should confine the discussion that evening to the bread-making question, seeing that the other was a general topic, and might be discussed with respect to any other manufacture. Questions of great importance had been raised, one of which was as to the action of cerealine, and he hoped some of their chemical friends present would be able to supply them with some information upon that point. Then there was the question of the action of the two kinds of bread, fermented and unfermented, upon the human system. A great authority was opposed to Dr. Dauglish in his views. Dr. Liebig, in his recent letters on the chemistry of food, had given an opinion unfavourable to unfermented bread, perhaps hastily. At all events, it was a legitimate subject for discussion. Dr. Dauglish had also thrown out some new hints with respect to the action of alum on bread. That question had been already discussed by this Society, but it still admitted of considerable explanation, and it was a very proper subject for consideration whether the action of alum could be regarded as injurious to health.

Dr. Letheby, having been called upon by the Chairman, said he must admit that, as far as his own experience went, he had come to the conclusion that the opinions expressed by Dr. Dauglish were utterly opposed to the sound principles of dietetics. He thought that which was given as the definition of a loaf, or of bread-making, was a definition which applied rather to Dr. Dauglish's own process than to the actual mode in which bread was manufactured. Dr. Dauglish had said that "bread-making essentially consists in completely incorporating flour, water, salt, and carbonic acid, with each other in such a manner as that they shall form a tenacious, elastic, and bulky mass, in which the aëriform constituent bears to the solid a proportion of about three or four to one;" in other words, that it was nothing more than the art of vesiculating flour. He was quite confident that those who had studied the chemistry of bread-making must be satisfied that the mere vesiculation of flour and water was not the object had in view from time immemorial in the formation of a loaf. The action of fermentation at all times tended to the conversion of the starch into a substance which was soluble and easy of digestion. Starch, as starch, was as useless to the human subject as it was to the vegetable kingdom. It must be assimilated before it could be digested or appropriated. There was a particular secretion to effect this, but that secretion was not endowed with unlimited power. From the earliest times the fermentation of bread had been adopted for changing the starch contained in the flour into a soluble substance, so as to make the bread more digestible, and to relieve the stomach of the labour it had to perform in digestion. Still, although the subject deserved a great deal of attention, he must be a bold man, and one whose opinion required to be supported by the strongest facts, who would venture to tell them that from time immemorial, from the earliest history of the human race, the method of bread-making had been erroneous, and that they had only now come to a knowledge of the fact that they might economise their food by not fermenting the starch. The whole quantity of starch that was affected by the process of fermentation, even supposing it was lost, which he did not admit, was so ridiculously small that it was not worthy of the least consideration on the score of economy. But he (Dr. Letheby) said it was not lost but by the act of fermentation; it was changed

into a material capable of easy digestion. The question had been raised as to the effect of unfermented bread upon the human body. He could not help saying, in answer to the statement made by Dr. Dauglish, that the experience of those who at certain seasons of the year took unfermented bread, was that at although at first it digested easily, and produced no discomfort, in the course of a few days it began to produce symptoms which were evidences of injury to the body—dyspepsia in various forms. The Jews knew very well that when they used unfermented bread various gastric derangements were produced. That he regarded us a strong fact against the statements made by Dr. Dauglish, some of which were rather startling, but which certainly required investigation before they would be received. They required much larger experience in the use of unfermented bread before they could say that it could be used as fermented bread was for a long period of years without injury to the body. He was not at present prepared to say whether cerealine had the effect referred to. As far as his own experiments had gone, the matter required more investigation before an opinion could be formed upon it. With regard to the use of alum in bread that was still a moot question. He would not be disposed to sanction the belief that alum was a proper thing to be applied to the manufacture of bread; but he gathered from the statements made, that one of the effects of fermentation was to show, by the rapidity with which the gluten was then resolved into a saccharine mass, when unsound flour was present, and that alum was employed to correct it. The process adopted by Dr. Dauglish would, however, give no indication of unsound flour. Alum was a means used to improve the general appearance of bread made from unsound flour, but the process of Dr. Dauglish might be the means, perhaps, of causing unsound flour to be extensively used in the place of sound flour. He must admit that the whole of his experience was in opposition to the views enunciated by Dr. Dauglish.

Mr. Heywood said he was not able to enter into the chemistry of the question, but he had had an opportunity of trying the bread made by Dr. Dauglish's process, which had been recommended to him by a medical friend, as being considered more wholesome than ordinary bread. He had now tried it for some time, and found it remarkably wholesome,—more wholesome, and more digestible than ordinary bread.

Mr. Morrison (of Stirling) thought this was eminently a practical question. He agreed with the last speaker, that this bread was the most wholesome, and therefore he regarded it as the best bread. It was a matter to be decided not by chemistry, but by practice.

Mr. Bonthron wished to say a few words in defence of the bread-baking trade. He did not think it quite fair that Dr. Dauglish should connect the question of the position of the journeyman baker with his new system of bread-making. He (Mr. Bonthron) held that it was quite possible even for companies and large manufacturers to oppress their workmen; and at the same time he held that the position of the journeyman baker was capable of amelioration under the ordinary system of making bread. He begged in the next place to take an objection to the remarks of Dr. Dauglish which implied the general use of alum by bakers. He spoke from an experience of twenty years in the trade in London, when he said he did not believe that alum was generally used in the full priced shops. He did not use it himself, and he did not know of its being used by any of his acquaintance in the trade, for the simple reason that they did not require it. He cared not so much what the colour of his bread was, but he found that the best flour manufactured by respectable millers produced a sufficiently white loaf, and here the use of alum would only be pernicious, inasmuch as bread made of ordinary yeast, salt, flour, and water, kept better and more moist than if it contained an admixture of alum. He did not pretend to deny that alum was used in the cheaper kind of bread made of inferior flour. In that case alum acted as a corrective. In Scotland, where he was apprenticed, the use of alum in bread was unknown, and for that reason bread made from badly harvested corn was unsaleable. Dr. Dauglish had said the reason why bread-making companies did not and could not succeed was because one of their rules was that they should not use alum. It was, however, a singular fact that one of the largest establishments in London conducted their business without the use of alum. One reason why companies succeeded so well was this—they had not to compete with the difficulties under which the private manufacturer laboured in the shape of credit. Companies carried on their business in a more independent way than individual tradesmen could do. He was himself compelled to give a large amount of credit in his business. Companies did not do so, and they mostly had a custom secured to them through the members of the company, and they were secured from loss by the ability they possessed of calling for payment by a forfeiture of shares. The expense of the delivery of bread to customers out of doors was very considerable, and amounted, on an average, to as much as a farthing per 4lb. loaf, which became a serious item in the trade expenses. He had sold the bread manufactured by the process of Dr. Dauglish from the time it first appeared, and his name stood amongst those of the agents first appointed. At the same time he held that fermentation had not the effect upon bread which Dr. Dauglish ascribed to it. It was said that under the ordinary system, bread was produced at a waste; but even if this were so, a superior article in point of flavour was produced. He had been asked by gentlemen how it was the unfermented bread was so tasteless. The answer to that, in his opinion, was that, by the ordinary process, a portion of the starch of the flour was converted into a sweet saccharine matter, which must take place in order to generate the carbonic gas which caused the bread to rise. He therefore held that the slight waste of fermented bread was more than compensated for by the superior flavour of the article produced. His chief object in rising was, however, to speak upon the subject of alum, which seemed to be a great bugbear. If people would give a fair price for their bread, and obtain it from respectable tradesmen, in most cases, he believed, they would get bread free from alum.

Dr. Waller Lewis said that bread was so complex a substance, and the various chemical effects produced upon it, in the process of digestion, were so intricate, that the question as to the better use of fermented or unfermented bread was difficult to decide. He thought before so apparently valuable a process as that which they now had before them was put down, it should, at least, have a full and fair trial. Dr. Letheby had told them that he did not think bread manufacturers from the earliest times could have been going wrong when they introduced fermentation into bread-making. Now, for his own part, he did not think their baking ancestors were very good judges of the effect of fermentation on starch, or as to the formation of glucose, dextrine, or the other matters produced. He was quite sure the knowledge of chemistry at that time had not arrived at such a point as to give them much idea, if any at all, of the changes which fermentation produced upon flour. He believed the only point they wanted to arrive at, and which they did arrive at, was to vesiculate the bread. It did produce that effect, but it undoubtedly produced many other results, which, as far as his knowledge of chemistry went, were superfluous effects, and were not required for the production of good bread. He thought a large experience to the contrary must be shown to them to convince them that the bread produced by Dr. Dauglish's process was not wholesome bread, and that it was necessary that they should continue to eat fermented bread. He had seen this process of manufacture from the commencement, and had visited the well-conducted manufactory in which the bread was made. He had a great number of specimens of the bread sent to him before it became an article of commerce, and he had continued its use, not only per-

sonally and amongst his friends, but he had given this bread in large quantities to the officers of a very large establishment in London — the largest Government establishment — and it had met with universal favour. As to its causing dyspepsia in any form, so far as his experience went, it had quite a contrary effect; for various persons whom he knew to be affected by fermented bread could take this bread with great comfort. He should be glad to see the use of this bread increased instead of diminished, and he thought the discovery and application of this system of manufacture was a source of great credit to Dr. Dauglish.

Mr, Lobb wished to say a word or two upon the chemico-physiological view of the question. Dr. Letheby had stated that yeast had the effect upon starch of making it more soluble in the stomach, and more easily digestible. That he denied totally. The effect of the yeast upon the starch was to lower it to a much greater extent than was necessary merely to make it soluble. It was not the healthy stomach which was a fit judge of an article of diet. They knew that the South American Indians lived for three months in the year upon clay, which they would hardly regard as healthy nutrment: but they did eat it, and became none the thinner for it. It was the dyspeptic stomach, however, which was the best judge of the quality of bread, or any other article of diet. He had himself used this bread a good deal in cases of dyspepsia, and he had used it in the case of a patient in whom he felt more than ordinary interest, viz., his own person. He had not touched a morsel of fermented bread for four years except, when he did so, with the greatest possible amount of pain and dyspepsia, whereas he could eat any amount of this unfermented bread without inconvenience. He had found that it not only alleviated dyspepsia, but cured it, which he had never found medicine to do. He considered they were commencing a new era in bread-making, and from the personal experience he had had of this bread, he thought it of great value. To some constitutions he believed fermented bread was all but poisonous.

Dr. Odling, F.R.S., thought they ought to discuss this question in a rational manner. It was simply ridiculous to say that good baker's bread was all but poisonous. He had paid considerable attention to this subject, and with regard to the baking trade, he could corroborate a good deal that had been said by Mr. Bonthron. He had examined bread from the best bakers, and he did not find alum the universal constituent that it was said to be. With regard to fermented bread, there could be no doubt whatever that good fermented bread was one of thebest possible articles of diet which could be used, but all fermented bread was not good fermented bread. The great merit of Dr. Dauglish's process was that it provided a means of making bread uniformly good – bread which, perhaps, was equally good with the best fermented bread; some might think it better. He (Dr. Odling) had a partiality for it, but it could not be doubted that such bread as this, and the best fermented bread, were alike excellent articles of diet. One great merit of Dr. Dauglish's bread was, he conceived, that he was enabled to produce a better kind of bread than the baker could produce, unless he introduced alum into it. Now, he confessed he did not believe that the effects of alum in small quantities were so prejudicial as was usually supposed. There could be no doubt if they could get a good loaf without alum, it would be better that the alum should not be there. That was a point which had been established. But Dr. Letheby objected to this, inasmuch as he said Dr. Dauglish's process enabled the bakers to make pseudo-good bread, but which was really bread make from bad flour. Now, he thought that was hardly a fair way of putting the case. The fact was, that certain flour, which had not been well harvested, if it was allowed to remain a long time in a state of dough, would undergo a change which was objectionable. The utmost that Dr. Dauglish did was to prevent it undergoing that change. It was not that the flour was unwholesome, it was simply that, in the process of bread-making, it becamed changed in an objectionable manner. Dr. Dauglish's process prevented that change. There was another objection made by Dr. Letheby with reference to the alteration of the starch. It was implied that in Dr. Dauglish's bread, the starch did not undergo alteration. The fact was, if they took a loaf of Dr. Dauglish's and a loaf from a first-rate baker, they would be able to distinguish very little difference indeed between them. He had compared a loaf of Dr. Dauglish's bread with one of Mr. Bonthron's, and there was not a difference of more than 1 or 2 per cent. in the amount of altered starch; but in inferior qualities of bread, the starch had undergone more alteration. With regard to the effects of diet, experience differed very much. He himself had taken this bread since it first came out. He liked it, and it had agreed with him very well. There was one point with regard to the cerealine, on which he would not say he differed from Dr. Dauglish, but on which he would ask for some explanation. Cerealine and diastase, and similar substances, were, he believed, rendered insoluble by a comparatively moderate temperature. The temperature of a loaf of bread, during baking, was pretty well ascertained. If it was not quite up to 212 degs. it approximated very near to it. That was a temperature which he considered would render the cerealine and diastase unavailable. He would not absolutely say the cerealine was of no use, but he would ask for an explanation of Dr. Dauglish's views on that subject. Then there was a value in this process, inasmuch as it rendered it possible to convert into white bread a larger portion of the entire grain. No doubt the amount of waste during fermentation was greatly exaggerated, but it was clear that Dr. Dauglish could produce a better article, at the same time using a larger amount of the substance of the wheat than could be employed in the ordinary process.

Mr. Meredith remarked that the use of unfermented bread was not unknown in London; but he must say the specimens before them were better than those ordinarily sold. He would suggest whether, with all the alleged advantages of machinery and economy of time and labour, this process could not be made more useful to the lower orders of the people. The objection to low priced bread was its unwholesomeness, and if this bread could be made at a penny per loaf cheaper than the other bread it would be a great advantage to the working classes.

Mr. W. N. Wilson had used this bread from the time it was first introduced, and he enjoyed it very much, but the ordinary kind was cheaper, the one costing 5d. or 6d. and the other 8½d., weight for weight. If this bread could be produced at so much less cost of time and labour, and so much more produced from the same amount of flour, it could surely be sold at a less enhanced price as compared with the ordinary kind of bread; and if it could be thus produced at a reasonable price, he thought it would confer a boon upon the community, and Dr. Dauglish would merit the thanks of the public for his invention.

Dr. Aldis agreed with his friend Dr. Odling in the opinion that the adulteration of bread with alum was not practised to such an extent amongst respectable bakers as was generally supposed, but he believed it was practised in making the inferior qualities of bread. A few days since a specimen of bread was sent to the Sanitary Board of St. George's, Hanover-square, by a medical gentleman attending a family at one of the parochial dispensaries, whose illness was attributed to the eating of that bread. He therefore thought it his duty to bring the subject under the notice of the Sanitary Board. The bread in question was quite sour, and it did not require any chemical acumen to detect that it was exceedingly bad. It was proved that the bread was purchased in the neighbourhood of Westminster, but as the family lived in another district, the board could not interfere in the matter. A loaf was purchased at the same shop, and the matter was brought under the attention of the local authorities of Westminster. They could readily conceive

the evils which would be inflicted upon the working classes if bread of that quality were allowed to be vended for their consumption.

Mr. Edwin Chadwick, C.B., said his own views of the economy of this question had been laid before this Society in an extract from a paper which he had occasion to prepare for the Statistical Society; and he would only reiterate the assertion therein made. But he believed it was impossible the condition of the workmen who conducted inferior processes of bread-making in inferior places could be good. He believed it was absolutely necessary for their improvement that the process itself should be improved and the places improved, and that could only be done by the application of capital on a large scale. Upon the chemical part of the question he would say, with all submission, that there was great difference of opinion amongst scientific men as to what was edible and what was not. Professor Liebig had analysed timber, and had found in it the constituents of food, but if presented to the stomach in that condition he did not think it would be found to be wholesome. With all submission to Dr. Letheby, he (Mr. Chadwick) thought he would have done well to have assured this Society that he had made trial of this bread in what he thought for this purpose the best laboratory of all—his own stomach. He (Mr. Chadwick) rose simply to say that he knew an instance of the trial of this bread upon what he thought were good subjects, even better than dyspeptic people, viz., little children. He had seen extraordinarily good effects produced by it upon them. With respect to what was said about people liking bread of a peculiar taste, that reminded him of the defence made by some of the dealers in milk, who boldly asserted that their manipulation of the milk was necessary, because they did not believe that London stomachs could stand the pure article. For the sake of the working community at large, it was important that science should be directed to these improvements. They owed a debt of gratitude to the gentleman who had commenced this; and whether it was a commercial success or otherwise, he had great pleasure in bearing his humble testimony in favour of the bread that had been produced by Dr. Dauglish's process.

Dr. Gibbon had found that neither his friends nor his patients would take this bread, on account of its insipidity. It was like distilled water, perfectly pure but insipid. The Turks lived entirely upon unfermented bread, and flourished upon it, and most of the Irish ate unfermented cakes. The adulteration of bread with alum had been to some extent contradicted. Bread was now so cheap, and there was so little bad flour in the maket, that alum was not so much required; but in the low districts of London that method of adulteration was very much practised at the present time.

Mr. Shelley remarked that the question of capital, as applied to this process, had been a good deal talked of. It appeared to him that no very great expenditure of capital was required. He thought the entire outlay necessary to set up a very respectable bakery upon this process might be covered by about £2,000.

Dr. Guy said there was one point which had been scarcely touched upon, which he thought was pertinent to the subject—that was the extreme cleanliness of Dr. Dauglish's process. Practical men would bear out the assertion that in many of the houses of London, breadmaking was conducted under the most unfavourable circumstances as to cleanliness. He had heard them spoken of as being in the most disgraceful state. He thought one advantage of breadmaking by machinery was that it would lead persons to pay more attention to the places where bread was made. If the officers of health felt it to be within their province to inquire into the management of the bake-houses of the metropolis, it would be a great public benefit. He could not help thinking that the atmosphere in which the bread was made was really a far worse thing than the alum which was used. What he had himself seen, twelve years ago, was so bad that he could not speak of it in this or any other mixed assembly. He thought the superiority of the bread before them, and much of the bread which they saw about London, was as much due to the cleanliness observed it its manufacture, as to the mode of manipulation. And he was happy to bear out what had been stated by Mr. Bonthron that he believed amongst the respectable class of bakers alum was very little, if at all, used. The master bakers with whom he had conversed had either misrepresented the matter, or they did not use alum. He had heard it stated that when the flour was good no alum was used. But that did not touch what was called the "cutting" trade. He was happy to hear the statement from a practical man that the condition of the journeyman baker admitted of improvement under the present system of manufacture. The hope of the journeyman, he thought, was not so much in the advancement of machinery, but in the humanity of the master, and in his own consciousness of the evils under which he laboured. From what he had heard from the master bakers, there was an anxious desire on their part to ameliorate the condition of the journeymen, if they could see that they could make their bread without keeping the men up all night. The possibility of making bread without keeping the men up all night had been proved beyond the reach of doubt; and those masters who had not adopted the new system had abstained from doing so for two reasons. First, because they had not the requisite determination to make their own internal arrangements for the purpose; and another difficulty was that the condition of the journeyman baker was so lowered by the circumstances under which he laboured, and the length of time he worked in an impure atmosphere, that it was difficult to find men of sufficient physical energy, or "pluck" as it was termed, to carry out the better system of baking during a less number of hours. Those two difficulties, he believed, were really at the root of the whole mischief. Some allusion had been made to proposed remedies by legislation. He was happy to think that the journeymen bakers were desirous, if they could avoid it, to have no interference on the part of the legislature. He liked that spirit, but this was one of those cases in which a great number of tiresome knots had been tied round these poor men by the habits of their trade, and they could not get rid of them unless they were cut asunder by the sharp knife of legislation. Their condition was such that he feared, although they much desired it, they could not amend it unless through the legislature, and although some difficulties in the way of legislation had been pointed out, he was of opinion still that upon the whole it would be beneficial.

Mr. Scott mentioned that, with regard to the whiteness of bread, he believed the manufacture by machinery, owing to the material being exposed so much less time to atmospheric influences, tended to increase this quality. In the case of sea-biscuits those manufactured by machinery commanded a price of 2s. per cwt. more than the hand-made. The ordinary ship bread was wholly unfermented.

Mr. G. F. Wilson, F.R.S., said mention had been made, both in the paper and in the course of the discussion, of the effect of bread-making upon the health of the people employed in it. He had an opportunity, some time back, of visiting the large bakery establishment at which Dr. Dauglish's process was carried on; and whether it was owing to any difference in the manipulation or from some other cause, they appeared to be a remarkably healthy set of work-people.

Mr. Blackie remarked that there was one item in the manufacture of bread to which no allusion had been made, and that was potatoes. He believed they were made use of in large quantities, even by the best bakers. Besides this, as the discussion had turned very much upon the question of economy to the consumer, he thought in purchasing the best bread they would sometimes find a deficiency of two or three ounces in the weight of a loaf.

Mr. Bonthron admitted that he used potatoes, although

he had not considered it necessary to mention it, because they were never used as an adulteration. He had paid as much as 3d. per lb. for potatoes, and at 1d. per lb. they were more expensive than flour, because they would not absorb water. The proportion in which he used potatoes was 12 lbs. to two sacks of flour. They were beaten up and strained through a sieve. The object was to produce a saccharine ferment, and it was done at a decided expense. With regard to the weighing of the bread to the customers, he should consider it a dishonest act to refuse to do so, although, when the dough was weighed out and baked in a properly heated oven, he believed it would come out, upon an average of the loaves, of proper weight, though in particular instances there might be a deficiency.

Dr. Dauglish, in reply upon the discussion, said Mr. Bonthron assumed that he had asserted that every bread-baker used alum. He had only gone upon the opinions of those who had inquired extensively into the subject, and he had not asserted that every baker used alum. He had said there was a temptation to use it, but he believed there was so little bad flour to be had at the present time, that there was not the temptation that there had been to use alum in bad harvest years. As a proof of this, when he wished to make some experiments with sprouted wheat, he was obliged to send to Scotland for it. That wheat would ferment, but it would not make good bread by the ordinary means, but by his process it was made into good bread without the addition of alum; and on its being shown to the foremen of the factory, they chose the loaf made from the sprouted corn as the best, as it had that sweetness which was spoken of as belonging to bread made by fermentation. He had no doubt that the best bakers used the finest flour; and when he stated that large manufacturers and companies had found that their greatest obstacle to success was in being restricted from the use of alum, he only stated that which had been represented to him by the managers of those establishments. It was from this fact that almost all companies sought their customers amongst the lower orders, and therefore they could not afford to use the high-priced flour, and without the use of alum for improving the appearance of the bread, they stood no chance of competition with the other bakers. With regard to what had fallen from Dr. Letheby as to this process favouring the use of unsound flour, he could say that flour which was in the slightest degree musty must be rejected, because there was nothing to cover the flavour. In fermentation he had been told that they could work out the mustiness. With regard to the price at which this bread was sold, of course he could exercise no control over that. The supply was furnished from the manufactory of Messrs. Peek & Co., to return their agents a profit of 8s. per sack upon the sale of the bread. In some cases they were not satisfied with that and made a higher charge to their customers. When, however, the supply of this bread became more general, and the system of delivery was better organised, he had no doubt a proportionate reduction of the price would take place.

The Chairman rose to propose a vote of thanks to Dr. Dauglish for his paper. At the late hour to which the discussion had extended, he would not detain the meeting by any lengthened remarks of his own, although this was a subject in which he took a great deal of interest. Dr. Letheby had made an observation, which he thought had not been sufficiently answered, and he was afraid some persons might be prejudiced by what that gentleman had said with so much confidence, viz., that mankind had partaken of fermented bread from the beginning of history. That was not correct. By far the larger portion of the human race was fed upon unfermented bread. The rice and maize eaters never used fermented bread, and the Scotch consumed their oatmeal unfermented: and, therefore, he thought that assertion of Dr. Letheby's should be taken with much reservation. His own conviction, from the use of this bread, was in favour of it, although he did not say that individual experience would satisfy the conditions of the inquiry. But still he thought Dr. Dauglish had made out so good a case that the public ought to hear what he had to say to them. They ought to try the bread, and pronounce an unbiased opinion upon it. He was glad that this discussion had taken place upon the subject of alum in bread, for it was not so much a question of the food of the rich, who could buy the best bread, but it lay at the foundation of the sinews and the industry of the country. It was the question of the bread which the poor man ate. The question was, were the great masses of the people eating this alum, and what was the effect of it upon them? That was an inquiry worthy of the physiologist and the philanthropist.

The vote of thanks to Dr. Dauglish was then passed.

The paper was illustrated by specimens of the bread manufactured by the author's process.

The Secretary announced that on Wednesday evening next, May 2nd, a paper by Mr. W. E. Newton. "On the Employment of Peat in the Useful Arts, together with an Account of some Recent Improvements in the Preparation of it for various Useful Purposes," would be read.

MANUFACTURE OF ANCHORS AND CHAIN CABLES FOR THE MERCHANT SERVICE.

The select committee appointed to inquire into the manufacture of anchors and chain cables for the merchant service, and who were empowered to report their observations, together with the minutes of the evidence taken before them, have considered the matters to them referred, and have agreed to the following report:—

1. That at the outset of this inquiry, it was established in evidence, that the loss of chain cables by parting, and of anchors by breaking, is of rare occurence in her Majesty's navy; and that this appears to arise from their having been subjected to a sufficient test before they are received from the contractors, and also from their being thoroughly examined, and in many cases re-tested when returned into store, or before they are again issued for service.

2. That a variety of witnesses, chain-makers, ship-owners, engineers, and persons conversant with shipping, examined before the committee, concur in the opinion that it is highly expedient that chain cables and anchors for the merchant service should be subjected to an adequate test before they are used, as it would be the means of saving much life and property.

3. That a considerable portion of cables now made for the merchant service are of inferior iron and defective workmanship.

4. That the corporation of Liverpool and Harbour Trust of that port have for many years employed a testing machine of limited power, which is kept in full employment; and that since this inquiry was ordered by the House of Commons, it appears that the Harbour Trust, to meet the demands of that port, have decided on the erection of machines of greater capacity and power. That it is also in evidence that, during a period of five years, of cables sent to the Liverpool testing machine, 82½ per cent. are imperfect cables.

5. That in Sunderland two testing machines have been for some time in operation, which, although private property, are accessible to all, and that the superior character of chain cables made in that district is in a great measure due to the results of these testing machines.

6. That from the evidence of all the witnesses examined, your committee has formed the opinion that nothing but the use of proper testing machines can afford any guarantee for the soundness of cables or anchors, as defects may exist, either from badness of material or imperfect welding, which no inspection can detect; and so closely can the tenacious quality of iron be calculated, that

chains may be made to bear a given strain, which would break if the least excess of it were applied.

7. That though instances have been adduced by some witnesses to support the opinion that the application of a severe strain in testing has an injurious effect on a cable, this idea seems to the committee to be completely refuted by the evidence of Mr. Willcocks, and by the results of experiments made at Woolwich, and referred to in his evidence.

8. That all the witnesses examined agree in the utility of a test, and some of them, including all the manufacturers of chain cables examined, desire that its use should be compulsory, as many cables are now sold with false certificates.

9. That good grounds having been established in this inquiry for recommending the adoption of public tests, the only questions which remain are, the authorities into whose hands this duty should be confined, and the regulations that should be enforced.

10. That your committee are of opinion that bodies enjoying the confidence of the mercantile and shipping interest, and whose local residence will ensure an adequate superintendence (such as dock trustees), are the proper persons to undertake this duty; and that the regulations under which they act should be approved of by the Board of Trade.

11. That in order to suit the convenience of manufacturers of chains and anchors who have testing machines on their own premises, the Board of Trade, on receiving a requisition from any such manufacturer, should appoint inspectors to attend the testing of any chains or anchors, and give certificates, according to printed regulations to be framed for that purpose, of the strain applied to them, which should be the test applicable to their size.

12. That although the committee cannot overrate the advantage of having the chains of every vessel subjected to a test, they are unwilling to recommend that the test should be made compulsory, but as they have recommended the general use of testing machines, they consider that all ships launched after the 1st January, 1861, which come under the provisions of the Passenger Act, or are employed by any department of her Majesty's government, either in the conveyance of emigrants or troops, should be required to produce certificates that their cables have been properly tested.

MANUFACTURE OF TEETH IN PHILADELPHIA.

A very interesting branch of Philadelphia manufacture is the making of incorruptible teeth. Originally, natural or human teeth, as well as sheeps' teeth, and those cut from ivory or from the teeth of the hippopotamus, were used. Fifty years ago there was not a porcelain tooth made in this country; 20 years ago not more than 250,000 were manufactured annually in the United States, and but a trifling number in Europe. Since this the demand has been steadily increasing, owing chiefly to the great improvements made in their manufacture, and their more perfect applicability to the purposes designed, combining beauty and utility to such a degree as to leave almost nothing more to be wished for. Now, at least 3,000,000 of teeth are annually made in the United States alone. The first operation is the choosing of the materials. These are felspar, silica and clay, all of which are found in great abundance in various parts of the United States. To those are added various metallic oxides to produce any shade or colour desired. The felspar, clay, &c., are ground to an impalpable powder under water, dried and made into a paste. That composing the body of the tooth is of different materials to that composing the base or enamel. The teeth are made in brass moulds, and this is quite a delicate process. The enamel is first put in place with a small steel spatula; the platinum rivets, by which the teeth are fastened to the plate, are placed in position, and then the body is pressed into the mould. They are then submitted to a powerful pressure and dried. After being dried they are submitted to a process called biscuiting, in which state they can be cut like chalk. They are then sent to the trimmers, who scrape off all projections and fill up all depressions which may have been left in the operation of moulding, and then wash them with what is technically termed enamel. This is composed of various substances, more fusible than the tooth itself, and answers to the glaze in common porcelain making. It is ground to a fine powder, and suspended in water, and is laid on with a camel's hair brush. They are now sent to the gummers, who apply the gum. This is chiefly composed of oxide of gold, and is applied in the same manner as the enamel. After being dried, they are burned. This operation is carried on in a muffle. The teeth are placed on a bed of crushed quartz, which is placed on a slab of refractory clay. After being exposed to an intense heat for some hours, they are taken out and assorted for sale. Each tooth is subjected to ten different processes. A large amount of capital is invested in this manufacture; one house alone is stated to pay 2400 dols. per month for the single item of platinum. The platinum rivets are cut from the wire by a small machine, especially adapted to the purpose. Another heavy item is that of wages. Employing about 100 operatives, its expenses in this departmen average 700 dols. per week. A large proportion of the work is done by females. The same house can turn out 150,000 finished teeth per month, or about 7000 per day, and the value of its yearly production does not fall far short of 350,000 dollars.

THE WESTMINSTER BELL.

At a recent meeting of the Institution of Civil Engineers, Mr. S. A. Varley exhibited a cracked bell, the metallic contiguity of which had been restored by soldering the crack with tin, so that the bell rang as perfectly as before it was injured. It was explained that tin had the property, when heated above its melting point, to nearly a red heat, of rapidly dissolving copper. If, therefore, the cracked bell, after being soldered, was kept at a dull red heat, or nearly so, for a little time, it was suggested that the crack would become filled up with an alloy of tin and copper, of nearly the same kind of composition as the bell itself, and in absolute metallic union with it, and quite as sonorous as the other portions of the bell.

Home Correspondence.

IMPROPERLY BALANCED GEARING RAILWAY AND OTHER WHEELS.

Sir,—Although the importance of this subject is well known to most engineers and machinists, it has not obtained, generally, that close attention it demands.

We frequently observe in workshops, factories, and mills, where machinery is in operation, that the floors, the walls, and even the ground in the neighbourhood is in a state of constant vibration, causing an unpleasant sensation and a reasonable fear of danger.

Now, the principal cause of such results arises from the inaccurate balancing of the drums, pulleys, and gearing, as the following fact will illustrate:—

Belonging to one of the largest machine works in England, there was a large shed, in which was a circular saw, driven by a pulley on a counter shaft, affixed to the roof-beam; this shaft was driven about 600 revolutions per minute, and the pulley was 30 inches in diameter; it caused the beam and roof to vibrate exceedingly, to prevent which the proprietors secured large upright and spur timbers to the beam and to the stone work on the ground; when the shaft was put in motion, the vibration was as great as ever, and shook the ground all about, so that draughtsmen and clerks in a building on the other side of

the street complained of its interference with their operations. The foreman of the works mentioned these facts to me, and I informed him, (as perhaps, many others might have done), that the pulley was not balanced; "but," said the foreman. "It is beautifully turned and polished, and runs as true as a hair." "It matters not," said I, "it is not balanced." I then showed him how to test it, by an operation requiring only a few minutes, and he found that the pulley was 2½ lbs. out of balance; it was then adjusted and perfectly poised, and again set in motion. The result was most satisfactory; it worked without any perceptible vibration, and, as was remarked, as quietly as a lever watch; they removed the wooden props and spars; there was no vibration in the roof, nor any more complaints from the counting-house.

It thus appears, that the small weight of 2½ lbs. uncounterpoised, and revolving at a velocity of 4,000 or 5,000 feet per minute, is sufficient to exert the marvellous force described; and when we consider that there may be hundreds of wheels, pulleys, &c., similarly poised in mills or workshops, we can account for much of the vibration.

The proprietors of the works referred to were as fully alive to the importance of balancing as are most of their compeers, but attention is not sufficiently directed to pulleys and wheels, which are seldom tested after being made or finished, and the method adopted, even for parts of machines, such as fans, glazers, saws, beaters, card-cylinders, &c., is very crude, tedious, and often inaccurate.

It is true, the heavy gearing and spur wheels seldom attain a high velocity, but as momentum is the compound of weight multiplied by velocity, and in heavy gearing, such as wheels of one ton weight, the inaccuracy of balance may amount to 50 lbs. or more (no attempt being now made to test them), it follows that, in such a case, a wheel making 100 revolutions, and being 50 lbs. out of balance, will cause as much vibration as one making 1,000 revolutions and being 5 lbs. out, at a similar distance from the centre.

Some engines, lathes, and tools work steadily, whilst others, by the same maker, from the same patterns, and in every respect, except one, exactly similar, are quite unsteady, although bolted down to extra stone work, neither the engineer nor machinist at all divining the real cause of the difference.

It is evident that a great amount of vibration is caused by the inaccurate balancing of rotating bodies, causing immense wear and tear, shaking brick, wood and iron work, bolts, and other fastenings, with loss of power, great expense, danger, and sometimes loss of life.

But the most important of all, perhaps, is that of railway wheels; and I am informed that engineers are perfectly cognizant of the fact; and I am aware that a paper was read upon the subject, about ten years ago, before the Society of Arts, but the fact is, that although great attention is paid to construct the wheels so as to ensure accuracy, they are never tested in any manner whatever, after they are fixed to the axles, to prove that they are accurately balanced or poised.

The wheels made entirely of wrought iron, are now brought to great regularity by the machinery employed in their manufacture, and although more expensive than those made partially of cast-iron, it is stated they are more economical; it is a question whether that economy is not due to the fact that the machine-made wrought-iron wheels are almost perfectly poised or balanced, and whether, if the other and cheaper kind of wheel were equally well balanced, they would not last as long.

Through the courtesy of the engineers, facilities were kindly afforded a few weeks ago, for testing, by my method, several of the wheels belonging to a railway company. The first pair we tried had cast-iron bosses, and I found they were 9½ lbs. out of balance; another pair were 1½ lbs. out; both these had been recently working under passenger carriages; we tested some new or unused ones, constructed entirely of wrought iron, and they were astonishingly correct, being only 8 oz. out of balance, although weighing 15 cwt. I tested one pair of carrier wheels of a locomotive, which had been just new tyred; they weighed 25 cwt., entirely of wrought iron, and were only 1 lb. wrong. The apparatus for testing was fitted up temporarily, but was sufficiently accurate so to test these heavy wheels as that an ounce weight turned them either way after being balanced.

There is no doubt that there are hundreds of thousands of wheels now working on railways which are exceedingly out of balance; every one must have experienced the oscillation, both lateral and to and fro, in travelling on a railway; of course much may be ascribed to the rails, and much to the bad working of the engine, but a great deal is caused by the wheels of the carriages; and when we consider the results before alluded to, of 2½ lbs. at a velocity of 4,000 or 5,000 feet per minute, what must be the effect on a carriage of 9½ lbs. going at a speed of 2,000 or 3,000, or as in express trains, of 5,000 feet per minute!

It will be readily imagined that where there is a constant working of the buffers and springs, there is a constant wear and tear, and the bolts, screws, and joints must rapidly become loose, for, although constructed of enormous strength, nothing can withstand the separating force of vibration; there is also a large amount of needless wear and tear upon the rails and permanent way, as well as great injury to goods caused by the oscillation, also a wasteful expenditure of power, so that altogether it is probable millions of money are by these means lost to the railway companies every year; and lastly, but a most important point, causing uneasiness, danger, accident, and sometimes loss of life to passengers. If the wheels of the engine and carriages be properly balanced, and the rails in good order, there would be very little more oscillation at 40 miles per hour than there is at 10; and, by means of a very simple contrivance and trifling expenditure, any wheel may be tested and adjusted to a perfect balance.

I am, &c.,

H. F.

PAPER MATERIAL.

Sir,—The lateness of the hour on Wednesday evening prevented me from replying to some misrepresentations on the part of those who discussed the subject of my paper.

Dr. Watts supposed that my boiler, or rather apparatus, is intended for high-pressure boiling, so as to obtain a great temperature; that is a vital error in reference to my system; no pressure is required in the apparatus where the materials are treated—the steam is generated in another vessel, or boiler, under a pressure of thirty to forty pounds only; it there, by a suitable apparatus, is superheated and conveyed to the materials.

The moment super-heated steam is brought into contact with liquid it ceases to be super-heated, the excess of heat merely converting the liquid into vapour; this fact has been overlooked in many patents. I have carefully searched the patent-office in order that no infringement should exist; the whole arrangement and mode of application are entirely new.

The application of 400 degrees of heat to the alkaline saturated material will cause the silica to be removed in an incredibly short space of time. Where great pressure is employed to obtain that heat, when over 230 lbs. to the square inch the affair becomes unmanagable, inasmuch as the free circulation and percolation of the alkaline liquid is impeded; as also, the removal of the materials, when tons have to be operated on requiring much time; besides a host of inconveniences, independent of the expense, which must suggest themselves to every practical person. In fine, it would be impossible to carry out my system if high-pressure steam were to be employed. Your reporter makes me say that Mr. Morrison makes 40,000 tons of paper per annum. What I said, or ought to have said, was, "that he made thirty tons per week in three mills—one near Philadelphia, the others at

Cincinnati." It was evident that the many paper-makers present could not—as they did not—take exception to my new system of treating raw materials. One gentleman, Mr. Evans, who conducts the extensive works of Messrs. Dickenson, spoke most favourably.

Mr. Norris, who spoke of the political bearing of the subject, makes packing paper, which does not require great skill in the use of chemicals, as the lower class papers present none of the difficulties or delicacy in the treatment incidental to the best class writing or book paper. What was said in relation to the increased price of straw was particularly fallacious in a general sense. For instance, suppose a mill or half a dozen mills in each county using each 20 tons of straw, would that materially increase the price of straw at Smithfield Market? I grant that should a paper mill be placed in a locality where straw was comparatively a scarce article, a sudden demand would necessarily increase the price. The margin for increase in price is so great that it must be more than doubled in value, in order to prevent its use, in the meantime other paper stuffs, other raw materials and rags would fall, therefore this supposed deficiency or increase in price would soon regulate itself, by the competition consequent on the demand.

No one with whom I have discussed the question, denies, the proposition :—" That the moment the silica is removed from straw and other raw substances, they will produce equally as good and no doubt a much stronger paper than rags."

Of course, the adaptation of the paper mills to the use and treatment of raw materials will involve some expense, though the paper making machine proper, of course, is retained. Every other branch of the arts has been subject to this necessity, by the improvements in the mode of manufacture; let anyone revert to the machinery and appliances of the cotton mills some thirty years since, in comparison with the existing machinery; a total change has been made in order to meet the requirements of the increased demand and necessities of the age; nor can we find any department which has been exempt from this obligatory adoption of new methods to expedite and facilitate the special manufacturer.

The paper maker must follow in the same wake; the old fashioned comparatively useless machinery in the preparation of the paper stock must give way to such as will be more suited to ensure economy, expedition, and the production of a superior article at much less cost. I am convinced that at no distant day, the astonishment will be, that we have been content with the present quality of paper; now good paper is the exception. It is true that in bank notes and the like, paper is produced of great strength and durability, but the price precludes its general use. There is no substantial reason why all writing-books and other paper should not be made equally strong at a low price, but this enjoins the use of new materials, not effete stuff, like worn out rags. It has been justly remarked by your correspondent, Mr. Simmonds, that the "megass," or refuse of the sugar cane, would be available. The quantity annually produced in sugar countries is enormous. The only use to which it is now applied, is to assist with coal as fuel, used in the evaporation of the water from the saccharine matter. It produces the best and strongest paper, specimens of which I have lately received.

The sugar planters may argue that the ashes tend to fertilize the land for the ensuing crop. The only substance of value is the potass, which it contains; and as this can be supplied at a low price, pure, only requiring to be dissolved and applied to the land, and it would take several tons to produce one cwt. of potassa, this difficulty can soon be met; so with straw, the prejudice of the English agriculturist will be removed the moment his reason is convinced. I am, &c.,

ROBT. H. COLLYER, M.D.

Beta House, 8, Alpha-road, N.W., April 24th.

VOLUME OF WATER USED IN PAPER MAKING.

Sir,—The question of paper-making is mixed up, in Great Britain, with water supply, to an extent few persons imagine. It has been given in evidence (on oath), before a Parliamentary Committee, this session, that 100 gallons of water are required to make 1 lb. of paper, or, by weight, 1,000 lbs. weight of water to make 1lb. of paper. That is, for water by weight 1,000 to 1. One hundred gallons of water make one pound of paper; 224,000 gallons will make one ton of paper, and at twenty gallons of water per head, 224,000 gallons of water would supply 11,200 persons.

Some firms make five tons of paper per day, and consequently use water which would supply 56,000 persons—the population of a large town.

To make 100 tons of paper per day will require a volume of water equal to the supply of a population of 1,120,000 persons. Any process of paper-making which economises the use of water will be a great boon. In England, most of the available water is difficult to reach.

I am, &c.,

ROBERT RAWLINSON.

BLACKBONED FOWLS.

Sir,—About three years ago * I made a statement in a letter, which was published in the Society's Journal, that there existed in Honduras a species of gallinaceous fowl, the bones of which were black. The verity of the fact was much doubted. Some learned osteologists solemnly declared that when the sea serpent was caught, and mermaids were established, they would believe in fowls with black bones, but not before. For my part I fully expect that some day the scepticism of science will be put to the blush by the appearance in public of the ocean snake, and that both mermaids and mermen will demonstrate their existence on the platform at Exeter Hall. But, be this as it may, I have now simply to announce to your readers that I have just brought to this country six black-boned fowls, and that they may be seen by all believers and unbelievers in the gardens of the Zoological Society.—I am, &c.,

R. TEMPLE.

Proceedings of Institutions.

Belfast (People's Reading Rooms).—The annua meeting was held on the 16th February, when the annua report was presented to the members. The Committee express their satisfaction at its highly favourable character. The increase of members and subscribers is larger this winter than hitherto. Of the former there are at present 186 in all, 47 paying first class and 139 second class subscriptions. Of subscribers there are 116, 40 paying first class and 76 second class. These figures show an increase of 53 members and 37 subscribers, as compared with the last half-yearly meeting; the total number then was 212; at present it is 302. The weekly average of visitors for the past six months has been 290, only three less than the average of the corresponding period last year. This nominal diminution may, however, be considered as a real increase, for there is no doubt that a considerable number of those who were formerly classed as visitors now rank as members or subscribers, and yet the number of visitors remains almost the same. The classes, which are conducted this winter by Mr. Murphy, Mr. M'Clintock, Mr. Pink, Rev. Mr. Nelson, Rev. Mr. Anderson, and Mr. Rainey, are again highly successful, and form a most important feature in the character of the Institution; the

* See Journal, Vol. V. page 387.

attendance is about 150. They have, so far, taken the place of lectures of former seasons with advantage in every respect; but more especially as regards the real value and amount of the instruction conveyed. The committee express a hope that, however respectable the position may have been that this Institution took in the Society of Arts examinations last year, it will this year rank still more honourably. As regards the library, new books are being added occasionally, and worn-out volumes replaced. The demand for books is as great as could be anticipated.

Potteries Mechanics' Institution, Hanley. — A monthly magazine has recently been started in connection with this Institution. About a year ago a manuscript magazine was suggested as likely to afford valuable facilities for the discussion not only of interesting topics in science, art, and literature, but also of matters immediately affecting the Institution. The suggestion was very favourably received, and would have been carried out at once, had not the energies of the Committee and members been immediately afterwards concentrated on arrangements for a new building, which is now in course of erection. The project remained in abeyance for some time; and when the idea was revived some months ago it was proposed that the magazine should be printed, and a committee was appointed to conduct the publication. On the 1st of February No. 1 was published, and so great was the demand for the work, that the first issue was sold off in a few days, a second edition being got out, which was also disposed of very soon. No. 2 is as popular, scarcely a copy now remaining unsold. The magazine is, as it purports to be, a "Miscellany," no subject recognised by the rules as proper for discussion within the Institution being excluded from its pages. In each of the numbers published there are several poetic effusions, a space devoted to "Notes and Queries," and a page to chess, while the remaining contents are varied in character. The success of the experiment may perhaps stimulate other Institutions to similar efforts. Further information respecting the magazine in question will be gladly afforded by the Secretary of the Institution.

To Correspondents.

Errata.— In last *Journal*, page 405, col. 2, lines one and two from bottom, for "cents" read "pence," and line six from bottom, for "£10,000" read "10,000 dollars."

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Zoological, 4. Anniversary.
Actuaries, 7.
London Inst., 7. Rev. Henry Christmas, "On Eminent Personages of English History living between the years 1640 and 1660."
Medical, 8½. Mr. De Meric, "On injections of tris-nitrate of Bismuth in Gonorrhea."

Tues. .....Royal Inst., 2. Anniversary.
Civil Engineers, 8. Mr. D. K. Clark, "On Coal Burning and Feed-water Heating in Locomotive Engines."
Pathological, 8.
Photographic, 8.

Wed. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. W. E Newton, "On the Employment of Peat in the Useful Arts, together with an Account of some Recent Improvements in the Preparation of it for various Useful Purposes."
Geological, 8.

Thurs. ...Royal Inst., 3. Professor Ansted, "On Physical Geography and Geology—the Atlantic Ocean."
Royal Society Club, 6.
Antiquaries, 8.
Linnæan, 8. Dr. Hicks, "On certain Sensory Organs of Insects hitherto undescribed."
Chemical, 8. Dr. Gladstone, "On Circular Polarization."
Artists and Amateurs, 8.
Royal, 8½.

Fri.....Archæological Institute, 8½.
London Inst., 7. Prof. Bentley, "On the Structure and Formation of the Nutritive Organs of Plants."
Royal Inst., 8. Dr. E. Lankester, "On Breadmaking and Baking."

Sat.....Royal Inst., 3. Mr. F. A. Abel, "On Heat and Chemical Force."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on April 4th, 5th, 7th, 12th, 13ih, 14th. and 16th, 1860.

197. Universities (Scotland)—Ordinance.
157. East India (Patna Police—Report.
174. Navy (Ships Building, &c.)—Account.
177. Orange-street Waterworks - Return.
213. Poor Law (Wallingford Union—Correspondence.
156. East India (Meer Ali Morad) - Return.
210. North Kent Railway—Return.
214. Army Pay—Return.
76 (57). Local Acts (57. Eau Brink Drainage)—Admiralty Reports.
162. Queen's Printers' Patent—Report.
168. Navy—Statement.
170. High Sheriffs (Ireland)—Return.
183. East India (Currency)—Correspondence.
192. The Serpentine—Report.
178. Clare Election—Minutes of Evidence.
179. Increase and Diminution (Public Offices)—Abstract.
160. Peterborough Election—Minutes of Evidence.
161. Hong Kong—Papers.
207. Chopwell Woods (Durham)—Account.
212. Metropolitan Police—Returns.
215. Artillery—Return.
198. Universities (Scotland)—Return.
206. Spirits—Return.
113. Coinage—Accounts.
182. Anchors (Merchant Service)—Report.
204. Local Taxation—Return.
238. (Sess. 1859). Administration of Justice (Colonies)—Returns.
87. Bills—Poor Law (Medical Relief).
90. „ Bank of Ireland.
93. „ Highland Roads and Bridges.
101. „ Leith Harbour and Docks.
103. „ Adulteration of Food, &c. (Amended).
98. „ Poor Relief, &c. (Ireland).
99. „ Fisheries (Scotland).
100. „ Public Charities.
104. „ Customs (Amended).

Savoy and Nice—Map referred to in Paper No. 15.
Tariffs—Supplemental Return (Brazil).

Delivered on April 17th, 1860.

190. The Paramatta—Report to Board of Trade.
191. Dover Election—Minutes of Evidence.
195. Crime and Outrage Act, &c. (Ireland)—Return.
95. Bill—Sir John Barnard's Act, &c.—Repeal.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April 20th*, 1860.]

Dated 1st February, 1860.

260. J. Ambler, Little Horton, Bradford, Yorkshire—Imp. in looms for weaving.

Dated 1st March, 1860.

566. W. Krutzsch, Chamber-street, Goodman's-fields—Imp. in cartridges and projectiles.

Dated 22nd March, 1860.

740. J. Stainthorp, 67, Gracechurch-street—An improved method in coating or forming a hard shell on a candle at the time of moulding the same, and in apparatus connected therewith.
746. G. B. Rennie, Holland-street, Blackfriars—Imp. in the construction and mode of working and employing floating platforms, pontoons, or docks for supporting ships or other vessels.

Dated 27th March, 1860.

788. T. Briggs, Salford, Lancashire—Certain imp. in the manufacture of oil cloth or oil paper to be employed for packing purposes, or for coating or covering surfaces, and in apparatus connected therewith.

Dated 28th March, 1860.

797. C. Barthelemy, 27, Busch-lane—Using vacuum as a motive power, and of the means by which the same is effected.
800. E. Ewer, Chapel street, Curtain-road, Shoreditch—Imp. in fountain pens.

Dated 29th March, 1860.

808. A. Pentzlin, Glasgow—Imp. in machinery for cutting wood. (A com.)
810. I. Holden, St. Denis, near Paris—Imp. in means or apparatus for preparing and combing wool and other fibrous substances.

Dated 30th March, 1860.

820. J. Reidy, 27, Cook-street, Cork—A machine for breaking stones and other hard substances.
822. J. R. Breach, Leeds—An improved household fire-escape.
826. W. M. Chambers, Birmingham—An imp. or imps. in the method of and apparatus for straightening angle-iron and other bar iron of a trough like shape after it leaves the rolls, and while still hot.

Dated 31st March, 1860.

836. R. A. Jefferson, 31, North-street, St. John's-wood, and M. Jefferson, 49, Crown-street, Finsbury—An improved construction of steam engine, applicable also to the raising of water.

Dated 2nd April, 1860.

840. T. Dahll, Krageroe, Norway—An imp. in the separation of nickel and cobalt from magnetic pyrites and bisulphuret of iron, or any other sulphur composition.
841. J. S. Starnes, Cock-hill, Ratcliff—Imp. in signal and other lamps.
842. H. B. Powell, Foxleize-park, Lyndhurst, Hants—A moveable stud or button.
843. R. A. Brooman, 166, Fleet-street—Imp. in buttons. (A com.)
844. E. Partridge, Stourbridge, Worcestershire—Imp. in axles and axle boxes.
845. T. Gamble and E. Ellis, Nottingham—Imp. in the manufacture of fabrics of the description known as bobbin net.
846. C. Johnson, 6, Northumberland-street, Strand—Imp. in the manufacture of shoes and boots.

Dated 3rd April, 1860.

847. J. Robertson, 3, Stanisby-road, East India-road—Imp. in the construction of furnaces or fire places.
849. E. Simpkin, Bury, Lancashire—Imp. in couplings for carriages, waggons, and other vehicles on railways.
850. W. A. Gilbee, 4, South-street, Finsbury—An improved apparatus for making signals on railways. (A com.)
852. J. Ambler, Little Horton, Bradford—Imp. in looms for weaving.
853. J. M. Jones, Netheravon, Wiltshire—An improved apparatus for generating steam.
855. W. Rimington, and W. Rimington, jun., Skipton, Yorkshire—Imp. in box hinges for swing doors.
856. C. V. Walker, Fernside-villa, Redhill, Surrey—Imp. in the manufacture of troughs for receiving electric telegraph wires.
857. J. Schloss, Cannon-street—An improved plug for smoking pipes.
858. D. G. Hope, Manchester—Imp. in slide valves of locomotive and other steam engines, and in gearing for working them.
859. A. N. Jensen, 3, Chambers-terrace, Malden-road, Haverstock-hill—Imp. in brewing warts from saccharine and farinaceous substances, with a new method of retaining the aroma and better qualities of the hops, forming an infallibly keeping ale, nearly white and admitting of aeration, part of which imps. is applicable to distillers' wash, vinegar making, and preserving fermentable liquors.

Dated 4th April, 1860.

861. T. Ingram, Bradford—Imp. in looms for weaving.
862. A. Pullan, Fordie-cottage, New-cross, and T. Cresswell, Ravensbourne-terace, Lewisham—Imp. in the construction of steam, water and other fluid gages.

Dated 5th April, 1860

864. G. Mallinson, Salford—Imp. in the manufacture of woven fabrics.
865. W. F. Brown, Westgate-street, Gloucester, and W. Jeffery, Eastgate-street, Gloucester—A more convenient and effectual method of attaching and securing brooches and such like articles, and for improved fastenings to be used therewith, and for other purposes.
867. A. White, Great Missenden, Buckinghamshire—Lifting at one lift a load of corn, hay, straw, or manure, or of other things.
868. W. Leuchars, 38, Piccadilly—Imp. in portable ink-holders and match boxes.
868. J. H. Fuller, 70, Hatton-garden, and W. Davidson, Wisbeach, Cambridgeshire—An apparatus for cutting or screwing pipes and round metal.
871. J. H. Wilson, Cornholm Mill, near Todmorden—Certain imp. in machinery to be applied in the manufacture of bobbins used in the preparing and spinning of fibrous materials.
872. W. Parsons, Pont-ar-Tawe, Swansea—Imp. in the manufacture of wrought iron.
873. C. Dusautoy, Laverstoke, Southampton—Imp. in apparatus used in the manufacture of paper.
874. J. H. Johnson, 47, Lincoln's-inn-fields—A new metallic alloy. (A com.)
875. J. Smith, Birmingham—Imp. in the manufacture of buttons and other dress fastenings.
876. A. V. Newton, 66, Chancery-lane—Imp. in the construction of pressure gauges. (A com.)
877. A. V. Newton, 66, Chancery lane—An improved arrangement of parts for supplying steam to steam engines. (A com.)
878. M. Henry, 81, Fleet-street—Imp. in the mode of and apparatus for obtaining motive power. (A com.)

Dated 7th April 1860.

879. H. Carter, Manchester—Imp. in machinery or apparatus for making gas burners.
880. W. Clark, 53, Chancery-lane—Imp. in fire-arms. (A com.)
881. W. Clark, 53, Chancery-lane—Imp. in axles or journals in combination with lubricating axle boxes for railway and other carriages. (A com.)

Dated 9th April, 1860.

883. H. L. Hall, 6, Upper Bedford-place—Imp. in the manufacture of India-rubber cloth, japanned and leather cloths, and in the machinery or apparatus employed therein.
885. A. Howat, Farmworth, near Bolton-le-Moors, Lancashire—Certain imp. in miners' safety lamps.
887. H. Bridle, Bridport, Dorset—Imp. in refrigerators.
889. T. Parker, Blackburn, and G. Harrison, Burnley, Lancaster—Imp. in self-acting mules.
891. T. Aveling, Rochester, Kent—Imp. in locomotive engines.
893. L. Eidlitz, New York, U. S.—Imp. in producing printing and other irregular surfaces by the aid of photography.

Dated 10th April, 1860.

895. L. J. Repelin, St. Marcellin, France—An expeditious mode of tanning.
899. J. Rigby, and W. N. Norman, Dublin—Imp. in guns and other fire arms, and in cartridges to be used therewith.

Inventions with Complete Specifications Filed.

935. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the production of motive power, and in the apparatus connected therewith. (A com.)—14th April, 1860.
953. J. B. A. Carpentier, Boulogne-sur-Mer, France—A new metrical apparatus with table.—16th April, 1860.

Patents Sealed.

[*From Gazette, April 20th*, 1860.]

April 20th.

2407. J. H. Green.
2414. P. Jones.
2418. W. Brookes.
2434. H. Greaves.
2436. W. C. Day.
2450. J. Armour.
2458. P. R. Hodge.
2462. R. A. Brooman.
2466. H. Greaves.
2473. S. C. Lister and J. Warburton.
2474. C. Stannet.
2480. J. Ingham and G. Collier.
2489. W. Spence.
2526. W. Mannix.
2535. W. E. Newton.
2552. W. Clark.
2588. C. Chalmers.
2604. J. A. Drieu and A. Legeay.
2620. A. H. Le Pontois.
2632. J. Cowan.
2533. W. E. Newton.
2644. W. E. Newton.
2752. G. Feldwick.
2759. J. Shaw.
2800. R. Hellman.
121. B. Burrows.
207. B. P. Jeandelize.
238. E. Brooks and H. Waters.
409 J. Weeks.
429. J. Hopkinson.
434. E. Westwood.
454. T. Osborne.
460. A. C. Hill and W. Morgan.
508. J. H. Johnson.
548. H. Higgins.
568. W. Bush.

[*From Gazette, April 24th*, 1860.]

April 24th.

2433. H. S. Rosser.
1444. J. J. Bourcart.
2449. J. L. Pritchard.
2451. C. E. Wlson and H. G. Hacker.
2453. T. Whitby & W. Dempsey.
2455. C. Stevens.
2459. R. M. Ordish.
2461. R. A. Brooman.
2469. J. F. Cole.
2471. G. Ghesquière.
2486. J. T. Pitman.
2491. J. Jones.
2505. G. Wemyss.
2507. E. Juzet.
2525. T. W. McCallum and L. Woodward.
2545. W. Clark.
2551. J. Dales.
2563. T. Blinkhorn.
2663. A. Hubart & V. Cantillon.
49. J. B. D. Boulton.
375. A. Henry.
549. M. Manson.
551. A. Anderson.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April 20th*, 1860.]

April 18th.

1167. S. Sunderland and R. Dean.

[*From Gazette, April 24th*, 1860.]

April 19th.

1112. J. Underwood.
1123. J. Chanter and D. Annan.
1151. G. Wright.
1153. W. C. Cambridge.
1159. E. Manico.
1176. W. Pickstone.
1220. C. Cammell.
1244. B. C. Tilghman.
1369. C. Bartholomew, J. Heptinstall.

April 20th.

1119. A. F. Sherman.
1133. J. H. Johnson.
1320. C. W. Siemens.

April 21st.

1135. G. Cavanna.
2150. R. Bodmer.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, April 20th*, 1860.]

April 18th.

926. G. A. Cator.

[*From Gazette April 24th*, 1860.]

April 19th.

947. W. S. Harris.
1157. S. C. Lister.

April 20th.

981. H. Houldsworth.

April 21st.

1023. W. Reid.

Journal of the Society of Arts.

FRIDAY, MAY 4, 1860.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William C. Ross, R.A., is now open at the Society's House, and will remain open during the month of May only.

The public are admitted on payment of one shilling each person.

Members of the Society of Arts have free admission, and may *personally* introduce one friend.

CONVERSAZIONE.

The Second Conversazione of this Session will take place on Saturday evening, the 26th May, at the South Kensington Museum.

The card of invitation will admit the member and two ladies, or one gentleman. These cards have been issued.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council that the amount of the Guarantee Fund promised, up to the 2nd May, was £205,500.

The following letter has been sent to the Institutions in Union:—

Society of Arts, Manufactures, and Commerce,
John-street, Adelphi, W.C.
April, 1860.

Sir,—I am directed by the Council of the Society of Arts to request you to lay the accompanying papers, relative to the International Exhibition of 1862, before the Committee of Management of your Institution.

The Council have reason to hope that in many ways the proposed Exhibition will be both useful and interesting to the various Institutions throughout the United Kingdom which are in union with the Society; and they consider it to be of great importance, in order that each Institution should have a voice in the disposal of any surplus that may result from the Exhibition, that every Institution in union should have its name connected with the preliminary organisation, and on the guarantee deed.

The Council are well aware that the corporate funds of many of the Institutions are of a very moderate character, but they can hardly doubt that at least one member of each Institution could be found who would be willing to become the representative of his local Institution, and to be associated in the list of guarantors with a large number of the members of the Society of Arts, and thus establish the claim of the Institution, according to the provisions of the deed, to take its part in the appropriation of any surplus arising from the Exhibition.—I am, &c.,

P. LE NEVE FOSTER.

The following letter has been addressed to the Secretary of the Society of Arts, by command of his Royal Highness the Prince Consort, President of the Society, expressing the readiness of his Royal Highness to place his name on the List of Guarantors for the sum of £10,000, so soon as the sum of £240,000 has been subscribed:—

Windsor Castle, April 9th, 1860.

Dear Sir,—I am commanded by His Royal Highness the Prince Consort to inform you that His Royal Highness has given his best attention to the proposal made by the Council of the Society of Arts for the formation of a Guarantee Fund, in order to enable them to give effect to the wish of the Society to hold another Great International Exhibition in 1862.

As President of the Society, it is ever the wish of His Royal Highness to assist, as far as it is in his power to do so, any well considered plan, proposed by the Society, which has for its object the advancement of Art and Science as applied to industrial pursuits. But feeling at the same time that the favour of the public to any such plan should be due to the merits of the proposal alone, he has in general made it a rule to decline giving his name to any undertaking which had not already received such an amount of public support as would ensure its ultimate success.

In the present case, however, considering the conditions under which it is proposed to raise the Guarantee Fund—one of which provides that "no liability shall be incurred by any person subscribing the Agreement, unless the sum of £250,000 be subscribed within six calendar months"—his Royal Highness will so far depart from his ordinary practice as to intimate his readiness, when the public interest in the proposed Exhibition shall have manifested itself to the extent of subscribing £240,000, to contribute the further sum that shall be necessary to complete the full amount of the proposed guarantee.

I remain, dear sir,
Your's very faithfully,
C. GREY.

P. Le Neve Foster, Esq.

The principal conditions of the Guarantee agreement are:—

1st. That no Subscriber will incur any liability until at least £250,000 have been guaranteed.

2nd. That no calls will be made unless it should happen that, contrary to the experience of the Exhibition of 1851, when there was a surplus of nearly £200,000, there should be a loss, when the call will be *pro rata*.

3rd. Any surplus will be at the disposal of the Guarantors, for the promotion of Arts, Manufactures, and Commerce.

4th. The Trustees and Managers of the Exhibition who have been named, are:—

The Earl Granville, K.G., Lord President of the Privy Council, Vice-President of the Society of Arts.
The Marquis of Chandos, Chairman of the London and North Western Railway.
Thomas Baring, Esq, M.P., } Royal Commissioners
C. Wentworth Dilke, Esq., } for the Exhibition of
Vice-Pres. Soc. of Arts, } 1851.
Thomas Fairbairn, Esq., Chairman of the Manchester Art Treasures Exhibition.

The acceptance of the trust by the abovementioned noblemen and gentlemen will depend upon the amount guaranteed, and also upon the character of the guarantee, as evincing the extent of public interest.

The Council do not propose to limit the fund to the £250,000 named, but, having secured that

sum, they will endeavour to increase it as much as possible.

A circular letter has been addressed to the Members of the Society, drawing their attention to the importance of filling up the Guarantee List as soon as possible, and those Members and their friends who are desirous of giving their assistance to this undertaking, are requested to send in their names to the Secretary of the Society of Arts as early as possible, specifying the sums they are willing to guarantee.

The amounts guaranteed by individuals vary from £10,000 to £100.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th April, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

ARTISTIC COPYRIGHT.

The Committee upon Artistic Copyright, having prepared the draft of a Bill, in accordance with the resolutions which were published in No. 279 of the *Journal* (Vol. VI. p. 293), have been in communication with the Rt. Hon. S. H. Walpole, M.P., who had expressed his readiness to consider the Bill, and to advise with the Committee upon the proper steps to be taken in order to bring the subject, in the most favourable manner, before the House of Commons. Acting under his advice, the Committee applied to Lord Palmerston for an interview in order to submit to his Lordship the present state of the Law of Artistic Copyright, and to urge upon the Government to legislate upon the subject. The interview was appointed for Saturday, the 28th ult., at Cambridge House, when the following gentlemen were present:—

The Right Hon. S. H. Walpole, M.P.; W. W. G. Wynne, M.P.; R. Monckton Milnes, M.P.; Hon. A. Liddell, M.P.; Hon. A. Kinnaird, M.P.; W. Stirling, M.P.; W. Coningham, M.P.; Sir Chas. L. Eastlake, President of the Royal Academy; Sir Thos. Phillips, Chairman of the Council of the Society of Arts; C. Wentworth Dilke, Vice-President of the Society of Arts; Fred. Taylor, President of the Old Society of Water Colour Painters; H. Warren, President of the New Society of Water Colour Painters; Sir E. Landseer, R.A.; W. Mulready, R.A.; S. A. Hart, R.A.; W. Dyce, R.A.; E. M. Ward, R.A.; R. Redgrave, R.A.; G. T. Doo, R.A.; A. Elmore, R.A.; J. R. Herbert, R.A.; W. P. Frith, R.A.; J. C. Horsley, A.R.A.; T. F. Lewis, A.R.A.; C. W. T. Dobson, A.R.A.; John Bell; Hon. Col. Liddell; Jas. Holland; F. Joubert; M. Noble; Edwin Field, P. Le Neve Foster, Vice-President of the Photographic Society; A. Claudet, F.R.S.; J. Leighton, F.S.A.; Jas. Fahey, Secretary of the New Society of Painters in Water Colours: G. Godwin, F.R.S.; F. W. Burton; J. J. Jenkins, Secretary of the Old Society of Water Colour Painters; Alex. Redgrave; J. M. Dodd.

Mr. Walpole introduced the deputation, and after referring to the number of gentlemen now present, whose names were so well known to his Lordship, requested Sir Charles Eastlake to state, on the part of the deputation, their object in seeking an interview. The memorial, which had been signed by the most eminent painters, sculptors, and architects of the day having been read,

Sir C. L. Eastlake explained that the object those gentlemen had in view was to protect their works from piracy, and their reputation from injury, by the publication of spurious works represented to be original, and referred to the provisions of the Bill which had been prepared upon the subject of Artistic Copyright as being generally approved, and then called upon Mr. Field to state the legal bearings of the question.

Mr. Field stated that in every country in Europe, except England, a Copyright in works of Fine Art existed; that the Artists sought for their works a protection similar to that granted to the works of their continental brethren; that the object of the Bill might be shortly described as a Bill for giving to the Artist's signature the force of a trade mark; that it was simply to prevent the reproduction of his works to his detriment during the lifetime of the Artist, and for a certain fixed period after his death; and that the Bill further proposed to give to the works of foreign Artists the same protection in this country as granted by the Bill to British Artists, without the complication of International Treaties.

Some discussion ensued upon some observations made by Mr. Walter, M.P, in which Mr. Walpole, M.P., Mr. Monckton Milnes, M.P., Sir C. Eastlake, Mr. R. Redgrave, R.A., Mr. Field, and others of the deputation, took part, upon the effect of the proposed Bill in respect to Copyright, as against the engraving of the picture of a modern artist. Mr. Field explained that, under the present law, the purchaser of a picture had not the right of engraving it, unless he stipulated with the Artist for the Copyright; that the object of the Bill was to define and protect *the Copyright*, whether the Copyright was vested in the Artist or in the possessor of the picture; and in point of fact that the possessor of a modern picture would be in a better position under the Bill than he was at present.

Sir Thos. Phillips, Chairman of the Council of the Society of Arts, said that the Council had for the last two years, in connection with a Committee represented by the deputation, considered the question of Artistic Copyright most carefully in all its bearings, and that they had drawn up the

Bill to which they ventured to request his Lordship's earnest attention. The Bill had been prepared with great care; it had been revised by Mr. Rolt, M.P., the eminent Chancery barrister; it had the general approbation of Mr. Walpole and Sir Hugh Cairns, and it had been considered also by Mr. Coulson, Q.C. The deputation, however, were anxious that the propositions made in the Bill should be thoroughly investigated, and they wished to urge upon the Government, if they approved of the principle of the Bill, to assist them in getting it so advanced in the House of Commons that it might be fairly and fully considered; and this could only be done by the aid of the Government. He was persuaded that the Government would meet with the sympathy of the House in assisting the Artists to procure an efficient protection for their works.

Lord PALMERSTON said that he would carefully consider the Bill, and consult with his colleagues upon the subject. His Lordship put several questions upon the effect of a Copyright, and remarked that the state of the law appeared to be this—that, if a man expressed an idea in black marks with a pen and ink upon paper, the law gave him a Copyright, but if he expressed the same idea in colour upon canvas, he had no Copyright.

The deputation thanked his Lordship for his courteous reception of them and for the attention he had paid to their representations.

TWENTY-FIRST ORDINARY MEETING.

WEDNESDAY, MAY 2, 1860.

The Twenty-first Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 2nd instant, Sir Cusack P. Roney in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Evans, John | Wright, Alfred.

The following Institution has been taken into Union since the last announcement:—

Abingdon Mechanics' Institute.

The Paper read was—

ON THE EMPLOYMENT OF PEAT IN THE USEFUL ARTS, TOGETHER WITH AN ACCOUNT OF SOME RECENT IMPROVEMENTS IN THE PREPARATION OF IT FOR VARIOUS USEFUL PURPOSES.

BY W. E. NEWTON.

The manufacturing prosperity of this country may be truly said to depend as much upon its natural resources and mineral riches as upon the industry, intelligence, and energy of its inhabitants. In the present highly organized state of manufactures, nothing perhaps is of greater importance than an abundant and consequently cheap supply of fuel. Wherever this article is cheap and accessible, and fiscal or political causes do not clog the operations of man, there manufactures and commerce will be found to flourish as in a congenial soil. If the intelligence, ingenuity, and industry of man, be the soul or spirit of commercial and manufacturing prosperity, iron may well be considered its thews and sinews, and fuel its life's blood. If we turn to Belgium, where the mineral resources of the country are more largely developed in proportion to the number of inhabitants than in any other country of Europe, England only excepted, we find a state of unexampled prosperity, especially in the metal manufactures.—In France we find manufactures in a far less robust state, arising partly from the government coddling and protecting various trades, by prohibiting foreign manufactures, or protecting native industry by highly exorbitant import duties, and partly from the scarcity or comparative dearness of fuel. France, however, is by no means deficient in fuel, (that first great reqirement of manufacturing industry) having no less than 2,500 square kilometres of coal measures; but from causes political, financial, fiscal, or otherwise (with which however we have no concern), these mineral riches are to a great extent undeveloped. The same may be said of Spain and other countries of Europe.

The development of the mineral riches of this country extends as far back as the time of the Phœnicians, who, it is well known, traded to the coast of Cornwall for tin; and there is little doubt that, if the ancient inhabitants of Great Britain, or their foreign visitors, were enabled to obtain the tin ore from the bowels of the earth, they also knew how to smelt the ore on the spot, and did in fact do so, thereby obtaining the pure metal. The dense forests which then, and for centuries afterwards, covered the face of the country, would afford an abundant supply of fuel, which was not likely to be exhausted by its employment for any purposes connected with the metal manufactures of that early period. We have no reliable means of knowing whether the Phœnicians made any attempts to obtain iron from Britain, but there is no doubt that this metal was worked to a very considerable extent by the Romans during their sojourn here. Whether they used coal in their metallurgic operations does not very clearly appear; they probably did not, at any rate to any extent, as the supply of wood and charcoal for the purpose was abundant in their time and more easily obtained than coal. All the metallurgic operations of ancient times however sink into utter insignificance when we think of the gigantic scale upon which the manufactures of metal are now carried on; and if the gradual and immense increase in the population of the country had not rendered it necessary to disafforest extensive tracts of land and convert them to the purposes of agriculture, the gradual but rapid increase of the manufacture of metals would have effectually cleared the country of wood. Pit-coal, however, supplied fuel in a more convenient form than the wood fuel of earlier times, and of course gave an immense impetus to all smelting operations, and as these operations increased in amount and extended in area, the extraction of pit-coal from the bowels of the earth became a matter of the highest importance. The use of pit-coal in some form or other for the smelting of metallic ores offered so many advantages over wood or charcoal that the use of the latter, except for certain special manufactures, has generally ceased in this country, and iron is now I believe throughout Great Britain reduced only by means of pit-coal or coke. Iron mines, except those yielding ores of particular qualities, such as the red hematite or other rich ores are, therefore, practically useless unless within a reasonable distance of coal. As an instance of this I may mention that the iron railing or palisading with which St. Paul's Cathedral is now surrounded was made from ore found in Kent. This mineral deposit still exists in the home counties of Kent and Sussex, but yet, notwithstanding its proximity to London, the ore cannot be smelted with advantage owing to the cost of the fuel required for the purpose; if however pit-coal or other suitable fuel could be procured in

abundance and at a reasonable price, there would be no reason why Kent and Sussex should not again have their iron works.

The consumption of pit-coal for manufacturing, domestic, and locomotive purposes has of late increased to such an extent as a few years since to have given rise to very considerable alarm in the minds of some people, and it was solemnly propounded, as a serious and undoubted fact, that, calculating the annual consumption of coal to go on as it was then progressing, we should at a very comparatively early period arrive at the unpleasant position of having burnt out all our fuel and have nothing left to keep the pot boiling but waifs and strays which we might pick up accidentally or buy from our neighbours.

Absurd as such an alarm was, it nevertheless existed, and it required all the authority of an eminent geologist to calm people's minds by demonstrating that at the then rate of consumption, and taking ample margin for an annual increase, the then known stock of fuel would last for some hundreds of years, and therefore would be likely to last our time at least. In reference to the coal supply existing in Great Britain, Professor Ansted lately stated, in a letter to the leading journal, that there are in England nine distinct coal fields or tracts of country known to yield coal; the smallest includes more than 60,000 and the larger more than 600,000 acres of coal lands, under the greater part of which, coal has been, is, or may be, worked to profit. Scotland contains another million of acres of such coal lands.

Besides these tracts marked in our geological maps, there are others exceedingly large, in which coal is also to be got, although the coal-bearing beds are covered up with accumulation of newer rocks. All these will be available when the price of coal justifies the outlay that will be involved in mining them.

The best known and largest of our coal fields are the Newcastle and Durham, the Lancashire, the Yorkshire, the South Staffordshire and Warwickshire, and the South Welsh. The ascertained acreage of coal in these amounts to about two-and-a-half millions. Adding to this the million of acres in Scotland, and half a million for the smaller areas, we have a total of four millions of acres; or, in round numbers, 6,000 square miles of coal lands in the British Islands.

In none of these districts are there less than ten, while in some there are more than 70 beds of coal, known and described, each capable of yielding coal to profit, by the ordinary processes of mining. Some of these beds are between one and two feet,—most of them between three and seven—and one between thirty and forty feet,—thick. Rarely more than a small number of seams or beds of coal can be obtained with advantage from the same area; but the average thickness of workable coal may, with safety, be taken as not less than fifteen feet, or five yards over the whole area of any coal-field.

Now, as an acre contains 4,840 square yards, and a cubic yard of solid coal weighs nearly one ton, there thus appear to be 24,000 tons of coals per acre of coal-lands on a general average; but, as a large quantity of coal in every coal-field is, from various causes, not obtainable, and another large part is lost by the ordinary mode of extraction, we cannot calculate on more than one-third of this, say,—8,000 tons per acre as the quantity that can be removed and sold. This would give about 5,000,000 tons of coal for every square mile of coal-lands.

The annual consumption of coal at present in England cannot be less than 80,000,000 tons; so that we are now exhausting about 16 square miles of our coal-lands every year. Estimating the area of our coal lands at 6,000 square miles, this would give a duration of rather more than 350 years.

It may be observed that the usual estimate of coal lands in England is 12,000 square miles; and that, in the smaller area I have taken, allowance is made for the unproductive portions.

The coal area in Belgium and Rhenish-Prussia together is not more than one-eighth part, and, in all France, not one-fifth part that of England and Scotland. The average thickness of coal is not so great, and the position of the coal is generally less favourable in the former district for extraction, and in the latter for transport to the sea.

The quantity of coal known to exist in North America (both in the States and British possessions) is so large, that for all practical purposes, it may be regarded as inexhaustible. Coal is also abundant in India, China, Borneo, Eastern Australia, and South Africa.

The attention of the French Government has lately been directed to the supply of coal; and although the Emperor, in the recent Treaty of Commerce, has provided for the importation of British coal, he has not neglected the interests of the coal owners of France, but proposes to devote a considerable sum annually for the improvement of existing roads and modes of conveyance, and the establishment of new ones. From a recent report made to the Minister of Agriculture and Commerce, we learn that the Emperor has indicated that the opening of roads for the conveyance of coal is one of the great material improvements projected; and after remarking on the importance of cheap coal to manufacturers, the report says that the French coal-fields are numerous, but that only a few of them are calculated, by their extent or the quality of their coal, to be developed on a great scale; and moreover, most of them are situated in mountainous districts, which are difficult of access, and in which there are few roads. These circumstances cause coal to be much dearer at the place of consumption than it is at the mouth of the pits. An official document shows, for example, that, in 1850, coal which was sold to consumers at 2f. the quintal only cost at the pits 0·933f. (about 9d. English), and at that price the consumption amounted to 72,254,700 quintals; in 1857, the average price of coal at the pits was 1·253f. (about 1s. English), and the price at the places of consumption was 2·536f., or rather more than 2s. The official document shows that the cost of conveyance more than doubled the price of coal consumed; and if it be taken into account that in that year (1857) the consumption of native and foreign coal was 131,494,700 quintals, it will appear that the supplementary charge on the consumer for conveyance exceeded 160,000,000f. The report goes on to say, that from investigations made by his Majesty's orders, it appears that of 62 coal-fields in France, more than half cannot have the pretension to export their productions, owing either to the small extent of the fields or the cost of extraction; still good roads and railways (the latter cheaply constructed) would enable the owners to find local markets. Among the other coal-fields, some are of great importance as regards number, extent, the thickness of the beds, or the quality of the coal. The first of these fields is that of the Loire, the next that of the Valenciennes (Nord and Pas-de-Calais), and the next in order are Alais (Gard), Blanzy (Saône et Loire), Commentry (Allier), and Aubin (Aveyron.)

Out of a total production of 79,000,000 quintals for all France, in 1857, 22,426,000 were from the Loire, 19,000,000 from Valenciennes, 7,540,000 from Alais, 5,806,000 from Blanzy, 4,435,000 from Commentry, and 4,435,000 from Aubin. Eleven other fields produced quantities not exceeding from 400,000 to 2,000,000 quintals, and they sent part of their coal to a distance for consumption.

Two others (Ahun, in the Creuse, and La Sarre, in the Moselle), though at present supplying only local wants, may be made to assume a considerable development.

Pit-coal is popularly supposed to consist of decomposed vegetable matter, which, by lapse of time has become consolidated and brought to the hard solid state in which it is now seen, and it is believed that at some remote time the solid hard pit-coal which we now burn in our fires, was a soft slimy pasty mass of decomposed vegetable matter, such as now exists in the peat bogs so generally diffused throughout the United Kingdom.

It is scarcely necessary to say that peat as an article of fuel, has been for a long time in very general use in various

parts of the United Kingdom, as well as on the continent of Europe, and it is a matter of astonishment to find that although peat fuel has been very extensively used on the continent for metallurgic purposes, it has never been practically, or at any rate generally, used for such operations in this country.

A true peat bog, or flow moss, as it is called in Scotland, is a tract of ground, generally almost level, often many miles in circumference, consisting of a light soft fibrous substance, of several feet deep, so inflammable as to be used as a common fuel. It is easily cut with a spade, and when so cut and exposed to the air it changes in a few minutes from a dusky yellow to a blackish colour. The surface of a peat bog is brown or dark in appearance, and even in the midst of summer is wet and spongy, and is commonly covered with heath, coarse grass and moss in detached patches, the intermediate and wetter places bearing no vegetable productions. Most deep pit bogs contain different qualities of peat. The upper part of the bog, or that near the surface, is light coloured, soft and spongy, and contains the vegetable remains but little altered; deeper the peat is brown, denser, and more decomposed; the lowest stratum is still more dense, and when removed from the bog and dried, the mass of turf assumes the black colour, and nearly the density of coal, to which it approximates very much in chemical composition. Now, if the peat when taken from the bog be carefully examined, even the densest portions or those taken from the lowermost parts of the bog, will be found to contain a large quantity of vegetable fibres or roots distributed through the mass.

The black or brown slimy portion of the peat consists of the decomposed vegetable fibres, while the rooty or fibrous portions of the mass consist of undecomposed vegetable fibres. The specific gravity of the light surface peat is 400, water being 1000, and from this it increases in compactness and to nearly the density of coal. For all flaming fires, peat is applicable, and in its application to steam boilers it is peculiarly useful, as there is no liability of that burning away of the metal which may arise from local intensity of the heat of coke or coal.

Mr. Burstall, of Bristol, has published the results of his use of peat with a high-pressure engine. The steam was of 36 lbs. pressure, and there were consumed 74 lbs. of peat per hour. The quantity of water evaporated from the boiler per hour was, on an average, 360 lbs., which is nearly five times the weight of the peat used as fuel. The following results as to the comparative effective power of peat and coal have been furnished by Mr. Charles Wye Williams, and are derived from the working of the *Lansdowne*, one of the steamers of the Inland Navigation Company, which ply upon the Shannon with goods and passengers. Before the use of peat, a week's work, consisting of 49 hours, consumed 24 tons of coal, costing at 15s. per ton, £18, or 7s. 5d. per working hour. To do the same work, there were consumed per week 315 boxes of peat, which at 7d. per box, cost £9 12s. 7d., or 3s. 11d. per hour, a little more than half the cost of coal. Mr. Williams, using well-dried peat, found that with a large waggon boiler, there were 3·87 lbs. of water evaporated per pound of peat, and that it cost 3s. 7d. to evaporate 100 cubic feet of water. Now, this is 5¼d. per horse-power per working day. When peat was burned in the furnace without Mr. Williams's peculiar mode of effecting perfect combustion, the cost per horse power was 6¼d. From the experiments that were made at that time, it appeared that in Ireland the horse-power of steam costs per day in fuel—

Using coals, whether British or Irish	7¾d.
,, Peat properly dried	6¼d.
,, Peat burned on Mr. Williams's system...	5¼d.

Almost all peat when taken from the bog is found to contain a large amount of water, and, as has been already stated, a considerable quantity of undecomposed fibre is mixed with the decomposed parts, which form the soft slimy mass of the peat. These undecomposed fibres are found to consist of minute tubes filled with water, which they retain until it can either be driven off, or evaporated by exposure to the open air, or by artificial heat, or be forced out by pressure. The presence of so much water of course materially detracts from the heating power of peat; and the peasantry and country people who use peat turfs as fuel adopt the practice (after digging or cutting the peat) of piling it up in rows on the ground, so as to let the sun and air act upon and dry it. After being exposed for some length of time, the peat will be sufficiently dry and hard for use, provided a heavy rain has not occurred in the meantime. It has been ascertained by experiment that the peat, even when considered dry, contains as much as 30 to 35 per cent. of moisture, and when taken from the bog it of course contains much more, a great portion of which must be got rid of before the peat can be used for any but the commonest and roughest domestic purposes.

In order to remedy the inconvenience and delay of stacking the peat for drying, it has been proposed to express the water therefrom by mechanical means, and at the same time solidify it to such an extent as to admit of its being used as fuel which will stand a moderate draught or blast.

From the experiments that have been made, it does not appear that the simple application of mechanical pressure to the sods of peat as taken from the bog is of any practical use. Wet peat from the bog contains as much as 75 per cent. of moisture, and to make one ton of dry peat four tons weight of turf must be dug from the bog.

Experience has shown that much of this moisture may be got rid of by a judicious system of draining, and that the peat, if left *in situ* until the bog has been properly and systematically drained, will be considerably improved in quality as a fuel by becoming more compact, dense, and solid. Mr. Jasper Wheeler Rogers, of Robertstown, in the county of Kildare, has devoted many years to the study of this subject and has brought forward a system of draining peat bogs which in my opinion leaves little to be desired. His plan is simple and effective, and aims only at assisting nature. Suppose it be intended to operate upon a moss of say 1000 acres in extent; he first ascertains the lowest point at which he can obtain an outfall; he then commences at that point and drives a drain forward along the lowest edge of the moss, and when he has cut this drain a sufficient distance in one direction, he begins at both ends to cut other drains at right angles to the first, thereby forming three sides of a square; these side drains having been made of sufficient length to inclose within the three sides say 50 or 100 acres, a fourth drain, parallel with the first, but at the opposite end of the side drains, is cut, and thereby the entire enclosed area of 50 or 100 acres is cut off or isolated from the rest of the moss. The effect of this isolation or cutting off will be that the moisture from the enclosed area will be expressed by the pressure of the atmosphere and the superincumbent weight of the moss, into the surrounding drains, and will run off at the outfall and no moisture from the other parts of the moss will be allowed to enter the isolated part. In order to assist this operation, other lateral drains may be formed on the isolated portion, and by this means the surface will be completely drained. The effect of this will be, that the upper and more spongy parts of the moss will gradually subside, and become more compact and solid. All the drains must then be cut deeper, so that the moisture from the lower part of the moss may be expressed by natural pressure, and run off in the way above mentioned. But here it must be remarked, that instead of cutting the drains with straight sides, as usual, Mr. Rogers cuts them in steps or terraces. By this means he more easily gets rid of the water, and he runs no risk of his drains becoming filled up or stopped by the lateral squeezing in of the sides, as sometimes occurs in drains with straight sides. This operation of gradually deepening the drains by cutting them down in steps is proceeded with until the solid ground at the bottom of the bog is reached,

by which time nearly all the water in the bog will have run off, and the peat, by gradually sinking as the water escapes, will have become more and more solid until at last it will reach to nearly the density of coal, and will require but little drying when taken from the bog. In connection with this subject, Mr. Rogers has recently patented a most ingenious contrivance for drying peat; an operation which, by the ordinary stacking, requires many weeks of fine weather. Having found by experience that stacked peat dried more rapidly in a cold but moderately dry March than in the hotter months of June, July, and August, Mr. Rogers was led to investigate the cause, and he came to the conclusion that the stormy winds of March had more to do with drying the peat than the heat of summer and autumn. Having satisfied himself on this point, he determined that when there was little or no wind to act on the peat he would create an artificial storm for the purpose. He therefore cut his sods out into pieces about twelve inches long by about three inches thick, and having placed them on wicker frames, in such a manner that the air could circulate among them, he placed these frames on an apparatus, and upon setting this apparatus in rapid motion, an artificial current or draught was produced of sufficient power to dry the sods in from twenty-four to forty-eight hours, instead of their requiring as many, or twice as many days. It was found that this rapid motion through the air, not only had the effect of drying the peat, but also of condensing or solidifying it, whereas the application of heat to drive off the moisture had precisely the opposite effect.

After the drying of the bricks has been completed, the sods or bricks of peat are, by a simple mechanical operation, cut into cubes or pieces of nearly equal size. Mr. Rogers informs me that using the pieces all of nearly the same size, greatly economises the fuel, and gives out a greater and more uniform heat.

The advantages resulting from the use of peat fuel are such as have induced many foreign manufacturers to use it in some branches of the iron manufacture. From the researches of a commission of French engineers, who, some years ago, by order of the French Goverment, published a report of their labours, we gather the following interesting information:—

It appears that in the department of the Landes, France, there are iron-works at Ichoux, which consume turf only; the cost there is about 8s. per ton. Forty-five cwt. of turf and 23 cwt. of pig-iron give one ton puddled iron. Twenty-six cubic feet of turf and 25 cwt. pig, yield 20 cwt. of bar-iron of superior quality.

M. Müller, of Wadenhammer, a manufacturer of leading notoriety, has proved, by actual working test, that an equal quantity of turf charcoal, used in place of wood charcoal, produces a greater quantity of produce from the ore than the best wood charcoal.

At Wachter Newnhammer it was found that when equal parts of turf charcoal and wood charcoal were used in place of wood charcoal solely, the quantity of iron was raised from 386lbs. to 464lbs., the quality being excellent.

There are at Ransko, in Bohemia, iron works for smelting, cupolas for re-melting pig, and reverberating furnaces, &c., for making bar and plate iron. The ore is but middling in quality. The fuel is turf and charcoal only, the turf being of light texture, and not in any way prepared or pressed. The fuel consumed to make one ton of iron is about 34 cwt. of turf and 30 cwt. of charcoal; the cost of the first is less than 9s., the latter about £1 4s.; smelting therefore, costs about £1 13s., and the total cost of pig-iron is about £3 15s. per ton. The quality of the iron is the highest.

In Bavaria there are iron-works similarly worked. One at Königsbrunn carries on the whole operations of fusion, puddling, reheating, and rolling solely by peat fuel. The commissioners state that the turf is not pressed but carefully dried by means of heat from separate fires or from the furnaces. Bertheir states the analysis of this turf to be:—

Volatile matter	70·6
Carbon	24·4
Ashes	5·0

30¼ cwt. of this turf to 22½ cwt. of pig produces one ton puddled iron.

30 cwt. of dense turf to 24½ cwt. of puddled iron produces one ton small bars of fine quality.

The apparent average is that 32 cwt. of properly dried turf to 20½ cwt. pig gives one ton of castings; 30 cwt. turf to 21 cwt. flat iron gives one ton of plates.

By compressing peat its value as a fuel for metallurgic operations is much increased, and when compressed peat is carbonised, it gives a fine coherent coke, which contains very little ash. When the coking is properly carried on, the peat yields about 30 per cent. of its weight of coke, and the density of this coke is greater than that of wood charcoal, being found to range from 913 to 1,040. The iron furnaces of Voitumra give a still higher per centage of coke when the peat is coked in small vessels.

The precise figures are:—

Charcoal	40·25
Tar	24·50
Watery liquor	14·00
Gaseous matter	21·25
	100·00

The calorific effect of peat charcoal uncompressed is about the same as coal coke, while that of compressed peat charcoal is, as before mentioned, much greater. The value of peat charcoal, whether made from compressed or uncompressed peat, is evident, as is also the increased value of iron made by means of such fuel. I take these to be incontestable facts, and it is almost incredible that so valuable an article as peat should have remained so long almost unnoticed and unemployed by our metal manufacturers. The neglect of peat as a fuel may, and probably has, arisen partly from its bulky nature, and partly from the open or spongy character of a great deal of the peat that is dried in the open air in the natural way, which renders it inapplicable, or at any rate, inconvenient to be used as a fuel for smelting purposes. The compression or solidification of peat by ordinary mechanical pressure is an expensive and slow process when applied to large quantities, and therefore, even although such an operation could be made effectual in expressing the water from the peat, the extensive and costly plant that would be required to work on the scale that would be necessary to meet a moderate demand would act, and no doubt has acted, as a barrier to extensive operations being carried on for this purpose.

Mr. Holland, some time since, invented a process of preparing peat so as to render it dense and solid, and more fit for manufacturing purposes than common air-dried peat. By this process the peat, as dug from the bog, was submitted to an apparatus, whereby it was torn to pieces, and when in a finely divided state, it was submitted to a considerable degree of heat, whereby it was not only dried, but the particles were so softened as to cause them to adhere together when pressed. The heated particles were then submitted to heavy hydraulic pressure, whereby they were consolidated, and a firm dense mass, somewhat resembling coal, was produced. In external appearance the product of this process was everything that could be desired, but it was found on trial to be unable to resist an ordinary blast, and the charcoal made from it was of comparatively inferior quality, and not suitable for the manufacture of iron. These defects probably arose from the high degree of heat employed for drying the separated peat, whereby some of the volatile matters were driven off.

Mr. Jasper Wheeler Rogers and other gentlemen connected with Ireland, have for years been earnestly endeavouring, but almost without success, to direct the notice of iron manufacturers to the extensive tracts of peat in Ireland and elsewhere, which have to a great extent hitherto been looked upon as nearly valueless. Those gentlemen, in despair of inducing iron manufacturers to

direct their energies to the preparation and use of peat as fuel, have now for some time past been quietly but gradually bringing peat into use for other purposes of scarcely less value than as an article of fuel. Some of these uses I shall presently refer to.

It has been said that even the densest kinds of peat, in a natural state, contain a large quantity of undecomposed fibres, which, being for the most part tubular, enclose a considerable amount of moisture, which adds to the weight of the peat. These tubular fibres prevent the peat from drying within a reasonable time, and also actually deteriorate its quality as a fuel. Struck with the knowledge of these facts and the practical difficulty of removing the water from the peat, either by mechanical pressure or by evaporation, by the application of heat in the ordinary way, Mr. Buckland, of the Maesteg Iron Works, in Glamorganshire, proposed to separate the undecomposed tubular fibres which contained the water, from the black slimy mass which forms the valuable part of the peat. He proposed two different plans for doing this, one of which may be called the wet method, and the second the dry method. According to the first plan, the wet peat from the bog is thrown into a vessel filled with water in which it is stirred for some time, so as to break up the mass and entirely separate it. The contents of the vessel are then allowed to subside, when the black decomposed and heavier portions of the peat will fall down to the bottom, while the rooty, undecomposed fibres will float above and may be drawn off with the supernatant water. The black muddy sediment may, when sufficiently drained, be moulded into any convenient form and size of block, and when dry will be found to possess the hardness, appearance, and density of coal, and may then be used as fuel for domestic or manufacturing purposes. The brown undecomposed fibres or roots, which are run off with the water, will present very much the appearance of finely-cut tobacco, and will be found to be a most excellent article of which to make some of the stronger and coarser kinds of paper. A process bearing some analogy to the wet process of Mr. Buckland, was invented some years since by Mr. Cobbold, of Mount Leinster, in the County of Carlow, who proposed to make artificial coal from peat, by grinding up and mixing the fibres, so as to form a homogeneous mass, which was subsequently moulded into any desired form. Mr. Cobbold produced a very dense black substance, which was capable of being moulded, and of receiving impression from dies, or of being turned in the lathe, to form a variety of articles, but the process was found too expensive for the manufacture of fuel. The grinding operation was necessarily costly, and too slow to admit of dealing advantageously with large masses, but the inventor succeeded in producing a most beautiful article, suitable for ornamental purposes.

Mr. Buckland's dry process is the one he employs in the manufacture of fuel, and for preparing peat for conversion into charcoal. It is founded simply on the principle of separating the rooty or undecomposed fibres of the peat from the dark, slimy, decomposed parts, by straining the mass through a sieve-like apparatus, whereby the rooty fibres are kept back, while the decomposed, slimy parts are allowed to pass through the perforations of the sieve. The apparatus whereby this is effected consists of a hopper or vessel, into which the peat as taken from the bog is thrown, and is carried down by means of a rotating vertical screw into a conical chamber or vessel made of metal, and having perforated sides. The rotating vertical screw not only carries the wet peat down from the hopper into the conical straining vessel, but forces the dark decomposed slimy parts of peat through the perforations or holes in the sides of the chamber, the size of the holes preventing the rooty portions or undecomposed parts from passing through. These latter are discharged from the straining chamber through an opening in the bottom, and are conveyed out of the machine by a pipe or conduit provided for the purpose. The conical straining vessel is about three feet in diameter by three feet deep, and is perforated with about 40,000 holes, of one-eighth of an inch in diameter, and is surrounded by or enclosed within, a metal casing within which hot air is admitted for the purpose of partially drying the peat. The expressed peat, on passing through the perforations of the straining vessel, falls down on the outside in the form of short worms, something like small pieces of broken macaroni. If it be desired to produce charcoal for manure or for disinfecting and some other purposes, these wormlike pieces may be allowed to fall directly on to a hot plate or travelling metallic platform, heated from below, for the purpose of driving off any superabundant moisture that the peat may contain. This object will be facilitated by causing a current of either hot or cold air to pass through the chamber that surrounds the straining vessel, so as to carry off any aqueous vapours that may arise from the peat. The partially dried peat, when delivered from the machine, may then, if required, be stoved or further dried for a short time, and it will then be ready to be converted into charcoal. If, however, it be desired to convert the peat into fuel or artificial coal for domestic or manufacturing purposes, the peat as it falls from the perforations of the straining chamber is received on the upper end of an Archimedean screw, which revolves in a close case, having at its lower end a die plate, through which the peat is expressed continuously, and as it exudes therefrom it is cut up into lengths of convenient size for removal from the machine to a drying shed, where, after being exposed from 24 to 48 hours to a temperature of 90 deg. Fahr., prepared peat will become dry enough for use.

In order to promote the drying of the peat as it passes through the machine, the heated gases from a furnace are made to heat the casing which surrounds the Archimedean compressing and delivering screws, so that, when the peat is delivered from the machine, but little subsequent drying will be required to render the fuel fit for use.

Peat, when dried, either naturally or artificially, possesses the peculiar property of not again absorbing water. When, therefore, peat has been prepared for fuel, it may be stacked out of doors without injury.

It should be mentioned that every straining or separting machine is provided with one straining chamber and expressing screw, and, in order to mould the expressed peat, as it is delivered from the conical straining chamber, four or more Archimedean or compressing screws and die-plates are adapted to each straining chamber or vessel. The cost of such a machine complete, with moulding apparatus, capable of delivering twenty tons of moulded fuel per diem, is estimated at £100. The cost of the straining machine alone, without Archimedean screws and moulding apparatus, will not exceed £30; and for preparing peat for being converted into charcoal to be used as a manure or fertiliser, or as a deodoriser, nothing more than the straining apparatus is required.

Although the peat during this series of operations has been subjected to but a trifling pressure, it will be found to possess a hardness and density not easily attainable by the application of mechanical pressure in the ordinary way, and therefore the peat so prepared will, from its density, be found exceedingly valuable as a fuel, and either in that state or when converted into charcoal, will be able to resist the pressure of a charge of iron in a high furnace and the draught or blast to which it would be subjected in such a furnace. The specific gravity of the samples produced is 1·15.

The conversion of the peat into charcoal is carried on in closed retorts, and from the gases evolved from the retorts is collected a valuable product in the form of peat grease (a black unctuous substance) containing a variety of valuable matters well known to chemists. Mr. Buckland, in his operations upon peat, does not intend to carry out any of the elaborate processes which are necessary in order to resolve the crude grease into the various substances it contains; he prefers to leave this to other hands whose everyday occupation it is to operate upon analogous substances. The peat charcoal produced is much heavier

and denser than wood charcoal, and its specific gravity is rather greater than water.

I may here mention that some few years since a company was established in Ireland, under the name of the Irish Peat Company, for the purpose of operating upon peat and obtaining from it all the chemical matters which it was known to contain. The company carried on their operations for some time under the able direction of Mr. Reece who succeeded in obtaining from 775 tons of peat, which were operated upon as an experiment, the following products, viz:—

Ammonia	1 ton 4 cwt. 1 qr.	
Naphtha	77½ gallons.	
Lubricating Oils	1,162½ gallons.	
Paraffine	2,325 lbs.	
The market price of these products was set down at		£565 18 0
The cost of cutting the peat and of chemical reagents and labour was.....		264 15 10
Shewing a profit on 775 tons of peat and 22 days' work, of		£301 2 10

From this, something must be deducted for the wear and tear of machinery, salaries of officials, and some other minor charges; but, on the other hand, credit must be taken for the peat charcoal left as a residuum, and which was set down as worth 42s. per ton.

Notwithstanding these brilliant prospects, however, the company, for some reason, did not succeed in a pecuniary point of view, and is now, I believe, dissolved, and the property sold to a private individual, who intends to carry on the works, but in a somewhat different manner to that adopted by the company.

Peat, when taken from the bog, sometimes contains as much as 75 per cent. of water; therefore, to obtain 1 ton of dry peat, 4 tons of wet peat must be dug from the bog. The cost of digging and carrying the peat 100 yards, Mr. Buckland sets down at 4d. per ton, or 1s. 4d. for the 4 tons of wet peat required to produce one ton of dry. To this must be added the labour attending the working of the machine, the cost of fuel, and other charges on the spot, which may be set down at from 1s. 6d. to 1s. 8d. per ton of prepared peat, making a total cost of about 3s. to produce 1 ton of dry peat fuel ready for use. This sum of 3s. per ton does not include cost of superintendence, wear and tear of machinery, nor interest of capital. From 2½ to 3 tons dry peat, valued at say 12s., are required to produce one ton of peat charcoal worth from 35s. to 40s. per ton, and during the process of conversion each ton of peat will yield 2 cwt. of black peat grease, valued at 25s. per cwt. The only deduction to be made from these figures is the cost of coking and the wear and tear of retorts. Little more than the very commonest unskilled labour is required to cut the turf and work the machines and apparatus; the peat is not required to be cut of any peculiar form and dimensions, as is now the case with air-dried peat which requires careful stacking; and the only part of the operations which requires any special knowledge on the part of the workman, is the coking process. The whole plan of working is therefore eminently adapted for parts of the country where skilled labour and anything more than a very moderate amount of capital is not available.

We have been hitherto considering the peat principally as an article of fuel, either in the form of hard dry lumps, of convenient size to be used as coal, or in the form of charcoal, to be used principally in the manufacture of iron. Important as these applications of peat undoubtedly are, they by no means exhaust its useful capabilities, for, as we have seen, valuable chemical products may be obtained by submitting the peat to distillation. For instance, the prepared peat will be found to yield, upon distillation, large quantities of carburetted hydrogen or illuminating gas, of the best quality, giving also as a product the peat grease above mentioned, and charcoal for fertilizing or deodorizing purposes. Apparently, however, much remains to be done before the delicate chemical processes required to obtain many of the valuable products alluded to can be made commercially useful; but the employment of peat charcoal as a manure or fertilizer, as well as a valuable desinfecting agent, is now established, and is extensively practised.

To Mr. Jasper Wheeler Rogers great credit is due for the persevering energy he has brought to bear on this subject. In a pamphlet published by that gentleman about 12 years since, he gives most interesting details of a series of experiments that he and other gentlemen tried, in order to establish and prove the value of peat charcoal as a manure or fertiliser on various soils and for different crops. Some of Mr. Rogers's observations are so valuable and interesting, in reference to this subject, that I cannot help giving one or two extracts from his pamphlet. He says, in reference to peat charcoal as a fertiliser:—"The first experiment which naturally suggested itself was, to have a certain portion of peat charcoal mixed with the earth in which different plants grew, and to increase its quantity, according as the advantage of the method was perceived. An addition of two-thirds of charcoal, for example, to vegetable mould, appeared to answer excellently for the *gesnera* and *gloxinea*, and also the tropical *aroideæ*, with tuberous roots. The first two soon attracted the attention of connoisseurs by the great beauty of all their parts, and by their general appearance. They surpassed very quickly those cultivated in the common way, both in the thickness of their stems and dark colour of their leaves; their blossoms were beautiful, and their vegetation lasted much longer than usual, so much so, that in the middle of November, when other plants of the same kind were dead, those were quite fresh and partly in blossom. *Aroideæ* took root very rapidly, and their leaves much surpassed in size the leaves of those not so treated. A cactus, planted in a mixture of charcoal and earth, throve prodigiously, and attained double its size in a few weeks.

At the same time that those experiments were performed with a mixture of charcoal and earth, charcoal was also used, free from any addition, and in every case the best results were obtained; cuts of plants from different genera took root in it well and generally. Pure charcoal acts excellently as a means of curing unhealthy plants; a *Doryanthus excelsior*, for example, which had been drooping for three years, was rendered completely healthy in a very short time by this means; an orange-tree, which had a very common disease, in which the leaves become yellow, acquired, within a few weeks, a healthy green colour, when the upper surface of the earth was removed from the pot in which it was contained, and a ring of charcoal was strewed in its place round the periphery of the pot.

It is unnecessary to say that one of the main constituents of vegetation is carbon; and in proportion to its proper supply to the culture of all plants, either by the atmosphere or otherwise, depends the luxuriance and vigour of their growth. Experiments made under many different circumstances have proved that the tenderest plants will vegetate and luxuriate abundantly in pulverized charcoal, unmixed with earth or any other substance; and I have found that even the most moderate quantity produces highly desirable effects; but in addition it possesses a singularly beneficial property, quite foreign to other manures. It is known that in the growth of all plants a putrescent matter is yielded from the root, which, if not absorbed either by filtration or evaporation, or removed by working up the earth around, produces evil of much magnitude, which may well be compared to that arising to human life by the retention around it of those excretions of the pores, &c., which nature has ordained. This is entirely corrected by the presence of charcoal. The putrescent matter is at once absorbed and decomposed, and the plant is not alone relieved from the evil, but gets back nutrition in the shape of carbonic oxide.

In a pulverised state, carbon acts in the first instance as

sand, thus making the soil desirably porous. During rain it absorbs a certain amount of moisture quickly and then, resisting all further saturation, aids in filtration of the water downwards, or in evaporation when rain ceases, invariably retaining in itself its full amount of moisture until the superabundance around has lessened, when it not alone gives out that moisture, but with it yields a portion of its carbon, and this action is unceasing until entire decomposition takes place, which is equal and gradual, usually not before four to five years. Thus, it is not alone a most lasting manure, but one by which the utmost ignorance cannot suffer; even the greatest proportion will not do evil, while the smallest will do good.

Mr. Rogers also gives the details of a series of experiments with cabbage and other horticultural plants, and potatoes both whole and diseased, in all of which cases the most astonishing results were obtained. In many diseased and unhealthy flowers and plants the disease was promptly arrested by means of the peat charcoal and the plants restored to more than their pristine vigour in a few weeks. As a deodorizer of fœcal matter, peat charcoal is the most effective substance known to chemists, it aborbs all noxious gases arising from such matters or from putrescent bodies, and therefore to the sanitary chemist it is as important as to the agriculturist.

The strong affinity of noxious gases and odours evolved from fœcal and putrefying substances for peat charcoal led Mr. Rogers to inquire whether this substance might not be beneficially employed for some medical purposes, and with the assistance of one or two medical friends, he carried on for some time a number of experiments, commencing by applying the charcoal in the form of a poultice or dressing for offensive ulcerous sores. The charcoal had a highly beneficial effect in such instances, not alone in totally destroying the smell by absorbing the gases, but also in cleansing the wounds. It was also found useful for absorbing the odours arising from consumptive patients in the latter stages of the disease. The first experiments being so successful, naturally led to the use of the charcoal internally, and it was found to correct putrescence and absorb those gases within, which, if they do not produce evil to the health, at least destroy comfort. The result of these experiments, and a continuous and pretty extensive use of the charcoal, has demonstrated that it may be used with advantage as a remedial agent in indigestion, or dyspepsia, and its results, viz., flatulence, heartburn, acidity of the stomach, waterbrash, sick headache, impurity of the breath, palpitation of the heart, throbbing of the brain, distension and sense of fulness, giddiness, and the other usual attendants of a disordered stomach. In all diseases of the chest, sore throats, diphtheria, or chronic bronchial affections, peat charcoal has been found highly useful, as well as in cases of diarrhœa, cholic, and English or Asiatic cholera. Dr. Hawkesley states that he has "used carbonised peat moss extensively in the treatment of various disordered states of the digestive powers, with the most gratifying results." Dr. Fergusson, formerly of King's College, says:—"I have used the peat charcoal extensively in the wards of King's College, and invariably with excellent success." He further says:—"In some instances hitherto it has been almost impossible to keep patients in any degree of comfort, the offensive smell of their wounds causing the utmost annoyance. I then thought of mixing the powdered peat charcoal with the poultice—the effect was in a manner perfect. There was no longer that offensive stench so peculiar in such cases." Again, he says, "In sloughing sores, and in certain forms of cancer (in which cases the smell is usually bad), I have been equally well pleased, and I have this preparation in almost constant use." Such is the testimony of two eminent physicians in this country.

In France, also, the subject has been investigated, and the highly beneficial effects of peat charcoal have been proved by a scientific commission appointed by the Government. I cannot, however, refrain from stating what has come under my own notice as to the curative powers of carbonised peat. I have found it beneficial in indigestion, flatulence, and acidity of the stomach, but no really bad case came under my notice until a few days ago, when I called to see a young friend of mine who was exceedingly ill with dysentery. He had been treated in the usual manner, with absorbents and the ordinary medicines given in such cases, but from the inquiries I made I found that these measures had not the slightest effect, and that in fact the patient was sinking fast. I immediately prepared a mixture consisting principally of carbonised peat mixed with Oswego corn flour in milk, boiled to the consistence of a thick paste, and made palateable with sugar. This I directed to be given as often as the patient required food, and could be induced to take it. The effect was that the evacuations became more healthy, the patient began immediately to gain strength, and he is now rapidly recovering.

The only other case which I will mention here is that of a lady who has for some years suffered from an eruption on the legs of an erysipelatous character. This has been sometimes so bad as to cause a considerable degree of pain and almost intolerable itching. This lady has sometimes had the eruption extend to other parts of the body, and lately even to the face. Upon examining the watery matter that exuded from some of the broken bubbles on the face, I found an acid reaction on litmus paper. I then had a paste made with carbonized peat and water, and applied to the legs, keeping the dressing on for some hours. The effect was a considerable alleviation of the pain and itching, and a gradual withering away of the sores. I should say that I administered internally a moderate dose of sulphur, and at the same time placed the hand (which was also affected) in a bath of carbonic acid gas. This was repeated several times, the patient obtaining relief upon every application of the gas.

In pursuing my subject of the employment of peat in the useful arts, I have been drawn into some digressions from the line I originally chalked out, and I am afraid I have sorely tried your patience. Many persons present may no doubt feel surprised and disappointed that I have not alluded to several other matters and inventions connected with the subject, but the time would fail me to allude even briefly to all that has been done to prepare peat for various useful puposes in the arts. I have, therefore, only referred to those which appear to me to invite attention from their practical usefulness. Many other processes patented or otherwise, no doubt exist, all more or less useful, and I hope they will be referred to in the discussion. I cannot, however, conclude without expressing my thanks to Mr. Buckland, of the Maesteg Iron Works, and Mr. Jasper Wheeler Rogers, of Robertstown, county of Kildare, for the kindness with which they have furnished me with a variety of most interesting information connected with the subject. I should have been much pleased to have been allowed to enter more at length into the medicinal and curative properties of carbonised peat. It is a most important and interesting subject, and one well deserving thorough investigation and discussion, but it would be impossible for me, on the present occasion, to do much more than allude to it. The use of peat as a fuel and for metallurgic purposes will, after all, be its most extensive application.

The superiority of iron made with charcoal over that made by the use of pit-coal, is so well known that it will be altogether unnecessary to insist upon it here; and yet for our best brands of charcoal iron, we depend on the foreign manufacturer, when we have, at our own doors, every requisite to produce iron of the finest quality, and materials in abundance to produce charcoal in every way fitted for metallurgic operations.

It is to be hoped, now the means have been pointed out of obtaining peat and converting it into charcoal at a very moderate expense, that iron manufacturers will turn their attention to the application of peat fuel to this important manufacture, and that we may not henceforth be obliged to go abroad for the iron, necessary for making steel and for other purposes where iron of the best quality is required.

DISCUSSION.

Mr. J. W. Rogers, having been called upon by the Chairman, said they had heard a most elaborate and admirable paper, which contained everything which had been done up to the present time with respect to the treatment of peat. He believed there was nothing which could be brought forward which was so likely to produce benefit to the country at large as the use of peat as a fuel, particularly for the manufacture of iron. For that purpose nothing could possibly surpass it, and he thought also its use would supersede that of charcoal,—now so difficult to procure. He believed if peat itself were properly prepared, it would be found amply sufficient for all the purposes of the iron manufacture. The grand difficulty, he believed, that had been hitherto felt in the production of iron had been to find a fuel free from sulphur and acids. Peat was precisely what was wanted. There was no sulphur in peat, and the quantity of acid was so trifling that it could scarcely be traced. Therefore, if peat fuel could be made sufficiently dense to bear the blast of the "bloom," as it was called, he believed all that could positively be required was obtained; and it appeared to him strange that so many years should have elapsed and that so little should have been done in the matter. It was not a theory; they had only to go the Continent and examine what had been done there, and they would find that iron of the finest and purest kind was made not only from wood charcoal, but in a great many instances from peat. It was well-known that we were paying a considerably higher price for foreign iron, because of the want of fuel without sulphur in this country, whilst in his unfortunate country, Ireland, it was to be found spread over thousands and even millions of acres, not merely of the depth of one or two feet, but frequently extending to 40 feet in depth. When they considered that, it was indeed to be wondered at that it should have remained so long without being used. With regard to the other properties of peat charcoal, about ten or twelve years since, he had, he might almost call it, the misfortune, to bring forward the advantages of this material as a deodoriser and fertiliser. He found his proproposals opposed on every side. Upon the occasion of his reading his first paper upon the subject in London, several persons, at the meeting of the Botanical Society, declared that what he stated was an utter fallacy, namely, that carbon given to the roots of plants could be assimilated by them. The class-books had taught, up to that time, that all plants depended upon the atmosphere for the carbon they contained, and he need not now state that this was no longer maintained. All plants could take in carbon from the roots, and they did so, and without this they could not exist. The next thing he was opposed in was his statement that peat charcoal had the power of deodorising the very worst description of fœcal matter. He had been challenged publicly to prove the fact, and had succeeded in doing so. He had deodorised the worst description of fœcal matter in 1½ minute with peat charcoal, which was thus proved to be as thorough a deodoriser as could be prepared. The intermixture of peat charcoal with that same fœcal matter produced an admirable manure, as he had then stated. Analysis showed that when those two substances were combined they were found to contain everything that was essential to give luxuriance and life to plants. It had been asserted, however, that the intermixture of fœcal matter with peat charcoal produced a certain fermentation and a chemical effect which totally destroyed all the fertilising properties. He quite admitted that if that fermentation were allowed to go on for a certain time, such an effect would be produced, but it was very easy to check that fermentation, and, when once checked, it was never resumed. He was happy to say, notwithstanding all this opposition, that the value of this substance was beginning to be appreciated. It was said that no new discovery ever was thoroughly taken up by the public in less than ten years. It was now more than ten years since he had brought this subject forward, and it was at length making its way. All that he had asserted on this matter had been proved to be true. Another use for peat charcoal had occurred to him, viz., its medicinal use. He was not a medical man, and he was aware that anything he said upon it would have little weight. However, he had an opportunity of trying it in numberless instances amongst the peasantry where he resided in Ireland. He commenced his operations by using the peat carbon, finely pulverised, simply in water, and wherever that was continued to be used for any length of time, it had, in almost every instance, been the means of curing dyspepsia and other derangements of the stomach. Its power of cleansing offensive wounds was most remarkable, and in every instance in which he had used it in the manner Mr. Newton had stated, it had been found perfectly effectual.

Mr. P. L. Simmonds said that, while he had listened with a great deal of interest to the paper of Mr. Newton, in which the use of peat as a fuel for smelting purposes had been chiefly dwelt upon, and to the very valuable corroborative observations of Mr. Rogers, he was anxious that the paper should elicit as much general information as possible on all the economic and manufacturing uses to which peat could be applied. Attempts, he knew, had been made to separate the astringent matter from peat, and to use it in tanning leather. The charcoal of peat, again, was one of the best for making gun-powder. Crude peat was an admirable ingredient in forming compost manures, for mixing with sea-weed, and refuse fish; and in the manufacture of fish guano, when it was to be had within reasonable distance, so as to be obtained at a moderate cost, it was very valuable. He should like to know what were the causes which led to the failure of the Irish Peat Company, alluded to by Mr. Newton, established under Mr. Reece's patent, about nine years ago. The products of the destructive distillation of peat were many of them of commercial importance, and he had seen the paraffine oil and candles sold not very long ago. The able government report of Sir Robert Kane, published in 1851, "On the Nature and Products of the Process of the Destructive Distillation of Peat," contained a great deal of chemical information and experimental research. In further illustration of the calorific power of turf, he might refer to an elaborate work, published in Berlin in 1853, by Dr. P. W. Brix, under the title of "Investigations on the Heating Power of the most important Fuels of the Prussian States," in which were some determinations of the value of turf. These investigations commenced in 1848 and terminated in 1850, under the auspices of the Society for the Encouragement of Industry in Prussia, and, in consequence of their expensive character, were assisted by a grant from the Government. As they were carried on under the immediate direction of Professors Karsten and Schubarth, considerable reliance might be placed on the results. He would not trouble the meeting with the figures of the several experiments upon different kinds of turf, but might state in brief that, according to the numbers, the relative value of turf, compared with coal, was very much higher than had been usually assumed. Sir Robert Kane calculated, upon the very imperfect data then available, that three tons of peat were equal to one ton of coal, a supposition that was considered by many at the time as far too high, and he had seen statements in which five tons of turf were equivalent to one of coal. It was therefore interesting to find that according to these the first complete experiments to determine the calorific powers of turf, the value of that fuel, if properly consumed, was even considerably higher than the assumption of Sir Robert Kane, and that good black turf had very nearly half the value of average bituminous coal. Other countries were outstripping us in the utilization of peat, a waste product of such great extent in the kingdom. Not only was an immense manufacture of bricks carried on in Holland with turf, and alum works, breweries, bakeries, and many other factories, both in France and Germany, using no other fuel, but even a considerable manufacture of wrought iron, arms, and

general hardware was carried on with it. Eight or ten years ago no one used turf in Sweden, and many perhaps believed that it could not be employed. Wood was however growing scarcer and dearer there every year, and at length people bethought themselves of turf, and accordingly the Government sent persons to the countries where turf was used to collect information respecting the best manner of using it, and so well had they taken advantage of the knowledge thus gathered together that already they had left us far behind. Mr. Newton had incidentally alluded to the use of turf for paper-making, and the hint was interesting at the present time, from the subject of paper-materials having recently been discussed before the Society. Not that peat was likely to come into extensive use for any but the coarsest paper; but it was at least worth attention. In the *Journal of Industrial Progress* of Dublin, a few years ago, the manufacture was discussed, and he might cite an extract or two therefrom: "Turf bogs of a very considerable extent and thickness, and very generally of ligneous character, are found in many parts of Piedmont. This peculiar quality of the turf appears to have first suggested its use as a material for paper-making, and accordingly a number of trials were instituted at Turin, which appear to have been remarkably successful. From these experiments we learn that certain kinds of turf may enter into the composition of paper to the extent of from 80 to 90 per cent., and into that of millboard even to 95 per cent. The other materials employed, in addition to the turf, were indiscriminately old ropes and bagging, and the bark of the mulberry. The economy of using turf instead of the materials now employed, is stated to be fully 50 per cent. In Germany also, successful experiments have been made. Mr. Keller, of Kuhnheide, in the Saxon Erzgebirge, has manufactured some excellent paper, of low qualities, from fibrous or flow peat, which possessed considerable strength and had a sort of fatty feel, which appeared to render them particularly well adapted to form packing paper for certain goods." Even so far back as 1838, Mr. L. Piette, in a small book, which he published at Cologne, upon the different indigenous substances from which paper might be made, showed that a good common paper might be produced from the upper layer of fibrous turf. From his statements, it would appear that 100 lbs. of turf would only yield 25 lbs. of paper, but this proportion would no doubt vary very considerably. But even assuming that dry turf only produced one-fourth of its weight in paper, it would still be the cheapest material that could be employed. On the edge of a large bog, turf could be readily had in large quantities for 2s. 6d. per ton, so that the raw material of one ton of paper, exclusive of a little scutching waste or other strong fibre to give strength, could be had for 10s. The process of manufacture of the turf paper resembled in many respects that now followed for straw paper. The peat was first thoroughly washed, to separate all the earthy matter from the fibrous portion; the latter was then put into a strong caustic lye, where it was allowed to soak for twenty-four hours. It was then removed, and placed for about four hours in a bath of weak hydro-chloric acid, and kept constantly agitated; then washed in water, and placed in a weak solution of alum. After steeping for a time in this solution the liquid was run off, and the mass bleached by means of chlorine, and mixed with from five to ten per cent. of rag half-stuff and worked up in the engine, and made into paper in the ordinary way. This was the process of M. J. Lallimand, of Besançon, in France, where it had been patented. The peat as cut from the bog, would answer for making paper according to this process, which, of course, would save the expense of drying, starching, &c. But it was as a material for making all kinds of papier-maché and carton pierre, that turf paper, from the low price at which it could be produced, would be invaluable. Papier-maché had already been applied to a thousand uses, but it was still far from having received one-tenth of the development of which it was capable, and which, no doubt, it would receive, if paper could be produced at a much lower price than it was now. These additional instances were but a few further exemplifications of the manifold uses to which many at present waste substances might be applied, with more or less commercial profit, as skill, capital, and energy were devoted to them. With a chairman who was so thoroughly acquainted with the industrial resources of Ireland, and with so many gentlemen present able to give information, he hoped many further valuable facts and data would be elicted upon the subject under debate.

Mr. WINKWORTH said that he rose rather for the purpose of asking one or two questions, the answers to which, perhaps, might explain, to some extent, the causes of the want of success in the adaptation of prepared peat to economic purposes in Ireland, to which Mr. Simmonds had alluded, than to occupy the time of the meeting with a regular speech. He wished to ask Mr. Newton whether any or all of the processes mentioned by him in his paper were patented? and if so, whether any actions at law for invasion of them had been instituted?

Mr. NEWTON replied that no doubt there were existing and expired patents for the treatment of peat, but that many of the more important processes were not so protected. He did not at the moment recollect any legal discussion or scientific adjudication with reference to this subject, but he thought he could very truly say that the inventors of the processes which had been patented had always been very anxious to afford every assistance to persons who were willing to undertake the matter and carry out the invention. He knew that was especially the case with Mr. Rogers, and he (Mr. Newton) was only surprised that that gentleman had not long ago abandoned the thing in disgust, owing to the opposition that he had met with. With regard to the causes of failure of the Irish Peat Company, he could not give all the reasons why it did not succeed, but he thought one cause was their attempting to do too much, and to work upon too large a scale. They might buy gold too dear, and if they went to an enormous expense in order to get a few ounces of a particular ingredient out of a ton of peat, the probability was they would fail of success. If, however, the Irish Peat Company had restricted themselves to the cutting of the peat and the conversion of it either into fuel to be used as coal in steam-ships and locomotives, or into rough coke for the manufacture of iron, or charcoal as a fertiliser, the probability was that the company would have achieved a commercial success.

Mr. WINKWORTH then observed that his own impression, derived from other sources, with regard to patents for the treatment of peat, rather led him to a different conclusion, but Mr. Newton's knowledge of the subject was doubtless superior to his. Limited, however, as the effect of such an incubus as patent right, in this particular, might be, he thought it would to some important extent account for the indisposition of English capitalists to invest money in the manipulation of the raw material of peat when they might find, after successful efforts, that others laid claim to prior protected inventions, or applications of them, even though they had been permitted to slumber for years. Upon scarcely any other hypothesis could he account for this indisposition, for if peat, when scientifically prepared, was available for medical, sanitary, commercial, and manufacturing purposes, it seemed incredible that of so much idle capital as generally existed in this country, a considerable portion should not be directed to so profitable a channel. To whatever cause, however, this anomaly might be ascribed, he hoped that the original matter which the paper contained, and the information which Mr. Rogers had imparted in the course of his very interesting speech, would lead to that material and social prosperity which every friend to Ireland most ardently desired. Before resuming his seat he wished to ask if Mr. Newton could give any information relative to the process of converting peat into charcoal by means of sulphuric acid. A paper was read before this Society upon this subject by Mr. Longmaid about four

years ago, and it promised to be a useful process of manufacture.

Mr. Newton said this process was a very pretty thing in theory. In a chemist's laboratory nothing was easier than to convert peat in a divided state, similar to the specimens he had before him, into charcoal by this process. Mr. Longmaid did not reduce the peat to small particles, but he steeped it, unprepared, in sulphuric acid, and did not succeed in properly charring it. He considered the process was a failure commercially; but he was so much struck with the feasibility of the plan, that he made some experiments upon it. He obtained some worm peat from Mr. Buckland and placed it in sulphuric acid, but he found that it took such an immense quantity to char the peat that, in a pecuniary point of view, the process was useless. It produced a good charcoal, but the excessive quantity of sulphuric acid that was required to char a ton of peat, made it a far more expensive process than the ordinary one in retorts, and he believed that neither Mr. Longmaid's process, nor any modification of it, could be practically successful.

Mr. Samuel Meredith wished to ask whether Mr. Newton was prepared to say that peat for the purposes of fuel could be obtained at half the ordinary price of coal in this country. It would be a great desideratum, when the price of coal was going up, to know that manufacturers could obtain properly prepared peat at about half the price of coal. He would further ask whether peat was used to any great extent as fuel by manufacturers in Ireland. As some allusion had been made to the Irish Peat Company, as he happened to know a little about it, he would remark that that company turned its attention, amongst other things, to the manufacture of oil from peat, but he found that for the purposes of machinery it was entirely useless; and an investigation of the accounts showed that a considerable expenditure had been incurred for Gallipoli oil. He happened to know that on one occasion, when the shareholders met in the expectation of receiving a dividend, they were presented with two wax candles each, and at a party at which he was present two candles were burnt which cost the owner £250 each.

Mr. W. C. Dutton bore his testimony to the remarkable effects which had been produced by the application of carbonised peat charcoal to wounds.

Mr. Rogers said, with regard to the relative prices of peat charcoal and coal, he thought he might say, from the experience of twelve years, that peat, properly prepared for the manufacture of iron, might be had on the bog at from 7s. to 8s. per ton. It could be made sufficiently dense, according to the terms of the patents he had secured, for the manufacture of all descriptions of iron, at the cost he had stated. It was not his wish to bring peat into competition with coal, and it would be folly to attempt to do so; but what he had endeavoured to do was to make it answer in the place of wood charcoal, and if they did that, it was almost all that was required. If peat, for the purposes of the manufacture of iron could be prepared at the price he had stated, there could be no question it could be had in this country at a cost of 25s. or 30s. a ton, whereas wood charcoal varied in price from £4 up to £10 per ton. Even at 30s., 40s., or even 50s. per ton, peat would compete with wood charcoal, and probably beat it out of the market. He believed the calorific value of peat fuel, prepared in the way described, was equal to that of coal, whilst its power of diffusing the heat was much greater. In some experiments which he (Mr. Rogers) carried out for the Emperor of the French for three days upon the Paris and Orleans Railway, it was proved that the quantity of steam produced by peat as a fuel, was three times greater than that produced by coal coke, whilst the steam was got up in one-third or one-half the time required by coke. The blaze was so great as to pass far out of the mouth of the funnel of the engine.

Mr C. E. Cawley (of Manchester) wished to know if he had rightly understood Mr. Rogers to state that peat possessed greater heating powers than either coal or coke. If that was the case he could not understand why it had not been used to a very great extent in this country.

Mr. Rogers added that by a reference to the report of the experiments to which he alluded (and matters of that kind were very accurately kept by the government of France) the quantum of steam produced by peat was shown to have been nearly three times that produced by coal coke. On the morning of the experiments he took account of the time occupied in getting up the steam. With coke it took a few minutes over two hours, and with peat fuel it took less than half an hour, and the blaze was such that it issued a yard from the top of the funnel. It was well-known that in the working of a steam boiler the greater quantum of flame that was produced the greater the amount of steam generated. What they wanted was flame, and that was one of the remarkable properties of peat fuel. Some ten or eleven years ago Mr. Wye Williams tried the plan of intermixing coal tar with peat, for the purpose of producing a larger amount of flame, in order that the boiler might be completely surrounded by it.

Mr. Cawley suggested that Mr. Rogers should be good enough to communicate to the Secretary where the report he had alluded to could be obtained, because, in a matter of this kind, nothing was so valuable as actual experiments, and they knew that, for railway purposes, it was found that coals were more economical than coke.

Mr. Rogers had no doubt that, upon an application to the French Government, copies of the report he had alluded to could be readily obtained by the Society.

Mr. George Blackie mentioned that the ashes of peat had been used by him with the best results, in the tempering of steel for the mainsprings of chronometers and watches. The tempering was effected by that means with a degree of certainty and uniformity which he had not been able to obtain by any other method. Thus, after the peat charcoal had been used for other purposes of manufacture, the ashes would be valuable for the objects he had mentioned.

The Chairman said the facts just stated by Mr. Rogers with reference to peat charcoal were very remarkable; because, assuming that it was produced at 8s. per ton at the bog, it would not cost anything like 17s. per ton to carry it from any part of Ireland to any part of England. In the southern districts of England, the best locomotive coke cost 25s. per ton, and if this peat fuel produced a service so greatly in excess of that of coke, there could be no doubt that it would come into very extensive use in this country. He thought Mr. Rogers would feel that he had used a word with reference to his own and his (the Chairman's) common country, which was hardly applicable—viz., "unfortunate." He was happy to be able to say that, at the present time, there was scarcely any part of Her Majesty's dominions in a more prosperous state than Ireland. The object for which he rose was to propose a vote of thanks to Mr. Newton for the very interesting paper he had read. He had taken a most enlarged view of the whole subject of peat, and although he had said he had not alluded to all the uses to which it could be applied, he had instanced a great many which he trusted would be sources of reflection and subsequent action on the part of manufacturers and men of science. Mr. Newton had commenced his observations with a review of the coal formations of this and other countries, and that portion of the paper he (the Chairman) considered was as interesting as any other. He had stated that about 80 millions of tons of coals were annually consumed in this country, but he (the chairman) apprehended it was hardly so much as that. The statistics of 1858 showed that under 70 millions of tons were consumed in that year, and at the present time it was probable the consumption would not be above 72 or 73 millions of tons. It would be recollected by most present that some few months ago a good deal of controversy took place with reference to the period when the coal fields of

England would become exhausted. Mr. Newton had taken the most gloomy view of that question, inasmuch as 400 years had hitherto been assigned as the shortest period within which the supply of coal might be expected to fail; whereas Mr. Newton made it 350 years. But he thought there need not be much uneasiness on their part as to either period, the length of time was so very great. If instead of looking forward they looked backward upon the history of England 400 years ago,—this would be 25 years before the battle of Bosworth Field, when Richard the Third was slain, and just a year after the time when he caused the princes to be smothered in the Tower; or, if they took the shorter period of 350 years,—that would be a few years after Henry the Eighth was married, and when he was living very happily with Katherine of Arragon, his first wife, and many years before he thought of discarding her and subsequently taking five wives to himself afterwards. It was a curious fact that there was no article of consumption so highly protected as turf, and that, too, in a country generally regarded as favourable to free-trade principles, for, in order to protect certain turf interests in Holland, there was a duty upon all coal imported into that kingdom of £1 per ton. Various efforts had been made by English and Prussian producers of coal to get a reduction of that duty, but up to the present time they had not been successful. Mr. Newton had alluded to the use of turf by the steamers on the Shannon. He (the chairman) had not been at that part of the Shannon for the last few years, but upon inquiry some months ago, he was told that they had ceased to burn turf in these boats, and the reason given was that in consequence of the enhanced value of labour in Ireland, owing to the people being in a more prosperous condition, and in consequence of the greater facilities of getting coal throughout that country, than was the case ten or fifteen years ago, it was found cheaper to burn coal than turf.

Mr. ROGERS believed that the Chairman had been misinformed upon that subject, as within the last four months an offer was made to him for the purchase of a quantity of turf for the use of the boatmen; and the distillers and brewers in every part of Ireland used turf in preference to coal.

The CHAIRMAN was glad that his error had led to those remarks from Mr. Rogers, for it showed the increased value of the turf in Ireland. He concluded by proposing a vote of thanks to Mr. Newton for the very instructive and interesting paper he had read.

The vote of thanks was then passed.

The paper was illustrated by specimens of peat prepared in various ways, and of the substances produced from it.

The Secretary announced that on Wednesday evening next, the 9th inst., a paper by J. Forbes Watson, A.M., M.D., "On the Chief Fibre-yielding Plants of India; with Observations on the Measures required for the Encouragement of the Growth of these and other Indian Products, to meet the wants of Britain," would be read. On this evening Thomas Bazley, Esq., M.P., will preside.

RATING OF LITERARY INSTITUTIONS.

In the Court of Exchequer, on the 23rd of April, before the Lord Chief Baron and Barons Martin, Bramwell, and Wilde, the following case of "The Shareholders of the Liverpool Library *versus* the Mayor, Aldermen, and Burgesses of Liverpool," was decided.

Mr. Milward, with whom was Mr. Aspinall, on behalf of the respondents, said this was a special case, stated by order of Mr. Baron Bramwell, in order to obtain their lordships' decision whether an Institution known as the Liverpool Library came within the 6th and 7th Vict., cap. 36, which exempted from local and borough rates scientific and literary societies. In this case the shareholders numbered 893, and the shares, which had been originally a guinea, now sold in the market at £9 10s. The Act itself only exempted societies which were exclusively for the advancement or encouragement of literature, science, and the fine arts, and if supported wholly or in part by voluntary contributions, and where there was no division of profits. This was a circulating library, with this addition, that it was a joint-stock company.

The Lord Chief Baron—But there is no dividend.

Mr. Milward—No, but there was an express power that the company might be wound up at any time, and they might alter the rules so as to enable the proprietors to divide the stock. They had, moreover, a personal advantage in being permitted to take home the books, and to introduce their friends. There was moreover a rule, by which any proprietor could assign or bequeath his or her "beneficial interest," and there were cases to show that where a beneficial interest existed the society could not be exempted. If the society took in the *Saturday Review* or the *Examiner* it would not be exempt.

The Lord Chief Baron—They cannot take in newspapers.

Mr. Milward—No. He would contend that in this case there was a beneficial interest, and that the society was not exclusively for the promotion of literature. Suppose the society circulated such a class of literature as found a sale in a street off the Strand.

The Lord Chief Baron—It would be very obscene, no doubt, but we cannot sit here as critics.

Mr. Milward—I will put a case of a society which circulated a record of all the prize fights.

The Lord Chief Baron—Well, a record of prize fights would be part of the history of the country. (Laughter.)

Mr. Milward proceeded to say the contributions in this case were not voluntary, because when a person bought a share he would still have to pay £1 1s. as an annual subscription, or his share would be forfeited. The payment of this was capable of being enforced by the forfeiture of the share itself, which was worth a considerable sum for sale in the open market, so that could not be regarded as a voluntary subscription. He submitted that the Exemption Act could not over-ride acts passed subsequently, under which several of the rates appealed against had been made.

The Court were of opinion that the society was clearly within the meaning of the act, and gave judgment for the plaintiffs.

Judgment accordingly.

Home Correspondence.

PAPER MATERIAL.

SIR,—I was favoured with an opportunity of hearing the paper read before your Society on the evening of Wednesday, the 18th of April, by Dr. Collyer, on material for paper. Admiring the zeal of the author in the field of investigation to which he is devoting so much time and attention, I think he would have added to the weight of his own particular theory for the manipulation of straw as a material for paper, if, instead of denouncing in so unqualified a manner (as he has also done through other channels besides) the errors of those who are operating practically by the daily manufacture of paper from straw, he had given a tangible illustration of the results of his own process by the production of paper manufactured in accordance therewith, that his audience might have been enabled to form an opinion of the comparative success attained over his rivals; for I believe it may be admitted as a maxim by paper makers themselves, that no accurate judgment can be formed of the precise quality of paper

produced from any material viewed in a state of semi-pulp, or as Dr. Collyer's boiled or even bleached straw.

Dr. Collyer states that the persons who manufacture straw paper are liable to the evil, which he professes to remedy, of the tendency of straw, when immersed in fluid such as alkaline liquor, to settle down in a compact mass, so as to be almost impermeable to the circulation of the heated liquor. To this I reply that arrangements of the most perfect kind have for years been in operation (by the most successful manufacturers) effectually to prevent this evil: and if the two processes had been presented to his audience, I believe that Dr. Collyer's would not have obtained the palm of preference.

Dr. Collyer next claimed the credit of applying superheated steam in the disintegration of straw fibre; this has already been in operation for some few years, under a patent of Mr. Sullivan's; and not having an opinion of my own to offer upon the relative merits of the two competing operations, it was incumbent on Dr. Collyer, with a knowledge of the existence of this patent, to have demonstrated to the satisfaction of his audience, in what consisted the superiority of his process over Mr. Sullivan's, for I am inclined to anticipate that the result of the discussion of the abstract question of the introduction of superheated steam into an open vessel, or rather, more properly speaking, not under pressure, and coming in contact with the straw on which the jets of alkali liquor had been previously poured, would be instantly to reduce it to the ordinary temperature of 212 degrees as the very maximum of heat, and thus the advantages of the extra heat would be dissipated. Whatever may be the opinion of Dr. Collyer on this matter, I would venture, with all becoming deference, to appeal to the most practical scientific members of the Society of Arts to determine whether the attainment of a high degree of heat from steam, either simple or superheated, without pressure, is anything more or less than a physical incongruity.

The only known agents by which the silica will be removed from straw, so as to remove the brittleness at present attaching to the paper, are the combined action of caustic alkali with the highest possible degree of heat, consistent with safety in the application of pressure. This is being accomplished with safety and success, and all efforts made in this direction will result in an addition to the supply of useful material for our paper manufacture.

There is one part of Dr. Collyer's arrangement which, in my judgment, appears to present an insuperable difficulty, arising from the bulkiness of the material he treats. By the most perfect condensation of straw, necessarily adopted by straw paper-makers, one ton cut into chaff occupies a vessel 12 feet long and 6 feet in diameter; whereas the piling of a ton of uncut straw upon trays in layers of 18 inches, would involve the occupation of a space almost as large as the room in which the paper was read.

Dr. Collyer referred to a process of straw paper-making conducted in America, where straw was boiled under a pressure of 200 pounds to the square inch, in a vessel 14 feet in diameter and 8 feet deep. As this would render necessary the use of a steam boiler in which the steam was generated, capable of a pressure of 350 pounds to the inch, he will be doing a public service by explaining the construction of a boiler of such vast capabilities, which will be more clearly appreciated when he calculates the *sectional* square inches contained in the vessel worked under a supposed pressure of 200 pounds, as indicated by the thermometer, but which in reality would be more than trebled. I admire the daring enterprise of our translantic brethren in the application of physical science, and this is the reason I wish for an explanation of the above phenomena.—I am, &c.,

AN INQUIRER.

April 28th, 1860.

THE STONEWARE TRADE.

Sir,—In Mr. John Doulton's remarks in the discussion on Stoneware, he said that he thought Mr. Goddard, in his statistics, had underrated the extent of the trade.

In support of this view he instanced the fact that we consume 8,000 tons of coals annually (not 9,000 as reported), and that it was therefore reasonable to suppose that the other eight or ten firms in Lambeth consumed together more than the remaining 12,000 tons.

We observe that Mr. Goddard writes to your *Journal*, questioning that statement, "Because he has the supply of 1859 lying detailed before him, and that does not credit Mr. Doulton with anything like the quantity."

From whence did Mr. Goddard get his returns? He never asked us for them, and it is not possible he can be aware of all the sources of supply.

Here are the exact figures, and your readers can judge who is most likely to be correct:—

Consumed in 1859—Coals..... 7,491 tons.
" " Coke..... 893 chaldrons.

Mr. Goddard's chief object, however, in writing to you, seems to be to tone down his admission as to our position is the trade, by limiting it to the manufacture of drain-pipes, and this may lead some to suppose that Mr. John Doulton included in his estimate our consumption of clay and coal at our country drain-pipe manufactories; this was not so; he spoke only of Lambeth, otherwise he would have had to state quantities of clay and coal together, amounting to Mr. Goddard's estimate of the whole extent of the stoneware trade in Lambeth.

We have made several inquires, but we cannot hear that Mr. Goddard communicated with the Lambeth potters previous to reading his paper; if he had done so he would have been more likely to be correct in his statistics.

We are, &c.,

DOULTON AND CO.

Lambeth Pottery, April 25, 1860.

BLACK-BONED FOWLS.

Sir,—I was surprised to learn, from Mr. Temple's communication in your *Journal* of the 27th inst., that naturalists questioned the existence of black-boned gallinaceæ; and lest it should be thought that those of Honduras are peculiar, I write to inform you that such fowls are common in China, and are preferred by epicures over other varieties, their nutritive qualities being supposed to be tenfold greater. This refers, however, only to black-boned fowls with white feathers; coloured feathered fowls having black bones are considered on a par with the common varieties.—Yours, &c.

D. J. MACGOWAN.

17, Regent-square, W.C., April 28th.

ELECTRO COPIES OF ENGRAVED STEEL PLATES.

Sir,—Through the medium of the *Journal of the Society of Arts*, in July last, I made known the result of my endeavours to deposit pure nickel upon the surface of engraved copper-plates. This I have continued to do with marked success. The deposit has nearly the appearance of silver in colour, possesses almost the hardness of iron, is free from oxidation by air, resists the action of the ordinary acids, and, being easy of manipulation, and inexpensive, is well worthy of attention. Each coating will furnish 5,000 impressions and upwards. It is so hard as to stand the free use of the burnisher, and its texture is so fine as not to show the worn away portions of the deposit after each successive coating.

Finding the deposit so beautifully fine in texture, and polished in surface, it occurred to me that if an engraved steel plate were covered with such a deposit the plate might safely be immersed in a solution of sulphate of copper, and a metallic matrix be produced direct from it, without the risk of injury from the action of the acid of the solution. I have tried this with complete success, and have found (as might be supposed) that an electro copy of a steel plate thus obtained is very superior to one made from a matrix of gutta percha or other plastic

composition. The engraved plate, however, must be quite free from under-cut lines.

I am, &c.,
HENRY BRADBURY.

12 and 13, Fetter-lane, Fleet-street, May 2, 1860.

MEETINGS FOR THE ENSUING WEEK.

MON. .....London Inst., 7. Rev. Henry Christmas, "On Eminent Personages of English History living between the years 1640 and 1660."
Entomological, 8.
British Architects, 8. Anniversary.
Medical, 8½. Clinical Discussion.
United Service Inst., 8½. Lieut. Heathcote, "The Andaman Islands."

TUES. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbivorous Mammalia—the Ox, Goat, and Antelope Tribes."
Syro-Egyptian, 7½. Mr. Frederick Goodall, A.R.A., "Illustrations of Ancient and Modern Egypt."
Civil Engineers, 8. Renewed Discussion upon Mr. D. K. Clark's Paper, "On Coal Burning, &c.," and Mr. J. J. Berkley, "On Indian Railways, with a Description of the Great Indian Peninsula Railway."
Medical and Chirurg., 8½.

WED. .....London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Dr. J. Forbes Watson, "On the Chief Fibre yielding Plants of India; with Observations on the Measures required for the Encouragement of the Growth of these and other Indian Products, to meet the wants of Britain."
Graphic., 8.
Microscopical, 8.
Royal Soc. Literature, 8½.

THURS. ...Royal Inst., 3. Professor Ansted, "On Physical Geography and Geology—Africa and Australia."
Royal Society Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.

FRI. .....United Service Inst., 3. Col. Shafto Adair, "The Defence of Portsmouth and the Adjacent District."
Royal Inst., 8. Dr. Thomas Mayo, "On the Relations of the Public to the Science and Practice of Medicine.
Astronomical, 8.

SAT. .....Royal Inst., 3. Mr. F. A. Abel, "On Heat and Chemical Force."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on April 18th, 1860.

201. Revenue Department—Estimates.
94. Bills—Valuation of Lands (Scotland) Act Amendment.
98. „ Police and Town Improvement (Scotland) Act Amendment.
105. „ Land Improvement (Ireland).
106. „ Census (England).
Post Office—7th Report of the Postmaster-General.

Delivered on April 19th, 1860.

186. Houses of Parliament—Return.
208. Hops—Return.
217. Registry of Deeds Office (Dublin)—Return.
221. Bank Notes—Return.
216. Cape of Good Hope—Return.

Delivered on April 20th, 1860.

Italy—Further Correspondence (Part 5).

FIRST SESSION, 1859.

208. (A. 10)—Poor Rates and Pauperism—Return (A.)

Delivered on 21st and 23rd April, 1860.

181. Public Institutions—Report and Evidence.
230. Public Income and Expenditure—Account.
227. Weedon Inquiry Commission—Return of Expenses.
107. Bills—Malicious Injuries to Property Act Amendment.
110. „ Dwellings for Labouring Classes (Ireland)—Lords' Amendments.
111. „ Paper Duty Repeal (Amended).
Consular Committee of 1858—Correspondence.

Delivered on April 24th, 1860.

193. The Office of Coroner—Report.
226. Navy (Consumption of Smoke)—Report.
229. Merchant Seamen's Fund—Account.
97. Bill—Prisons (Scotland).
109. „ Ecclesiastical Courts Jurisdiction.

Delivered on 25th April, 1860.

233. Army Estimates—Revised.
133. Bill—Charity Trustees.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April 27th*, 1860.]

Dated 13th March, 1860.

671. W. E. Newton, 66, Chancery-lane—Imp. in railway tracks and carriage wheels. (A com.)

Dated 14th March, 1860.

674. G. H. C. Jongkindt, 14, Palace-road, Westminster-bridge—Imp. in the method of and apparatus for making cakes and purified or refined oil out of cotton seed.

Dated 16th March, 1860.

695. G. White, 31, Dowgate-hill, Cannon-street—Applying as a substitute for the animal albumen hitherto obtained from bird's eggs or blood, certain parts of reptiles, fish, mollusca, and articulated or radiated animals. (A com.)
698. A. Ripley, 42, Bridge street, Blackfriars—Imp. in the mode and process of treating the shavings, parings, and refuse of hides and leather, and also in the process and mode of treating or operating upon these and waste leather in order to produce a new article or fabric.

Dated 26th March, 1860.

776. J. M. Carter, Somerset-house, Monmouth—Imp. in knapsacks and pouches for the use of soldiers and others.

Dated 29th March, 1860.

818. J. Buchanan, Glasgow—Imp. in the manufacture and finishing of heddles or healds for weaving, and in the machinery or apparatus employed therein.

Dated 3rd April, 1860.

848. W. Houldsworth, Bradford, Yorkshire—Imp. in machinery or apparatus for preparing cotton or fibrous substances for spinning.
854. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the construction and working of thrashing machines. (A com.)

Dated 4th April, 1860.

860. H. M. Mellor, Arkwright-street, Nottingham, and J. Gee, Radford, Nottinghamshire—Imp. in machinery for the manufacture of looped fabrics.

Dated 5th April, 1860

870. V. Rola, Southampton—Imp. in musical notation or symbolizing musical sounds to be printed or represented on paper or other material, with a view to facilitate the reading of music.

Dated 7th April 1860.

882. W. Clark, 53, Chancery-lane—Improved apparatus for treating peat or turf. (A com.)

Dated 9th April, 1860.

886. J. Hamer, Longsight, Manchester—An improved manufacture of rugs, quilts, coverlets, or covers for beds, and of certain articles of wearing apparel.
890. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in pumps for compressing elastic fluids. (A com.)
892. R. A. Brooman, 166, Fleet-street—A new woven fabric and method of manufacturing the same. (A com.)

Dated 10th April, 1860.

894. J. Peacock, Blackburn, and J. Garstang, Preston—Imp. in looms for weaving.
896. E. Heywood, Haley-hill, Halifax—Imp. in means or apparatus employed in winding yarns.
898. W. E. Newton, 66, Chancery-lane—Improved apparatus for superheating steam. (A com.)
900. J. Rankin, Liverpool—Imp. in mills for grinding bones.

Dated 11th April, 1860.

901. P. A. Gardrat, 4, South-street, Finsbury—Imp. in the cleaning of the waste of wool, silks, cottons, and flax.
902. H. Spence and J. G. Spence, Birmingham—Certain imp. in the manufacture of lacquer.
903. R. Atkinson, Southampton-court, Tottenham-court-road—Imp. in chimney tops.
904. T. A. Turner, Birmingham—An imp. or imps. in manufacturing the upper leathers of boots and shoes.
905. T. H. P. Dennis, Chelmsford—Imp. in the construction of iron buildings or glazed structures for horticultural or other purposes.
907. J. Burrup, Gloucester—An imp. in ploughs.
908. J. W. Rogers, Peat-house, Robert's-town, Kildare—Improved means of and apparatus for collecting the excrement of towns and villages, and for facilitating the drainage of houses.
909. T. Martin, Withybush, Haverfordwest, Pembroke—Imp. in the construction of roofs.

911. E. Westmoreland and W. Westmoreland, Newdegate-street, Nottingham—Imp. in sewing machines.

Dated 13th April, 1860.

913. J. Webb, St. Austell, Cornwall—Imp. in the cartridges employed in blasting.
914. M. Drukker, 47, London-wall—Imp. in clocks.
915. G. Addenbrooke, Green-hill, Womburn, and F. Lewis, Penfields, near Wolverhampton—Imp. in apparatus used in raising and lowering weights in mine shafts.
918. H. Smith, Glasgow—Imp. in machinery for cutting wood.
919. J. W. Rogers, Peat-house, Robert's-town, Kildare—An improved mode of draining peat-mosses, so as to render the peat obtained therefrom more useful as fuel, also improved means of and apparatus for drying and preparing the peat for fuel.
920. J. Petrie, jun., Rochdale—Imp. in machinery or apparatus for washing rags and other materials used in the manufacture of paper.

Dated 13th April, 1860.

921. O. Vandenburgh, Syracuse, New York—Imp. in projectiles and appliances of projection, imparting great precision and great range of flight to projectiles forced through the air by gunpowder or other explosive compound, with facility for rapid discharge, and for discharging many projectiles simultaneously by one projecting appliance with the same advantages, giving increased area to the space covered by the destructive projectile matter and light weight, and small space to the appliance for projection.
922. J. Platt, Oldham, Lancashire—Imp. in mules for spinning and doubling.
923. J. Hill, Ipswich, Suffolk—Imp. in wire screens.
925. J. W. Hadwen, Kebroyd Mills, Halifax—Imp. in machinery or apparatus for combing or cleaning silk, cotton, wool, and other fibrous substances.
926. A. Mitchell, J. Mitchell, and B. Emmerson, Bradford—Imp. in looms for weaving.
927. J. W. Crossley, Brighouse, and J. Crossley, Halifax, Yorkshire—Imp. in the construction of singe-plates, which imps. are also applicable to gas and other retorts.
928. W. Burgess, Newgate-street—An imp. in mowing and reaping machines.
929. T. Fry, Brooklyn, New York—Imp. in castors for chairs and other like articles of furniture.
930. T. Edwards, Birmingham—Imp. in obtaining motive power.
931. L. Dubois, Brussels—Imp. in printing rollers.

Dated 14th April, 1860.

933. J. J. L. Brémond and L. Z. Thuilliez, 29, Boulevart St. Martin, Paris—Imp. in spindles and other parts of spinning looms.
934. J. Notman, Plumtree-street, Nottingham—Imp. in sewing machines and in apparatus connected therewith. (A com.)
936. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved setting for lamp reflectors. (A com.)
937. F. Fontenau, 39, Rue de l'Echiquier, Paris—An apparatus for the preservation of life and property in cases of shipwreck.
939. A. Jones, Manchester—Imp. in machinery or apparatus for making rivets, screw blanks, and other such articles.
940. J. Petrie, jun., Rochdale—Imp. in machinery or apparatus for drying warps for weaving.
941. T. Fisher and E. Fisher, Wednesfield, Staffordshire—Imp. in steam engines.
942. A. V. Newton, 66, Chancery-lane—Imp. in rotating breech fire-arms. (A com.)
943. Sir J. S. Lillie, 105, Pall-mall—Imp. in carriage ways.
944. C. E. Wilson and H. G. Hacker, Monkwell-street, London—Imp. in machinery for the manufacture of chenille.
945. D. Patridge, Woolwich, Kent—An imp. in or addition to apparatuses for superheating steam.
947. R. Brough, Cumberland-terrace, Camp-hill, and R. Cox, Kingston-road, Birmingham—Certain imp. in machinery for the manufacture of spikes, nails, pins, and rivets, and which said imps. are also applicable for partially forming or making chain links, holdfasts, staples, spouting hooks, and other such like articles formed of iron or other metal by forging, pressing, rolling, or drawing.
949. T. Burstall, Southall, Middlesex—Improved machinery for manufacturing bricks from clay alone or mixed with other materials.
951. T. Walker, Birmingham—Imp. in apparatus for indicating the height of water in steam boilers.
955. W. E. Newton, 66, Chancery-lane—Improved nippers for attaching blocks and tackles to ropes. (A com.)
957. W. Clark, 53, Chancery-lane—Imp. in breech loading fire-arms, and in projectiles, as also in apparatus for reducing ordinary guns to condition suitable for such improvements in fire-arms, which apparatus is also applicable for other purposes. (A com.)

Dated 17th April, 1860.

959. C. Stevens, 18, Welbeck-street, Cavendish-square—An improved steam mill. (A com.)
961. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in caloric engines. (A com.)
963. G. Hansemann, Eupen, Prussia—Imp. in machinery for spinning yarns.
965. W. Carmont and W. Corbett, Clayton, near Manchester—An imp. in casting steel tyres for wheels, which is also applicable to casting other articles of steel.
967. W. Bridgett, New Lenton, Nottingham—The regeneration and expansion of steam, applicable to steam engines or for other purposes.
969. W. E. Newton, 66, Chancery-lane—An imp. in pianofortes.

Dated 18th April, 1860.

971. J. Shaw and J. Cook, Accrington, Lancashire—Imp. in looms.
973. G. W. Durham, Size-lane, London—Imp. in machine for washing rags, pulp, and other fibrous materials.
975. H. Payne, St. James's-road, Old Kent-road, Surrey—Imp. in lowering ship's boats.
977. W. E. Newton, 66, Chancery-lane—Imp. in pressing bonnets, bonnet frames, and similar articles. (A com.)
979. W. E. Newton, 66, Chancery-lane—Improved means of illuminating buoys, finger or direction posts, milestones, or other marks used at sea or on land, to guide or direct navigators or travellers, so as to render such buoys, posts, or marks visible at night.

Invention with Complete Specification Filed.

1020. D G. Berri, Bloomsbury, Middlesex—An improved date stamp. 24th April, 1860.

Patents Sealed.

[*From Gazette, April 27th*, 1860.]

April 27th.
2468. J. Higgins.
2481. J. Bolton.
2482. A. Chevrier.
2483. R. A. Brooman.
2484. R. Cichowski.
2485. J. Holmes.
2492. W. H. Perkin.
2499. I. F. Delavier.
2532. H. Barker.
2543. G. Hadfield.
2546. J. Hamer.
2558. S. Evans, W. Evans, and H. Evans.
2560. W. Fletcher.
2549. T. D. Perkin.
2595. J. Graham.
2712. W. E. Newton.
2810. S. W. Campain.
108. A. David.
480. S. S. Bateson.
562. W. E. Newton.
586. J. H. Johnson.

[*From Gazette, May 1st*, 1860.]

May 1st.
2498. J. Leeming.
2501. C. Bacon.
2504. J. Howard.
2509. A. P. Boothby.
2517. R. A. Brooman.
2518. J. Chesterman.
2529. J. A. Clarke.
2537. H. B. Powell.
2538. A. Learch.
2593. A. V. Newton.
2619. E. Barlow and F. Hamilton.
2639. B. Amsden.
2655. T. Lister.
2657. F. Preston and H. W. Garrett.
2667. C. Smith, I. Smith, and J. Smith.
2877. C. Bedells.
2679. M. Auerbach.
2681. M. Auerbach.
2733. A. V. Newton.
561. J. K. Smithies.
593. W. H. Muntz.
619. G. Walcott.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April 27th*, 1860.]

April 23rd.
1214. L. H. Spooner.
April 24th.
1174. W. Cory, jun.
1212. F. Walton.
April 25th.
1186. A. Eddington.

[*From Gazette May 1st*, 1860.]

April 26th.
1185. J. Macintosh.
1248. H. Mackworth.
1363. G. Crawford.
April 27th.
1273. L. Bissell.
1290. R. Bennett.
1316. H. Hobbs and E. Easton.
April 28th.
1200. D. Chadwick and H. Frost.
1208. J. Bottomley, C. Hodson, and W. Fielden.
1218. S. Mortimer.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, April 27th*, 1860.]

April 24th.
989. C. L. Desbordes.
April 25th.
1020. J. A. Bruce.
1026. W. F. Thomas.

[*From Gazette, May 1st*, 1860.]

April 27th.
1029. J. Etherington.
1061. G. Murton and W. H. Langshaw.
April 28th.
1034. Sir J. S. Lillie.

Journal of the Society of Arts.

FRIDAY, MAY 11, 1860.

VISIT OF HER MAJESTY THE QUEEN AND H.R.H. THE PRINCE CONSORT.

Her Majesty the Queen, and His Royal Highness the Prince Consort, President of the Society of Arts, accompanied by the Princesses Alice, Helena, and Louise, visited the Society's House on Tuesday last, and inspected the collection of the works of the late Sir William Ross, R.A. In attendance were the Duchess of Atholl, the Hon. Beatrice Byng, Lord Charles Fitzroy, and Lieut.-Colonel Ponsonby.

Her Majesty was received by Sir Thomas Phillips, Chairman, and the following Members of the Council :—Mr. C. Wentworth Dilke and Mr. Henry Thomas Hope, Vice-Presidents; Mr. John Bell, Mr. Peter Graham, Mr. W. Hawes, Colonel H. Cunliffe Owen, R.E., C.B., and Mr. Samuel Redgrave.

CONVERSAZIONE.

The Second Conversazione of this Session will take place on Saturday evening, the 26th May, at the South Kensington Museum.

The card of invitation will admit the member and two ladies, or one gentleman. These cards have been issued.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William C. Ross, R.A., is now open at the Society's House, and will remain open during the month of May only.

The public are admitted on payment of one shilling each person.

Members of the Society of Arts have free admission, and may *personally* introduce one friend.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council that the amount of the Guarantee Fund promised up to the 9th May, was £221,900.

The following is a Report of a Meeting of the Chamber of Commerce at Bradford, held last week :—

A communication from the Council of the Society of Arts, addressed to Mr. John Darlington, as a Member of the Society, asking him to join the Guarantee Fund of £250,000, for the proposed Exhibition of 1862, was read to the meeting. Mr. Behrens observed that the Guarantee Fund subscribed in respect to the Exhibition of 1851 amounted to £70,000. That sum was drawn from the subscribers, and no account had been given of it, although the Exhibition was said to have realised a surplus of £200,000. He moved that the Secretary be instructed to acknowledge the letter from the Council of the Society of Arts, and ask for information as to what had been done with the previous Guarantee Fund. Mr. Douglas asked whether there might not have been some misconception as to whether it was a Guarantee Fund. Mr. Behrens said that the promoters did not say it was a Guarantee Fund, but everybody else understood it to be a Guarantee Fund. The subscribers had no legal right; they subscribed *bona fide;* but he thought the *gentlemen in common honesty* ought to have given account of *their stewardship.* The amount of guarantee was £70,000, which was subscribed and paid. The Chairman expressed a doubt whether the Exhibition would pay. Mr. Behrens said he hoped it would never take place. The motion was seconded by Mr. Douglas and agreed to.

Mr. Titus Salt having asked Mr. Cole, a Vice-President of the Society of Arts, to give him an answer to the above statements, Mr. Cole addressed to him the following letter, which is published with Mr. Cole's permission. It states facts useful to be recollected at this period :—

Dear Mr. Salt,—I am very glad that you ask me for an explanation of some statements made before your Bradford Chamber of Commerce, on the Financial Management of the Exhibition of 1851. In the report of the meeting which you gave me I find it stated that in '51 a Guarantee Fund was subscribed for £70,000, and that no account had been given of it, although the Exhibition realised a surplus of £200,000. Here are two mistakes. First, the Guarantee Fund which was formed was not for £70,000, but exceeded £350,000; and, secondly, a full account of all the receipts and expenditure of the Exhibition *was printed*, published, and laid before Parliament in 1852. The First Report of the Commissioners for the Exhibition of 1851 contains not only the financial account, but the most minute statistical information of all kinds, illustrating the cost of everything, and even the number of buns eaten, which amounted to 1,800,000. (See page 150.)

I think I should best make the matter quite clear by telling you, in detail, the financial arrangements of 1851. The public were invited to *subscribe*, and were told, at the same time, that all subscriptions were *absolute* and *final*, and that any surplus would be applied in promoting future Exhibitions. I send you some extracts from the printed decisions, which were circulated by hundreds of thousands throughout the kingdom. The public subscribed £67,896 before the Exhibition opened, and paid this sum. When the period arrived to make a contract for the building, this amount was found to be quite insufficient. The question then arose, who was to take the responsibility of ordering the building? The Prince Consort and others personally entered into a guarantee which amounted to about £350,000. Of this amount the Prince subscribed £10,000, Sir Morton Peto £50,000, and others subscribed large sums, from £10,000 downwards. Upon this guarantee the Bank of England made the

necessary advances to enable the Exhibition to be realised. The subscriptions alone were not sufficient for the purpose, and if the guarantee had not been formed in addition, the Exhibition could not have taken place. After winding up all the accounts there was a surplus of £173,000. Upwards of eighty memorials or letters were presented to the Commissioners, suggesting various modes of spending the money. Some one suggested the formation of a Museum of Aboriginal Products; another, a Free Hospital for all Nations; another, the alleviation of Irish and Highland destitution; an Irishman suggested the purchase of an estate in Ireland for Prince Albert. In fact, everybody seemed to forget that the Commissioners had *pledged* themselves to apply the surplus to promote future exhibitions. The Commissioners took the most practical step to enable this to be done, and the best proof of it is that another Exhibition will take place in 1862. The Commissioners, instead of spending their money, or scattering it among all the wild projects suggested, invested it in the purchase of land, which they bought at a very moderate outlay. Since the purchase was made, the value of the land has increased nearly fourfold in less than nine years. The prudence of this step in every point of view was great. The chief difficulty in the last Exhibition was the provision of a site, and the Exhibition was nearly stopped by the repugnance of the House of Commons to the use of Hyde-park for the purpose of holding the Exhibition. Even after the Exhibition had brilliantly succeeded, the Crystal Palace could not be kept standing because it was in Hyde-park. By the foresight of the Commissioners in securing land near the metropolis, they are now enabled to offer 16 acres of land not only for holding the next Exhibition, but are willing that it should be secured for this purpose in perpetuity.

I send you a little woodcut, which shows where these 16 acres of land are. They are within a third of a mile of the site of the Exhibition of 1851, and a Bill is now before Parliament to enable a railway to deposit people and goods actually in the Exhibition, and by means of it the members of your Chamber of Commerce will be able to come up from Bradford, and return the same day if they think fit.

It was proved to demonstration, in 1850, that the Great Exhibition must be a commercial failure. It was also proved, in a most mathematical way, that the building would be blown down. Instead of a failure, there was a great profit, and the building was not blown away. With such facts, it is not necessary to discuss the apprehensions of any that the Exhibition of 1862 will be a failure.

That Exhibition will assuredly be much more interesting in its display of machinery and manufactures than the former one, as the world has not stood still during the last ten years, and experience makes exhibitors, as well as other people, more perfect. Moreover, the next Exhibition will contain Fine Arts and Music, which the last Exhibition did not illustrate; and I have great hope of seeing your vigorous townsman, Mr. Smith, bringing up a troupe of Yorkshire voices to show how well they can sing in 1862.

As for subscribing to the guarantee, it is no longer necessary for its pecuniary success, as the quarter of a million is very nearly completed. As a testimony of good-will towards the promotion of manufactures and peace between nations, I should hope your Bradford friends will not think it becoming to abstain from subscribing to it. In the present case they may like to know that the disposal of the surplus will rest with those who subscribe to the guarantee, and it will be very satisfactory to find—if there should be a surplus—that they have made better use of it, if that be possible, than the Commissioners of 1851 did of theirs. Yours faithfully,

HENRY COLE.

Titus Salt, Esq., M P.

Extracts from the Decisions in 1851.

"Her Majesty's Commissioners, having undertaken the absolute control over the expenditure of all money that may come into the hands of their treasurers, have made arrangements for auditing accounts and ensuring the strictest economy.

"Should any surplus remain, after giving every facility to the exhibitors, and increasing the privileges of the public as spectators, her Majesty's Commissioners intend to apply the same to purposes strictly in connection with the ends of the Exhibition, or for the establishment of similar Exhibitions for the future.

"All subscriptions must be absolute and definite."

17, Onslow-square, 5th May, 1860.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th April, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 9, 1860.

The Twenty-second Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 9th instant, Thomas Bazley, Esq., M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Haswell, Frederick Thame	Whitear, Rev. William
Pretious, John Thos. Mason	Wilson, George

The Paper read was—

ON THE CHIEF FIBRE-YIELDING PLANTS OF INDIA.

By J. Forbes Watson, A.M., M.D., Reporter on the Products of India.

On the present occasion I am desirous of bringing under the notice of the Society of Arts a subject which has already engaged much attention, and I do so with the hope that, however imperfectly I may accomplish the task, nevertheless some practical result will accrue from the effort.

After certain preliminary remarks, I propose in the first place to bring under notice those fibrous plants which, from practical considerations, seem worthy of immediate attention; and in the second place my object will be to touch upon our present wants as a manufacturing nation, and to indicate briefly the more prominent points of interest connected with the supply of various raw textiles to this country. The paper itself will be found to contain a mass of valuable statistical information, for which I am indebted to the Statistical Department of the India Office, as well as to that of H.M. Inspector-General of Imports and Exports. Personally, my warmest thanks are due to Mr. C. Prinsep and to Mr. J. A. Mann, for the special assistance they have afforded me in this department.

From the wide range which I have chosen, it will be evident that the time at my command will not allow me to enter much into minute detail. I shall, therefore, con-

fine myself as much as possible to principles, and to the indication of those practical points which must ever be borne in mind if we desire practical results.

Whilst, however, I have endeavoured to select and to touch upon only such fibres as seem to me best worthy of attention, I do not hold that amongst the great variety produced in India there are not others of, it may be, equal note. The great thing is, however, to determine what will suit our requirements, and to devote attention to the cultivation of these; for however luxuriantly a country may be covered with valuable plants in the wild state, it is only by special culture that the thousands of textiles we require can be furnished. The existence in the wild state of such plants affords sound foundation for the presumption, that these, when cultivated under similar conditions of climate and soil, will reward the labour of the husbandman. Whenever, in order to obtain the wished-for product, it is necessary to destroy the plant or tree, cultivation must be had recourse to. The jungle may seem to contain boundless supplies of plants for the use of man, but these in the end fail, for not even the gigantic South American forests can furnish inexhaustible quantities of the fever-healing Cinchona. In some cases it may be sufficient to collect and scatter the seed on waste lands or along the side of our Indian lines of railway,* but for the production of important fibres, careful cultivation is essential.

Before we consider the various fibres, it will be necessary to make a few remarks on their origin, with a view of explaining the arrangement I have adopted. And here we must record the facts that not only are two of the grand divisions under which plants are arranged by botanists based on the different manner in which their fibrous portions are deposited in the stem, but the actual fibres themselves differ both in structure and quality. All fibres are mere modifications of single cells. The condition of the cell in point of toughness is of first importance as regards the utility of the fibre, and no doubt its strength is much modified by the more or less complete change of cellulose into lignine. Diversities in the natural structure of the stem are owing to the different modes in which the fibrous or longitudinal portions are added to its substance. In the Exogens, these additions are made in regular layers on the outside of the central pith or of the wood last formed. The stem, in short, increases its diameter by the deposition of a new layer of fibrous matter, which in annuals remains flexible, but in perennials woody. Figs. A and B afford illustrations of the mode of growth.

Fig. A.

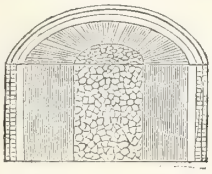


Fig. B.

In both, the clear space indicates the position of the newly-formed fibrous layer, composed of longitudinal fibrous bands, which, while imparting strength, give likewise that flexibility which enables so many plants of this class to recover their upright position when beaten down by wind or rain. The flexible fibres of flax and hemp are all thus formed. Plants of this class have all a true or separable bark immediately outside the fibrous or *liber* layers, and demand a different class of treatment by machinery than do the Endogens. In these, as the name also indicates, the fibres are deposited in an entirely different manner. The fresh deposits of fibres take place in these from within, where they intermingle to some extent with the older ones. Figs. C and D will best explain the nature of an endogenous stem.

Fig. C.

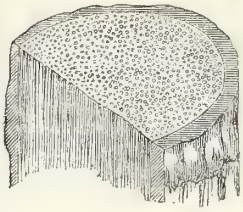
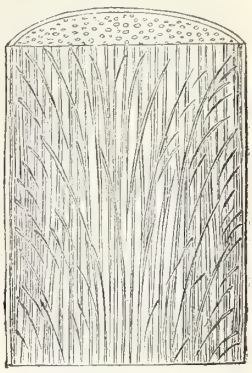


Fig. D.



The palm-tree furnishes a good illustration of an endogen. Therein the fibres in which we have an interest are distributed throughout the cellular system of the stem. The new matter, at first fibrous and flexible, becomes eventually woody, from the deposition of lignine and the other undefined encrusting substances.

One common effect in the arrangement of the stems of endogens, is to produce irregularity in the quality of the fibre. This is not the case, or at least to a much less extent, with the exogens.

In addition to the fibres obtainable from the leaves especially, of endogens and from the stems of exogens, we have another important class of fibres, which are found in connection with the seed itself. Of this class cotton is the best known example, but coir is the one to which we shall again have to refer. In other cases the margins of the sheathes or fronds of the leaves furnish hair or bristle-like fibres of value.

It follows then that all exogenous and endogenous plants will furnish fibres of some sort when carefully manipulated, hence the many patents for obtaining fibres, the difficulty alone existing in selecting those of a right sort.

In judging of the quality of fibres, in all probability much depends on the constitution of the cell-walls. The physical appearance, the power of resisting strains under certain conditions, separability, behaviour when exposed to the influence of moisture—in these respects great differences exist between the fibres of exogens and endogens, and these must be taken into account in judging of the relative value of the two divisions. Fibres from endogens present a characteristic white appearance, and, when examined under the microscope, are, with one or two exceptions, readily distinguished from exogens. The isolated fibres are less transparent, arising from the deposition of a larger quantity of what has been called encrusting matter, or from the deposition of lignine in the interior. These deposits, whatever their nature be, seem as if fractured at innumerable places. Some of them also present a characteristic opalescence not found in others. The ultimate fibre cells, too, are as a rule separable with difficulty, and are brittle when compared with exogens, and this has an important influence both upon their suitability for spinning and papermaking. With the valuable assistance of Mr. Wentworth L. Scott, whom I have entrusted with the preparation of the various fibres for my examination (and who has throughout superintended the execution of the cuts),* I have submitted

* This is already being carried out on some of our Indian lines. The plan cannot be too strongly recommended, not only on account of the fibres which such a plant as the *Agave Americana* can furnish, but also for the protection of the line from the incursion of animals.

* The wood-cuts here referred to have been executed by Mr. Orrin Smith. Those of the various fibre-yielding plants by Mr R. Branston.

the whole of them to repeated and careful microscopic inspection under various conditions, and I believe that the descriptions which accompany each will be found very fairly to represent their characteristic differences, although it is impossible by language always to express the character which strikes the eye.

The importance of the microscope in such investigations is obvious. It enables us to detect in different fabrics the existence of fibres of an inferior class.

In addition to such aids as are afforded by the microscope, the eye, and the touch, we have certain other practical tests of the quality of fibres arising from their behaviour under mechanical treatment. But, before considering the fibres themselves, I would make a few remark, upon the mode of separating them from the parent stems reserving further comment until treating upon individual fibres. I have at the present moment in my possession no less than 180 specifications of patents bearing upon this important subject. The analysis of these and the discussion of the various processes adapted to the purposes of cleaning and preparing fibrous substances, would occupy the whole of the time at my disposal this evening. I shall therefore only indicate principles. But to understand the process of cleaning Indian fibres, it must be remembered that we have to deal with a climate in which fermentation and putrefaction readily succeed each other in the freshly-cut plant. A forgetfulness of this fact has acted injuriously upon their value. The common practice has been to steep the plant in water, until the sap is decomposed. Labour is thus saved, but in India the fibres are often irreparably discoloured and weakened for manufacturing purposes. It is therefore obvious that steeping, if employed, should be for the purpose of loosening and dissolving the binding constituents of the plant.

And now as to climate and soil:—

In endeavouring to illustrate the capabilities of a given country for the growth of certain plants, two lines of inquiry present themselves. We have in the first place to show that the soil and climate are suitable, and afford the fundamental conditions necessary to full development; and in the second, to indicate with what success a particular product has been already cultivated. As regards climate, no country in the world of equal extent is so favoured as Hindostan. This arises to a great degree from the physical inequalities of its surface, without which India would have been a vast desert. The Himalayas, rising in height from 20,000 to 29,000 feet, act as the great modifiers of temperature, and provide proper water supply to the rivers in the north, as well as to the atmosphere; while the Malabar range of mountains, and the Eastern Ghauts, rise abruptly in their turn, and produce similar effects.

Then again, as a rule the growth of plants for their fibres is more exhausting to the soil than that of any other crop. In the case of ordinary food substances, the seed alone is removed, and the constituents of the straw or stem which furnished the seed, in all good husbandry, are again restored to the soil. For effective nutrition it is essential that not only should the soil contain the elements necessary for perfecting the seed, but likewise in equal abundance the constituents of the stem. The amount of constituents required for the vigorous growth of different plants varies considerably; but it would seem that all of like species, wherever grown, require the same constituents to be furnished by the soil. Thus, in the case of flax, we find, from an examination of the mineral constituents of the whole plant, that certain salts are more abundantly present than others, and we may fairly conclude that the soils which afford the largest supplies are, always supposing climatic conditions to be favourable, the best adapted for the cultivation of such.

The suitability of our Indian soils to the growth of cotton, afforded me an opportunity, on a former occasion, of pointing out the general features of the country, with respect to its surface, and to this I would again refer.

Although subject to considerable modifications, the soil of India may be divided into three great classes. In the North, we find great alluvial tracts, the results of countless ages of deposits from those majestic rivers, the Ganges, the Indus, and the Brahmapootra, which, together with their tributaries, fall respectively into the Bay of Bengal and the Indian Ocean. By this alluvial, India may be said to be bounded on the north; but passing southward and eastward from the delta of the Indus, we find the rivers of Guzerat and the intractable Nerbudda, have each afforded its quota to the same class of deposits. On the opposite side of the country, the mouths of the Godavery, the Kishna, the Cauvery, and sister rivers, supply soils identical in physical character; and stretching still further to the eastward to Burmah, extended evidence presents itself of that ceaseless attrition which at last subjugates the hardest rocks.

It is not possible for me to say exactly, or, indeed, with any amount of precision, how much of the 1,200,000 square miles which comprise Hindostan consist of the deposits here referred to, but I believe at least one-third does so.

The soil next in amount, and of equal if not superior importance, is the well-known "black cotton soil" of the Deccan and other parts of India. In amount it occupies a position next to the alluvial. It stretches from Bundelcund in the north, nearly to the south of the Peninsula. A very considerable portion of the Deccan consists of this; it is also to be found in Guzerat and many other parts of the country. In depth it varies much. As to origin, it seems to have arisen from the decomposition of basalt and trap, which constitute, to a great extent, the mountain ranges on which the great plains of the Deccan are elevated.

In depth it varies from 3 to 15 feet or more.

The third characteristic soil is usually called "red." It is found in all parts of the country, but perhaps chiefly in Southern India, where it apparently mainly arises from the decomposition of granite rocks. Its lime and some valuable constituents are, however, obtained from different sources. In other parts of India this soil would seem to take for its origin rocks of a volcanic description, such as the red jaspery brick-like *Laterite*, which is found extensively in many parts of the country.

Having dealt thus far with generalities, I am glad to be able to present to my audience a considerable number of analyses of soil, extracted from the extensive series lately executed for the Secretary of State for India, by Professor Bernays (to whom I am personally indebted for much valuable assistance), as also by Mr. F. A. Manning. These soils may be fairly considered as types of cultivated India, and in this capacity we proceed to notice them.

In proceeding to remark on the various analyses shown in Table I., we observe that the soils of India differ in some respects from the best known cultivated ones of Europe. No feature is more remarkable than the comparative absence of organic matter, and the state of comminution so common to them. Whole tracts of country may be said to consist, as regards their surface, of impalpable powder when dry, or of tenacious mud when moistened. So strongly argillaceous are many, that they bake into a hard brick-like mass when exposed to the sun. A common and very important feature attaches to the generality. Potash and soda are so abundantly present as to furnish almost exhaustless amounts. Sulphates and chlorides would seem to be defective, but these are supplied by the irrigating waters of the various rivers.

The soils of the Punjab and of Sind are much alike. In colour (See Table, next page) a light drab, and physically almost impalpable. With some 20 per cent. of alumina and oxide of iron, they are stiff in character, and readily turned by water into a thick mud. Carbonate of lime and magnesia exist in very large quantities; and when we take into consideration the plants usually cultivated, phosphates are present in sufficient quantity. Contrasted with European soils, there is a falling off in the amount both of sulphates and chlorides.

SOILS FROM LAHORE, SIRDARPOOR, MOOLTAN, &c.

	PUNJAB.							SIND.
	LAHORE.		SERDAR-POOR.	MOOLTAN.		KOTISA-SHAH.	RAWUL PINDEE.	LARKHANA
	Soil.	Subsoil.		Soil.	Subsoil.			
Moisture at 212 deg.	3·930	2·160	2·000	1·860	1·090	1·750	4·430	3·000
Water above 212 deg., and organic matter	0·930	0·500	2·000	1·520	1·370	2·410	2·840	2·300
Potash	1·029	1·820	0·933	2·240	2·130	0·520	1·038	1·103
Soda	0·722	1·313	0·410	0·801	1·232	0·213	0·404	0·620
Lime	3·290	4·670	2·439	2·150	2·480	5·493	7·480	5·331
Magnesia	1·910	2·010	1·001	0·443	0·590	1·330	0·720	0·560
Alumina	12·660	14·630	11·230	12·980	14·150	12·260	17·890	15·850
Peroxide of iron	10·000	4·100	11·700	8·010	6·340	6·310	5·110	14·720
Chloride of sodium	0·036	0·033	trace	0·055	0·078	trace	0·074	trace
Phosphoric acid	0·132	0·097	0·100	0·117	0·109	0·043	0·107	0·060
Sulphuric acid	0·024	0·030	trace	0·041	0·055	trace	0·075	trace
Carbonic acid	1·760	2·400	1·631	0·720	1·400	4·317	0·512	4·208
Silica, as silicate and as silex	63·800	66·710	69·240	70·000	68,670	66·640	59·500	54·940

The soils of Eastern Bengal are somewhat peculiar. The lime present in them is chiefly in the form of silicate, carbonates being almost entirely wanting. They seem, too, to be much more dependent upon the inundating waters for supplies of sulphates and chlorides. In clay they abound; consequently they are more retentive, and have much more capacity for moisture than the soils of the Punjab. As to silex, too, a great difference is observable, so that in many cases the presence of pebbles greatly detracts from the otherwise too great stiffness. Though less rich than the Punjab soils in potash and soda, they may yet be said to abound, being richer than those of Europe in which flax is successfully cultivated. Other observations might be made, but the agricultural reader will fairly deduce these for himself on comparison of the subjoined soils of Eastern Bengal from the localities specified. It will be observed from Table I., above referred to, that all are inundated, either during rains or for stated seasons.

	EASTERN BENGAL.				ASSAM.			
	5 MILES EAST OF KORALEE.	RAJAGANJ.	OPPOSITE JAIRAM-POOR.	JUMAL-POOR.	NEAR TO DEBROOGURH.		MACHULEE.	BIJITOLLIA.
					For Tea.	Occasionally Cultivated.		
Moisture at 212 deg.	4·160	2·930	6·750	4·700	5·700	3·300	5·830	3·930
Water above 212 deg., and organic matter	1·190	1·730	1·950	1·780	0·020	0·130	3·500	1·440
Potash	0·598	0·786	0·664	0·450	0·820	1·810	0·620	0·700
Soda	1·656	1·686	0·513	0·253	0·758	1·795	0·167	0·043
Lime	1·490	0·890	Trace	0·084	2·530	0·890	trace.	0·224
Magnesia	1·430	1·240	0·240	0·232	0·740	1·450	1·210	0·500
Alumina	17·440	16·270	22·240	14·010	16·550	17·470	29·630	12·830
Peroxide of iron	4·890	3·460	5·230	7·040	7·850	4·530	3·570	9·660
Chloride of sodium	0·020	0·016	0·053	0·041	0·022	0·029	0·025	0·033
Phosphoric acid	0·132	0·082	0·015	0·125	0·115	0·042	0·058	0·063
Sulphuric acid	0·052	0·004	0·020	0·005	0·001	0·003	0·004	0·006
Carbonic acid	none	none	trace.	0·130	trace.	0·006	0·080	0·040
Silica, as silicate and silex	67·000	70·600	62·505	71·550	65·046	68·700	55·330	69·660

The soils of Bengal almost speak for themselves. The one from Lucknow is peculiar, being distinctly calcareous. The two soils from Bundelcund are very loose in texture. (See first Table next page.)

The cotton soils from Malwa, Saugur, Deccan, and Mysore have quite a distinctive character. They are for the most part very dense, and contain not only much moisture, but have great power of absorption; and this has a most important bearing on the question of irrigation. In the black soils it is evident that irrigation must be employed with great caution. In organic matter they are strangely defective, especially when compared with dark-coloured European soils. Of potash and soda they contain abundance. (See second Table next page.)

In considering the various Indian fibres, I would first remark upon the arrangement which I have adopted. In a didactic treatise, giving in detail the whole of the plants which, up to the present time, have been proved to contain fibres of more or less value, an arrangement, founded upon the botanical affinities of plants, while not only scientific, proves in many respects productive of results of practical moment. As the present paper will, however, only deal with a selection, and that, too, a comparatively small one, I have adopted a classification founded upon what experience has connected with our manufacturing wants. As already shown, nature has, with very few exceptions, provided every plant with fibrous materials, which, when separated, may be turned to some account, but it is not every plant which will pay the expense of such manipulation by affording a marketable commodity. No doubt numberless plants have, in the lapse of ages, been tried and found wanting, not having stood the test of experience. Looking at the matter from this point of view, I hold that those fibrous substances

—	BENGAL.				
	Rajpoor.	Cawnpore.	Lucknow.	Tiree.	Bomoree.
Moisture at 212 deg.	1·470	3·170	1·500	2·860	1·083
Water above 212 deg., and organic matter	1·130	0·370	2·400	0·140	1·247
Potash	1·570	0·445	0·193	0·578	0·614
Soda	1·162	0·582	0·050	0·283	0·590
Lime	0·208	3·930	36·405	0 224	1·420
Magnesia	0·400	0·240	0·270	0·308	0 100
Alumina	9·100	13·560	2·870	11·930	9·180
Peroxide of iron	5·410	3·770	3·270	1 400	1 250
Chloride of sodium	0·041	0·051	trace	0·033	0·023
Phosphoric acid	0·088	0·121	trace	0 023	0·041
Sulphuric acid	0·018	0.003	trace	0·001	0 021
Carbonic acid	—	1·200	26 202	0·200	trace
Silica, as silicate and as silex	79·670	72 842	28·290	80·130	83·950

COTTON SOILS.

	Gurchamer.	Between Panagurh and Jubulpore.	Khamlepur	Bellary.
Moisture at 212 deg.	16·000	10·700	17·000	12·000
Water above 212 deg., and organic matter	0·200	—	0·460	0·260
Potash	0·720	0·573	0·813	9,332
Soda	0·529	1·719	0·779	0·774
Lime	2·190	1·680	5·610	6·350
Magnesia	1·440	0·720	0·143	0·290
Alumina	23·292	16·660	19·930	13·330
Peroxide of iron	13·438	6·000	11·400	5·330
Chloride of sodium	0·055	0·053	0·053	0·055
Phosphoric acid	0·008	0·166	0·038	0·101
Sulphuric acid	0·003	0·071	0·014	0·034
Carbonic acid	0·200	0 200	0·980	4·060
Silica, as silicate and as silex	41·930	61·500	41·738	57·330

which have either been employed for the longest period, or which are now most commonly in use, are likely to be exactly those most worthy of attention. Of this kind are flax and cotton, which have been employed from the earliest ages. With respect to the former, we have only to look to the great variety of purposes which it subserves, to come to the conclusion that it is, of itself, *par excellence*, the best of fibres. It furnishes, as a rule, the broad sheets which impel the navies of the world—carrying the blessings of commerce from shore to shore—and from it are manufactured fabrics of not only the finest but most enduring texture. But even independently of questions founded on past experience, there is another point from which to view the matter. As a great manufacturing nation we have already invested a great amount of capital in machinery specially adapted to the manufacture of certain classes of fibres, and from this fact alone it is manifestly a duty to encourage the growth of products which will either suit present adaptations, or do so with the least amount of change. In short, we cannot afford to make great changes in our machinery, although in some instances this might be of ultimate advantage.

This, however, would not be necessary, for the fibres which I propose to bring under your notice will fully answer every one of our manufacturing necessities. Since the subject of the fibrous plants was last brought before the Society of Arts by my late predecessor Dr. Royle, and chiefly through the interest excited by his efforts, extended attention has been paid to the subject, and on the experience thus furnished some of my own conclusions have been founded.

There is one striking fact connected with this part of my subject, which I must not omit to mention. In the beginning of this century, Dr. Roxburgh, under the orders of the Court of Directors, instituted a number of experiments on the growth of different plants, and on the preparation of their fibres. The results of these experiments were then, as now, appropriately brought under the notice of this Society.

Since his time, although numerous experiments have been made, we have not obtained many fresh results of practical importance. I am therefore inclined to think that we now possess the elements necessary for forming a tolerably fair opinion as to the relative importance of our various Indian fibres, and I believe that the enumeration about to be given will embrace almost all that is essential.

For reasons before alluded to, fibres from exogens, from their superiority, occupy the first place. I have divided them into those which, from their strength, flexibility, and other practical qualities, are fitted for spinning and manufacturing purposes.

Of fibres belonging to this class, *flax* deservedly occupies the foremost place. Next to flax stands the *Rheea*, or "China grass" fibre. Thirdly, we have the Neilgherry nettle, called also vegetable wool. Fourthly, the Mudar (*Calotropis gigantea*), and, lastly, the Bedolee sutta, or "vegetable silk" from Assam.

In the next division I have placed a selection of fibres fit for spinning and manufacturing purposes of a certain kind, but possessed of such inferior lasting qualities that they cannot be legitimately employed for purposes likely to subject them to much wear and tear, or to the action of water in the ordinary operation of washing. This class of fibres fulfils many important uses, but when either of them, on account of their cheapness, are surreptitiously used in cases which demand the superior qualities of the first group, they may then be fairly said to occupy the place of adulterants.

To this class belongs the well-known jute of commerce. Secondly, the Bariala (*Sida rhomboidea*) of Assam and Bengal; and, thirdly, the Ambaree (*Hibiscus cannabinus*) of Western India.

In the second group I have placed those fibres which are chiefly useful for the manufacture of cordage, twine, &c., but which may be, and are occasionally, used for the purposes to which the three fibres last mentioned are suited.

At the head of this class stands the true hemp (*Cannabis sativa*); then, 2nd, we have Sunn (*Crotalaria juncea*); 3rdly, the Dhunchee (*Sesbania aculeata*) of Bengal; and 4thly and lastly, the Jetee (*Marsdenia tenacissima*) a fibre possessed of certain qualities which may eventually entitle it to a higher place. And the same remark applies to hemp, which, after certain manipulations, has been occasionally brought into a state of fineness and flexibility nearly equal to that of good flax.

We now come to the fibres furnished by Endogens. Of these there are two divisions. In the first we have various white fibres of varying qualities, furnished almost without exception by the leaves of different plants; and in the second we have dark-coloured fibrous substances of a rough or bristle-like nature.

With respect to the 1st division:—No rigid separation of these, in accordance with the purposes for which they are suited, can be effected, for we find that the fibres which at one time are only capable of being employed for the standing rigging of ships, or for the formation of cordage or twine, will at another be found of fineness sufficient to permit of employment for spinning into fabrics of a certain kind; for instance, for women's dresses and for imitations of horse-hair cloth, &c.

The finest fibre in this group is undoubtedly that of the pine-apple (*Ananassa sativa*); next in order of importance stands the moorva (*Sanseviera Zeylanica*); then come the agaves, such as *Agave Americana* and *A. Vivipara*, the last now called *Fourcroya gigantea*. Fourthly, we have the yucca and Adam's needle; and lastly, the plantain. The so-called Manilla hemp and New Zealand flax will likewise have to be referred to.

In the 2nd division of Endogens we have:—1st, Coir; 2nd, the bristle-like fibres from the Ejoo palm; 3rd, rough coarse fibres from the shoots of the *Pandanus*; 4th, similar ones from the *Chamaerops Ritchiana*; and 5thly, from the Moonj of Sind.

Having thus endeavoured to enumerate the different fibre-yielding plants in what I consider the order of their

relative importance, I shall now proceed to examine them more in detail.

And first with regard to Flax. Fig. 1 affords a fair representation of the plant, which is too well known to need description. At present flax is almost entirely cultivated in India for the sake of its seed. To what extent

Fig. 1.

Flax. (*Linum usitatissimum.*)

may be gathered from the first Table on the next page, which also demonstrates the fact that India furnishes a very large proportion of the supply to the United Kingdom. The quantity imported amounted to 97,000 tons, and a glance at the Table will show the prodigious rate of increase since 1840. Table II. (at the end of the paper) shows the quantities exported from India to all parts of the world, and will repay perusal, as showing the relative amount furnished by each of the Presidencies since 1850.

But besides the exports, linseed is largely used by the natives. These facts, therefore, indicate the existence of a wide-spread cultivation of flax for at least one purpose. But although grown chiefly for seed, the capability of certain parts of India to furnish fibre of the most valuable description, has at last begun to be fully appreciated, and this partly through the attention which the subject has received from Government, partly through the report of our agricultural societies, and partly through individual efforts. As the declared object has been the cultivation of seed, the flax has been sown sparsely, consequently the plant has thrown out abundance of lateral branches, and produced a first-class seed for oil. Indeed, Indian linseed rules the market here. The second Table on the next page indicates, for a number of years, the average annual price. In spite of many failures, and of much partial success, there is no ground for believing that flax of good quality may not be grown in many parts of India when once cultivated with that end in view.

That flax is an exhaustive crop there is no reason to doubt. It requires much of the alkalies, potash, and soda for its full development, but where these are abundantly present, as Table I. (at the end) proves them to be in the great alluvial soil of India, the mechanical texture of the soil is of less moment than suitability of climate.

In order to produce good fibre it is essential that the seed should be sown thickly, so as to cover the ground. Fig. 2 gives a fair idea of the proper distance. Thus the deposition of excessive ligneous matter is prevented. In India flax is a winter crop; in the northern parts it is sown in October and November, arriving at maturity about the beginning of April.

With respect to seed, successful culture would seem to depend much upon frequent change. This certainly is the case with us in Ireland and England, resort being had to various parts of the Continent for the purpose. On a hasty examination of the subject, we should suppose a similar importation necessary for India; but when we reflect upon the varieties of soil and climate, no such necessity exists beyond a frequent interchange of seed between the various districts. We must, however, admit that certain experiments * which have been made in India with imported seed have furnished results in agreement with our European notions. A better fibre has been the consequence, but we decline admitting the argument beyond the point we have conceded.

A few words more as to what has already been done. Dr. Roxburgh was the first to devote attention to this matter. The results he obtained in Bengal were so far encouraging, but nothing practical was accomplished until 1840, when the subject was revived by Mr. Rogers, of Calcutta, and shortly afterwards a company was formed in England called the London Experimental Flax Company. The Agri-Horticultural Society of India, ever foremost in all that concerns the development of our Indian resources, warmly supported this effort. An experimental farm was established near Ghazeepore, and much attention generally devoted to the subject, with the result of proving that even in the hot and moister climate of Bengal a fair quality of flax could be produced. The reports of the Society indicate very considerable success—a good, saleable fibre, and a fair profit to the cultivator. Attention was then devoted to the N.W. Provinces, in which flax is largely grown for its seed, and attempts were in some instances made to obtain fibre from the flax plant so grown. And there is no doubt that in spite of its stunted character, with improved methods of preparing the fibre, even from this a large quantity, useful for certain coarse purposes, might be obtained, available at least for native wants, even if unsuited for exportation. The present custom of the cultivator, to burn the flax stems, is undoubtedly the

* In some experiments reported by Mr. Steiner, native seed produced flax which gave 14 per cent. of fibre, while that from imported gave 18 per cent. The yield per acre from the latter was, however, less.

best under the circumstances, as he returns the ashes to the soil. Thus all danger of exhaustion is prevented, as also the necessity for long intervals between the crops.

As to the question of the production in India of flax for the supply of our wants. With the exception of the experiments in the North-West Provinces, already alluded to, nothing was done until the year 1853, when at the suggestion of Mr. Henry Cope, the subject of the introduction of flax into the Punjab was taken up by the local Agri-Horticultural Society. Time will not permit me to enter into detail with reference to the results obtained, although they are of the first importance to this country, as well as to at least one large division of our Indian territory. Suffice it to say, that owing to the energetic initiation of Mr. Cope, and the practical skill brought to bear upon the matter by Mr. Lawrenz Steiner, the warm support given by the Financial Commissioner, Mr. D. F. McLeod (with whose

TABLE Showing the QUANTITIES of **LINSEED** Imported into the UNITED KINGDOM, distinguishing the Countries whence Imported; and the Annual AVERAGE PRICE of EAST INDIA LINSEED, from 1840 to 1859 inclusive:—

	Russia.						Prussia.		British East Indies.		Turkey and Egypt.		Other Parts.		Total.		Annual Average Price of E. India.	
	Northern Ports.		Souther Ports.		Total.													
	Qrs.*	Tons.			Qrs.	Tons.	Qrs.	Tons.	Qrs.	Tons.	Qrs.	Tons.	Qrs.	Tons.	Qrs.	Tons.	Per qr.	Per ton.
1840	320,914	58,739			320,914	58,739	42,259	7,735	25,984	4,756	2,051	375	53,551	9,802	444,759	81,407		
1841	278,193	50,919			278,193	50,919	37,639	6,889	24,915	4,560	113	21	22,600	4,137	363,460	66,526		
1842	276,020	50,522			276,020	50,522	57,370	10,501	8,973	1,642	10,124	1,853	15,213	2,785	367,700	67,303		
1843	342,614	62,711			342,614	62,711	65,740	12,033	8,003	1,465	25,038	4,583	29,144	5,334	470,539	86,126		
1844	448,393	82,072			448,393	82,072	90,382	16,543	29,745	5,444	22,385	4,097	26,042	4,767	616,947	112,923		
1845	523,309	95,784			523,309	95,784	27,634	5,064	24,528	4,453	16,553	3,030	64,939	11,886	656,793	120,217		
	Qrs.	Tons.	Qrs.	Tons.														
1846	256,794	47,002	147,518	27,001	404,312	74,003	44,441	8,134	11,843	2,168	7,427	1,359	38,116	6,977	506,141	92,641		
1847	118,190	21,633	235,710	43,143	353,900	64,776	36,848	6,745	15,696	2,873	10,913	1,997	22,155	4,055	439,512	80,446		
1848	298,949	54,718	356,827	65,312	655,776	120,030	62,046	11,357	25,781	4,719	31,786	5,818	24,261	4,441	799,650	146,365	s. d.	£ s.
1849	436,834	79,956	45,979	8,416	482,813	88,372	87,273	15,974	26,142	4,785	17,523	3,207	12,744	2,333	626,495	114,671	41 4	11 6
1850	320,796	58,717	133,447	24,426	454,243	83,143	80,433	14,722	26,979	4,938	25,012	4,578	22,317	4,085	608,984	111,466	46 6	12 14
1851	270,382	49,490	147,569	27,010	417,951	76,500	58,179	10,649	93,814	17,172	39,464	7,223	21,063	3,855	630,471	115,399	47 11	13 2
1852	215,064	39,384	303,603	55,570	518,667	94,934	54,576	9,989	184,618	33,792	16,653	3,048	24,888	4,556	799,402	146,318	45 5	12 8
1853	378,320	69,246	386,699	70,780	765,019	140,026	57,848	10,588	151,113	27,659	19,413	3,553	41,942	7,677	1,035,335	189,503	50 4	13 15
1854	26,460	4,843	322,726	59,070	349,186	63,913	116,267	21,281	196,617	35,988	78,199	14,313	88,244	16,152	828,513	151,647	63 4	17 6
1855	3,249	595	87,220	15,971	90,509	16,566	139,900	25,607	364,339	66,687	115,063	21,061	47,140	8,628	756,951	138,549	70 6	19 5
1856	465,184	85,145	144,579	26,463	609,763	111,608	158,955	29,094	341,763	62,555	50,180	9,185	19,519	3,573	1,180,180	216,015	59 3	16 4
1857	368,830	67,509	316,739	57,975	685,569	125,484	69,323	12,689	209,277	38,305	37,080	6,787	49,864	9,127	1,051,113	192,392	65 5	17 17
1858	253,613	46,420	281,496	51,524	535,109	97,944	30,819	5,641	416,757	76,281	11,461	2,098	23,698	4,338	1,017,844	186,302	55 5	15 3
											Qrs.	Tons.						
1859	272,042	49,793	393,345	71,996	665,387	121,789	37,622	6,886	526,566	96,380	41,336	7,566			1,270,911	232,621	50 6	13 16

* A quarter of Linseed weighs from 400 to 420 lbs. In calculating the tons 410 has been the factor employed.

TABLE Showing Annual AVERAGE PRICES in LONDON, for 10 years, of:—

	1849.	1850.	1851.	1852.	1853.	1854.*	1855.*	1856.	1857.	1858.
	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.	Per ton. £ s.
Linseed, E.I.	11 6	12 14	13 2	12 8	13 15	17 6	19 5	16 4	17 17	15 3
Rapeseed, E.I.	12 19	11 18	10 13	10 9	13 9	15 10	18 2	16 17	17 2	14 19
Tallow, P.Y.C.	38 11	37 6	38 2	39 0	50 5	64 5	57 0	53 1	59 2	52 0
Cocoanut Oil	34 1	31 6	30 10	34 7	41 1	49 11	44 9	43 2	48 5	39 8
Linseed Oil	26 8	32 2	31 11	27 7	29 9	34 1	39 8	36 3	38 5	31 1
Linseed Cakes	7 7	6 16	7 5	8 5	9 1	11 2	12 10	10 18	10 11	10 6
Rape Cakes	4 9	4 1	4 1	4 11	5 9	6 4	6 4	5 10	5 14	5 15

NOTE.—Linseed is the average of Bombay and Calcutta; Rape, of Guzerat and Scinde; Tallow, 1st Petersburg Yellow Candle Cocoanut Oil, of Cochin and Ceylon; Linseed Oil, London Oil; Linseed Cakes, London made. The Price of Tallow prior to the above dates was:—1844, £41; 1845, £40 3s.; 1846, £46 6s.; 1847, £48; 1848, £41 9s.

Linseed weighs from 400 to 420lbs. per quarter. In calculating the price per ton, 410 has been taken as the factor. Rapeseed weighs from 410 to 420lbs. per quarter. In this case 415 has been taken as the factor.

PRICES of LINSEED and RAPESEED per QUARTER are as under:—

	1849.	1850.	1851.	1852.	1853.	1854.*	1855.*	1856.	1857.	1858.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Linseed, E.I., per qr.	41 4	46 6	47 11	45 5	50 4	63 4	70 6	59 3	65 5	55 5
Rapeseed, E.I., per qr.	48 0	44 1	39 4	38 9	49 11	57 5	67 1	62 5	63 4	55 6

* The increase in prices in the years 1854 and 1855 shows the effect of the Russian war, particularly in the case of Linseed and Rapeseed.

Fig. 2.

Figure showing how thickly Flax should grow, when sown for the sake of its Fibre.

presence we are favoured to night), combined with the special efforts of Col. Clarke, the Deputy Commissioner in Goojranwalla, and, more recently still, owing to the efforts of Mr. E. Prinsep, in Sealkote, flax has been produced which has been declared by the Chambers of Commerce of Dundee, Belfast, and Leeds, to equal the best kinds received from Russia. Hence, it is now satisfactorily settled that the Punjab is capable of supplying all the wants of the flax trade. To this the reports of the Dundee and Belfast Chambers bear ample testimony, and I have the pleasure this evening of exhibiting to the Society a sample of flax received last year, which at the present time has been declared by the Messrs. Noble to be worth £64 per ton.

And now a word as regards the cost of production. We have the authority of Mr. Steiner, who conducted the whole of these experiments, and who has throughout given evidence of the possession of every one of those qualities which peculiarly fit a man for the task, that flax can be produced on the spot at the rate of £20 per ton, and that conveyance to the port of Kurrachee (from which it ought to be shipped direct to this country) will add £5, thus increasing the cost to £25.

On the other hand, Mr. Cope holds that the estimate is too low, and that flax cannot at present, in the face of transit and other difficulties, be landed at Kurrachee under £32 per ton. On this point I would remark that, even admitting that Mr. Cope's statement is nearer the truth than that of Mr. Steiner, if the flax produced is equal to what we have lately received it will bear even that expense, and not only prove a more remunerative crop to the Punjabee cultivator, but also a positive boon to those interested in the flax trade. And, again, if we look to the transit difficulties, which are now in course of being conquered, and reflect upon the fact that the commencement of any new cultivation is attended with considerable expense, we must conclude in favour of the probability that flax can be produced at a rate remunerative to all parties.

The map,* which accompanies this paper indicates the vast superiority of the Punjab, with respect to possible water-carriage, over almost every other country in the world. Four of its five great rivers might be navigated with no large expenditure during several months of the year. Irrigation, too, of a very large district being in course of accomplishment by the Ravee Doab Canal, we may conclude that the day is not far distant when flax will be brought down to the sea-port of Kurrachee at the price mentioned by Mr. Steiner, or, at most, at a cost of £28 per ton.

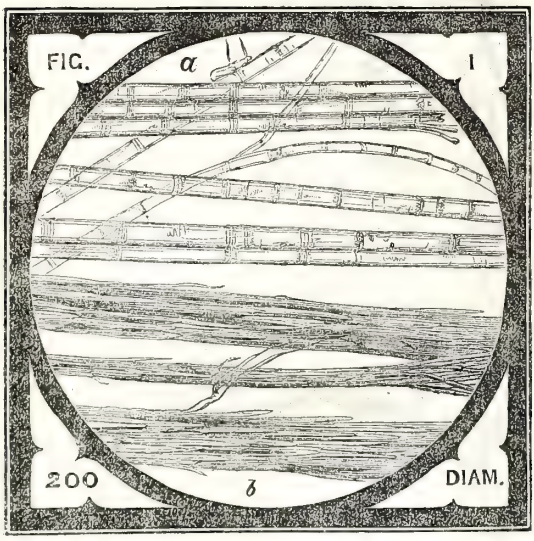
Nor does the Punjab stand alone. Other districts are well suited to the growth of flax for exportation, such as Saugur and Nerbudda, long since recommended by Dr. Royle and Mr. Williams, of Jubbulpore; its cultivation may probably be successfully undertaken as soon as the Great Indian Peninsular Railway is opened that length. Nevertheless, all our efforts should be directed without delay to the Punjab, as by far the most promising field.

There yet remain many subjects of interest connected with flax were there time to refer to them. The preparation of the fibre is, however, too important to be overlooked. And first with respect to retting. It has been held that the process invariably deteriorates both the strength and quality of the fibre, and there can be no doubt that when improperly carried out such is the case. But when this process is carried to the extent simply of dissolving out certain binding juices of the plant, and leaving the fibre in a more separable state, no evil consequence will result; nevertheless, in India more than ordinary care is required to put the process in operation, particularly in the case of inexperienced hands; if adopted, it must for some time be carried on in retteries under skilful management. Machines have, however, been invented, and others are in course of construction, for the extraction of the fibre from the dried stem, without the previous action of either dew or water retting. Could these be only furnished at a reasonable rate (as is the case with the hand cotton gins, which have resulted from the operations of the Cotton Supply Association), so as to enable the cultivator to purchase or hire them without resorting to

* The map, together with the woodcuts illustrative of the subject, have been presented to the Society of Arts by the Secretary of State for India in Council, with a view of aiding in the extension of our knowledge of some important conditions connected with our great Indian empire. In return for this, the Council of the Society has promised a donation of 3,000 copies of the paper for the purpose of distribution.

the means usually adopted, I believe a great impetus would be given to the development of flax culture. Flax thus prepared is, however, harsher to the touch, and less fitted for employment in the finer fabrics than when retted. As, however, by far the greater quantity of flax consumed in this country is expended on those coarser textures which chiefly require strength, it would be found that the larger quantity of flax so prepared would meet with a ready demand. If the finer qualities are wanted, there is abundant evidence that these can be produced by exposing the flax so prepared to the action of certain chemical steeps so as to impart the requisite softness and separation of the fibres. Several processes are at present in use for this purpose, and samples so prepared are before us this evening. The expense of such operations is said to amount to about £10 to £12 per ton, while the improvement in the quality of the fibre increases its value to an extent which far more than counterbalances such preliminary expenses, always supposing that the expenses will remain at the same figure when the operation is carried out on an extensive scale. These are points, however, which I must leave to be discussed by those more immediately interested in a commercial point of view.

One word as to the appearance of flax fibre under the microscope. It fortunately happens that, while flax is, as far as we at present know, the best and most useful fibre of its class, it is at the same time the one possessed of so characteristic an appearance when submitted to the searching of this instrument, that we can readily detect its admixture or adulteration, as the case may be, with fibres of an inferior quality. Under the ordinary manipulation, preparatory to microscopic examination, the toughness of the fibres and their ready divisibility into ultimate fibrillæ is ascertained. As seen at *a*, in Fig. I., it presents, at



a. Flax. (*Linum.*) *b*. Jute. (*Corchorus*).

varying distances, certain characteristic cross-markings. The outlines of the fibres are hard and smooth, and the ultimate fibrillæ can seldom be detected until carefully detached from the ordinary fibres.

The next important fibre to which I would refer, is the Rheea of Assam and other parts of India. Although it cannot yet be called an article of commerce, I believe that the fibre from this and other plants of the nettle species will occupy a place second only to that of flax. Figs. 3 and 4 represent the species best known in India.

The first is Urtica nivea, called also *Boehmeria nivea* and *Urtica tenacissima*. The other the *Boehmeria puya*, common in the north of India. The *Urtica nivea*, known also by the native names Caloee, Ramee, Kunkamis, and Goun, Dr. Roxburgh describes as growing luxuriantly in the Botanic Gardens of Calcutta, and states that it may be grown from cuttings as readily as the willow. In habit it is a shrub, varying in height from three to four feet. The branches are covered with short spreading hairs; the leaves, on long, hairy leaf-stems, broadly-caudate, with serrate margins, terminating suddenly in a fine point. the underleaf is covered with a dense white down; peduncles hairy, usually two together, carrying nearly sessile clusters of flowers; *a* represents a female flower; *d* a cluster of them; *b* a male flower; *c* the seeds of natural size; *e* magnified.

Boehmeria puya is a native of Bengal and Oude. The leaves, fig. 4, differ from those of *U. nivea*. The male flowers, *a*, are like those of the former species. The seeds also differ; *b* and *c* represent the denuded seed, much magnified; *d* the seed in its envelope or perianth.

Being a perennial, the expense of cultivation is less than that of most plants. It may be grown from seeds, but better by separating the roots. It will bear cutting down three times in a season; the first crop yielding coarse, the second and third fine fibres.

Sir William Hooker has proved *U. nivea* to be identical with the species which furnishes the grass-cloth of China, which, in point of texture and durability, has long been favourably known in the East, as well as in this country. This plant likewise attracted and received much attention at the hands of Colonel Hannay, as well as Capt. Jenkins, who have studied its production in Assam. *B. puya* flourishes considerably near Dharjeeling and at other places in the north.

The dried stems of both plants, of which specimens are before you, will further tend to display their character, as from their inner bark, or liber, the fibre has to be obtained. Experiments have been instituted in order to obtain the fibre from them. This has been accomplished, and the results are also before you. The proportion of fibre to stem has not been so accurately determined as I could wish, but it would appear to amount to from nine to ten per cent. No experiments have, however, yet been instituted, which will warrant my giving any definite statement as to the proportion of fibre. One thing I believe to be quite clear, even independently of the unadvisability of paying freight on refuse matter, the fibre cannot be advantageously extracted from the dried stems. That the rheea plant is very exhaustive, is proved by the following analysis of the stem and ash by Dr. T. K. Hornidge: —

The stems contained 8·61 per cent. of moisture. The dry stems consist of:—

Carbon	47·279
Hydrogen	6·265
Nitrogen	0·090
Oxygen	42·229
Ash	4·137
	100·000

The ash consists of—

Potash	32·37
Soda	16·39
Lime	8·40
Magnesia	5·39
Peroxide of iron	—·—
Chloride of Sodium	9·13
Phosphoric acid	9·61
Sulphuric acid	3·11
Carbonic acid	8·90
Silicic acid (with little charcoal and sand)	6·60
	99·90

Hence, in China arises the necessity for the application of manure where the culture of the plant is carefully attended to. This, however, will be the less necessary in

Fig. 3.

Rheea (*Urtica nivea*).

Fig. 4.

Ribera (*Bochmeria puya*).

many of our Indian soils, not only on account of their great fertility, but also of the practice of returning the ash of the refuse stems. The chief expense of preparing the Rheea fibre arises from the mode of manipulation, the process being sufficiently simple. When the plant is ready for cutting, the stalks, as you see them in bundles, are cut down about two or three inches above the soil. As the stalks are made up into bundles, they are either carried home, or on the spot taken by an expert hand, separately broken through the middle, and, by a smart movement of the right hand to either side, the thumb is passed up, and the fibre is ripped off with its adherent bark. The fibre is then steeped in water for a few hours, and thus much discolored refuse matter is withdrawn; but such a steeping does not appear to be absolutely necessary. The fibre with the bark is then fastened by one end to a hook. The operator takes one strand at a time, and holding the thicker end in his left hand, with slight tension passes the thumb of his right hand along the inside of the strand, which at once disengages the bark. This falls down, and whatever feculent matter may remain in the fibre is dexterously forced out by pressure with a blunt knife held in the right hand. When the bundle is finished, it is put out to dry if there is sun, if not it is spread out in an exposed building. When thoroughly dry it can be put aside.

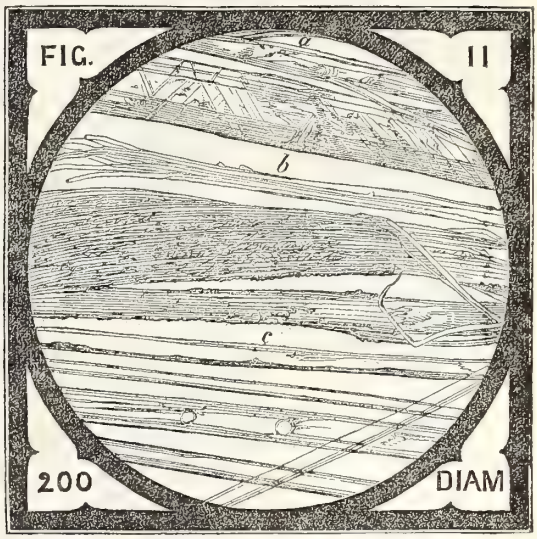
To produce the beautiful fibre exhibited, it has to be exposed to certain alkaline reagents. According to one process a soap is produced among the fibres by the conversion of oil, which has been previously added, into that substance by the addition of ammonia. Care must be taken not to damage the strength of the fibre.

The introduction of machinery into the manufacture of the fibre is a great desideratum. In Assam, where the plant is at present chiefly cultivated, which will be seen from the separate Table which accompanies the map, the population is sparse and labour comparatively dear. The machinery required must embrace two classes of operations. First, that of crushing the fresh young stems, and then of removing all but the fibres; otherwise, steeping must be resorted to as a preliminary process. If the whole of the operation could be economically carried out at once, so much the better. And this question of adapting suitable machinery for the preparation of this class of fibres, I would earnestly recommend to the attention of those who have a genius for such inventions.

As to cost of production, I can make no positive statements. The value of the prepared fibre is, however, such as would most amply repay a very large outlay. It is impossible to embrace the many purposes for which the Rheea is suited, although a notion may be formed from the samples of manufacture brought from Bradford, and now displayed.* To the touch they present a peculiar roughness, owing to slight asperities on the surface of the individual fibres, which confer the property of allowing it to be readily spun into fine thread, as well as being mixed with, and spun on machinery adapted for woollens. It may be possible to mix it with our much-despised shoddy, and so to give the latter that strength which it so much lacks.

Under the microscope (see *a*. fig. II.) its fibres present the roughness already alluded to, and when viewed under reflected light have an appearance not unlike frosted glass. Considering their value, it is as well that all nettle fibres are readily detected by this instrument, as they all indicate, with certain modifications, the same kind of structure.

The plant I would next draw attention to, as affording a fibre of great strength, is the *Urtica heterophylla*, of Roxburgh, or Neilgherry nettle. It is known by the various native names—Horoo Surat, Herpah, or Serpah, Bhootea, and Theng Mah. It is so similar to wool when crumpled up, that even merchants from a casual glance have not detected the difference, hence the common name of vegetable wool by which the plant is known. Under the microscope (*b*, Fig. II.), it indicates considerably greater asperities than the Rheea, consequently it is better suited for admixture with wool.



a. Rheea. (*Urtica.*) *b*. Neilgherry Nettle. (*Urtica.*) *c*. Bedoola Sutta. (*Pederia.*)

The Neilgherry nettle, or *Urtica heterophylla*, is the most widely diffused of the large Indian nettles. It is an annual of a most formidable character. (Fig. 5.) It has upright angular stems, covered with small prickles, and marked with small white specks. The leaves are similarly protected by bristles; they are irregularly serrate, long, variously lobed, petioled, and almost caudate at the base. From the severe injuries consequent upon a sting, there are greater difficulties in manipulating it, so as to obtain its fibre than in the case of the Rheea. The natives on the Neilgherries first boil the plant before subjecting it to manipulation. The necessity for machinery in this case, too, is also sufficiently obvious.

The next fibre on my list is that of the Mudar, or *Calotropis gigantea*, called by the natives Yercum, Ak, Mudar, Muddar, Tella jilladdoo, &c. It is one of the most common jungle plants of India, and appears to flourish on any and all soils, requiring neither culture nor irrigation.

Fig. 6 represents the plant. It is a perennial, and matures within the year. The leaves enclasp the stem, and are covered underneath with down; they are wedge-shaped and oblongate. The flowers are rose-coloured and purple mixed; segments of the corolla reflexed, with revolute edges. A silken floss surrounds the seeds.

Its fibres, in Dr. Wight's experiments, took the first rank in point of strength. In Fig. III., *e*, (page 462) their microscopic appearance is presented; it is not unlike flax without its transverse markings. The ultimate fibres are, however, distinctly to be seen in the ordinary bundles, which is not the case with flax.

As may be witnessed by the specimens upon the table, the finest fabrics can be manufactured from the Mudar; and yet the fibre-extraction is the most difficult of any in India. The plant stems are succulent, and contain a quantity of juice of an acrid description, which is used as a medicine by the natives, and in addition a gum-resin, which Dr. Riddell has shown to possess many of the valuable properties of gutta percha. It is, however, in all probability the acrid juice which so interferes with the separation of the fibres by any of the ordinary methods. Hitherto the fibres have had to be separated from the fresh plant by means of the fingers, and

* These samples of Rheea manufacture (forty in number), kindly lent by Mr. Whitaker, of Bradford, excited much attention.

Fig. 5.

Neilgherry Nettle (*Urtica heterophylla*).

not only the native, but even Dr. Hunter's more elaborate methods, have proved that steeping cannot be employed at all, for even short periods. The dissolved juices, set free from the lactiferous vessels, appear to act upon the fibres and to injure them. As long, therefore, as the fibres shall have to be separated by the hand, Mudar is not likely to come into general use. It is, however, possible that a method may be devised for obviating this difficulty. But without such method the fibres can never take the rank for which they seem designed.

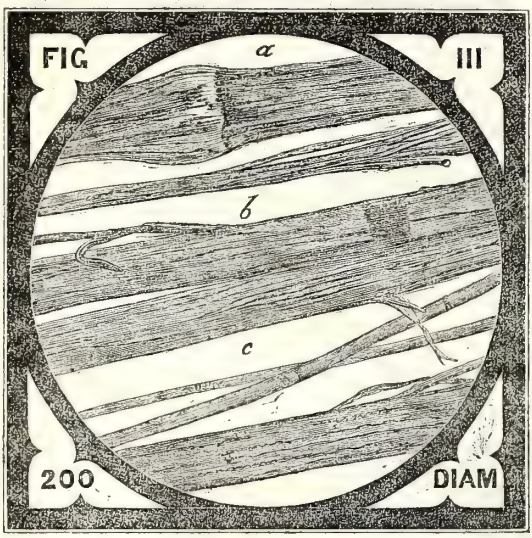
The per-centage yield of fibre seems small. The floss from the seed is useful for stuffing pillows, and also, notwithstanding the smoothness and absence of twist in the fibre, for manufacturing into fabrics of a soft but unenduring description. It was long since suggested by Dr. Roxburgh as a substitute for silk, and it certainly seems to me a better one than the *Palu* produced by a fern, and known by the name of vegetable silk, which is now exciting attention. At all events, it is deserving of trial.

The last fibre of this class to which I would refer, is called, in Assam, *Bedolee sutta*. Botanists call the plant which yields it *Pederia fœtida*, from the offensive odour exhaled by the crushed plant. The specimens of the stems and fibres of this plant which I have the pleasure of introducing to your notice to-night, have been sent me by Colonel Hannay, than whom no one has been more devoted to the development of the resources of Assam. Although referred to in Rumphius' works, Vol. x., p. 436, under the name of *Convolvulus fœtidus*, no better description of the plant is contained than that given in Col. Hannay's letter; I shall therefore quote the most interesting portion:—"The plant which produces this very delicate and strong fibre is a creeper, running along the ground, and is abundant in the jungles, but the best description of fibre is obtained from that which grows on grass alluvial deposits of rivers. It forms a complete network along the ground on some of the old deposits of the large rivers. There is another species which climbs trees, but the former is preferable as regards fibre. The flower of the tree-climbing plant is used by the natives for blackening the teeth; the

FIG. 6.

MUDAR (*Calotropis gigantea*).

plant has also medicinal properties, and is eaten most voraciously by elephants. The fibre, it will be perceived, lies in joints, varying in length according to the luxuriance of growth. The length is cut at each joint, and the



a Safet Buriala (*Sida Rhomboidea*). *b* Ambaree (*Hibiscus*). *c* Mudar (*Calotropis*).

fibre extracted when the plant is fresh and green, from each separately. The operator takes a joint, and holding it by each end, twists it about as much as he can, thus disengaging the fibre. This, however, is done after the entire bark has been carefully stripped off. He then disengages the fibre at one end sufficiently to lay hold of, and gradually pulls the silken fibre away from end to end till none remains. This is a very slow, and must be a very expensive process, but it is one in which the children of a family can be employed by day and night, so long as material lasts. The practicability of the success of this speculation can only be tested by the personal observation of practical men. A steady demand, and a high value of the article in the European market, might cheapen the manufacturing process, and improve the method. The plant is abundant, and, I have every reason to believe, might be cultivated. As it is, however, the supply could scarcely be exhausted, as the best grass plains on which the Pederia luxuriates, are burnt down yearly, and during the rains the roots throw out fresh shoots. The proper season for collecting the fibre is that commonly called the cold or dry season. I have noticed that, during the rains, the fibre comes off dirty and discoloured, but in the dry season clean and silky."

It is a fibre possessed of great strength and flexibility. Under the microscope (Fig. II. *c*.) it presents a perfectly characteristic appearance, being that of a smooth solid cylinder with very slight markings.

With respect to the separation of the fibre, a few remarks may be made. They will in a measure apply to all creepers. In these the length of the fibre is dependent in a measure upon the interval between the joints. In the case of the Pederia these are not more than a foot in length; it is therefore evident that, unless some other mode than that described is adopted, the supply of the fibre must be very limited. If suited for spinning on our flax machinery, its value must be very great, probably, indeed, from £150 to £200 per ton.

Here then, again, machinery will be required, and greater lengths than those presented by single joints will have to be operated upon.

These remarks, then, conclude what I hope may be considered the more prominent points of interest connected with this class of plants so fitted for textile purposes.

At an earlier period I have mentioned that I should place the well-known Jute of commerce at the head of the next group, because it now occupies a most important position amongst the supplies of raw textiles furnished to this country.

There are two species which afford the jute of commerce, viz., *Corchorus capsularis*, and *C. olitorius*. The natives call the latter *Putta; Pat*. It is an annual, growing to the height of 5 to 6 ft.; it belongs to the same family as the Limes. Tiliaceæ; its leaves are alternate, egg-shaped, and serrate, the two lower serratures ending in a slender thread. The flowers are small, and have five yellow petals; the flower stems one to two flowers. The seed-capsules are nearly cylindrical, and contain numerous seeds. It flowers in July and August.

Fig. 7 represents *C. capsularis*, the Ghi-nalita pat of the Bengalee. The capsules are short and globose, wrinkled and muricated, with five cells, and composed of five valves. Seeds few in each cell, and without transverse partitions.

Jute is very largely cultivated, particularly throughout the Bengal Presidency. Table III. represents the quantity of jute and jute rope exported from India and each presidency to all parts, from 1850-51 to 1857-58, and although gunny bags and gunnies (pieces of gunny cloth) are occasionally made from other fibres, still the proportion of these is so small that they may be disregarded. According to a statement made to me by the Messrs. Noble, from whom I have received much valuable assistance in filling up the various columns of prices in the Tables, each gunny-bag weighs on an average 2lbs. The gunnies are usually in pieces of 30 yards, and weigh on an average 6lbs., but in converting these into lbs. and tons, the numbers 2 and 45 have been the factors employed. This, when applied to Table IV., gives for 1858 upwards of 118,000 tons weight of jute manufacture to be added to the 39,000 tons exported to all parts during the same year; and taking 1855-56, which is the year of largest exports, we find that 225,000 tons have to be added to the 44,000 exported to all parts, giving upwards of 269,000 tons as the total quantity of jute, in either the raw or manufactured state exported from the whole of India, or considerably more than the whole of the flax and hemp fibres consumed in this country during the same year. This brings out in a strong light the enormous jute-production in India. For, in addition to what is exported, jute is largely employed in the country itself, and it is commonly reported that the jute grown by the natives for their own purposes is much superior to that exported.

The jute which presents a fine glossy appearance, obtains the best price in the market.

The effect is produced by cutting down the plant, which is at all times a quick grower, some time before the fibre has become matured. The natives, however, for their own use, allow it to remain longer in the ground, in order to strengthen the fibre, but with even this advantage jute cannot be legitimately employed when lasting properties are required.

Water-retting is the process adopted for separating the fibre, which strips off very readily after the operation. Judging from this fact, the nature of the stem, and the price of jute, as shown in Table V., it does not seem probable that the application of machinery can be accomplished with profit. If this opinion be correct, its quality will not improve.

In Table VI. I have attempted to give the number of acres under cultivation for jute and other fibres in various districts of India. However imperfect, it indicates some points of interest.

The presence of jute is readily distinguished by the microscope. Fig. I. *b* affords a good illustration, and shows the marked difference between it and flax. Jute has a rougher outline, and is much more opaque than flax; it

has no definite cross markings, and the cells frequently terminate in a tongue-like shape.

Leaving the subject of jute, we would draw attention to *Sida rhomboidea*, the *Safet* and *Lal bariala* of Bengal. The whole family of plants to which the common mallow belongs, contains species valuable for their fibres. One species of the genus above-named—the *Sida picta*—has been long cultivated in our green-houses, and even out of doors, on account of the beauty of its flower and the abundance of its foliage; and this species, we believe, is cultivated in China as a substitute for hemp and flax.

Dr. Roxburgh says, with reference to *Sida Arbutilon*, the

FIG. 7.

JUTE (*Corchorus capsularis.*)

fibre of this plant is strong and pliable, very silky in its nature, and the plant of very rapid and luxuriant growth, three crops being obtained in one year.

Fig. 8 represents the *Sida rhomboidea*, in which we are most interested. It is a shrub with serrated, rhomboid, lanceolate leaves, the underside of which are covered with down. The flowers are rather small, and of yellow colour.

The plant is well-known to the natives of Bengal, and samples of the fibre have lately been received at Dundee, and favourably reported on by Mr. Sturrock, the secretary of the Dundee Chamber of Commerce, to whom I am also indebted for much valuable information. It is said to be in all respects superior to jute, and worth at least £5 per ton more. In the case, however, of a comparatively unknown fibre, it is almost impossible to speak of its value until the point has been practically determined. One sample now before the meeting has been valued at £26 per ton, a price £8 above that of the best jute. It is, therefore, clearly worthy of renewed attention.

The microscopic appearance of the fibre, in *a*, Fig. III. (p. 462), exhibits a regular, distinct longitudinal

Fig. 8.

Safet bariala (*Sida rhomboidea*).

structure. It is opaque and slightly woody. By reflected light it presents a pearly appearance, not unlike that seen in endogenous fibres from New Zealand flax.

Our next fibre is that from the *Hibiscus cannabinus*, hemp-leaved Hibiscus; Palungoo, Madras; Ambaree in Western India; Kongkura, Tamil; Maesta paut, Bengalee; and Deckannee hemp; Indian hemp sometimes.

Fig. 9 affords a fair representation* of the plant, which

Fig. 9.

Ambaree (*Hibiscus cannabinus*).

is very generally cultivated in India. The stem is straight, and from three to seven feet high, with prickles here and there. The leaves alternate—the lower heart-shaped, the upper smooth and serrate, and three, four, and five lobes. The flowers are solitary, with short flower-stalks in the axes of the leaves, of a pale yellow colour, very large, with purple centre. Of the double calyx, *a*, the outer is seven to eight-leaved; stamina, *b*, numerous. The carpels, *d*, are joined into a five-celled, five-valved capsule, with but few seeds in each cell. It is herbaceous, and of three months' duration. It is sown in the cold season, in a rich, loose soil, as thickly as hemp. Colonel Sykes mentions it as one of the plants grown in the wet season. Though so generally cultivated, its fibre is but little known in commerce.

This plant is capable of very easy cultivation, but the fibres introduced into our markets have hitherto been very badly prepared; consequently they take a much lower place than would seem to be their due, if in the state of the specimens now before us. In the trade it is often called Bastard jute. Particularly in Western India its growth is likely to repay attention.

Under the microscope it presents an appearance, fig. III., *b*, not unlike that of the *sida*. Its ultimate fibres are readily obtained.

The next group of fibres embraces those employed for twine or cordage purposes. Chief among these stands the *Cannabis sativa*, or true hemp, called *Gunja*. It is grown in India for the sake of the intoxicating properties of the resin which exudes from its leaves, called bhang; it is not generally cultivated for its fibres. In the Himalayas these are used for economic purposes. Hemp, fig. 10, is an annual; diœcious; from three to ten feet high, according to soil. The stem is erect, hollow within, and filled with a soft pith. It is covered with a thin bark, made up of parallel fibres, united by cellular tissue, and coated with a thin membrane. The leaves are opposite or alternate, on long leafstalks, made up of from five to seven narrow, lanceolate, sharply-serrated leaflets. Flowers in spikes; axillary, small, greenish white. Males, on a separate plant, lax and drooping. Females erect, leafy at the base.

Its seeds are sown about the end of May and beginning of June. The ground must be cleared of weeds and the plants thinned, with a distance between each of three or four inches.

Hemp, unlike flax, requires to be carefully manured, and flourishes best in a virgin soil. It grows in great abundance in the North of the Punjab, as well as in the Himalayas, and at elevations varying from 1,500 to 10,000 feet. Plants 14 feet in height have been found at an elevation of 9,000 feet. No fibre of value is obtainable from wild hemp. We have however the high authority of Dr. Jamieson for the statement that hemp of superior quality is obtainable in the Doons or vallies in the North, as well as on the mountains, and it is probable that in this, as in so many other cases already recorded, more attention to its culture would ensure large and profitable production. Taking however the common experience into consideration, as well as the fact that it is only grown successfully at great elevations, we cannot expect it to become an article of export without improved means of communication as well as of cultivation. In strength the Himalaya hemp is very superior to the best Russian.

Fig. IV. affords an admirable illustration of Russian (*a*), Himalayan (*b*), and Italian (*c*) fibres. They are not unlike flax, except as to the transverse markings in which hemp is usually defective; when present, they are not nearly so pronounced. Some samples of fine hemp can however scarcely be distinguished from flax.

The largest proportion of the so-called hemp exported to this country is supplied by the *Crotalaria juncea*, or Sunn. It is cultivated everywhere in India. Its fibre constitutes the brown hemp of commerce, and is also known under the names of Madras hemp, Taagor Conkanee hemp, Salsette and Bombay hemp. Fig. 11 (p. 468) represents a portion of the plant.

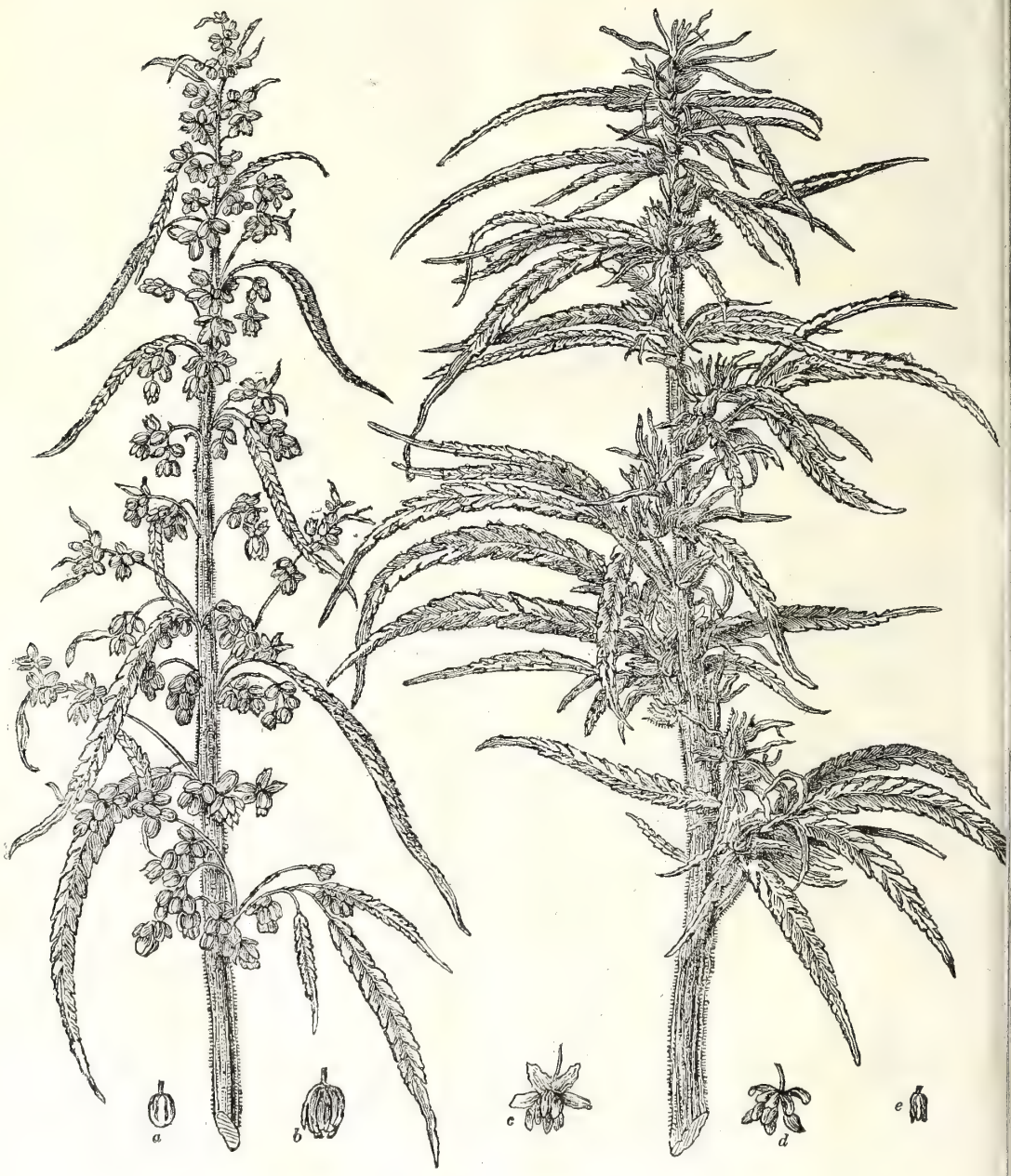
It is a small plant, 4ft. 8in. high, straight, smooth, striated. The leaves are scattered, lanceolate; the flowers

* Not quite a correct one, as the lower leaves should be heart-shaped.

of a beautiful bright colour, like our broom. Calyx 2-lipped; anthers on the shorter filaments linear, on the longer two-lobed, round-hearted; seed numerous, kidney-shaped.

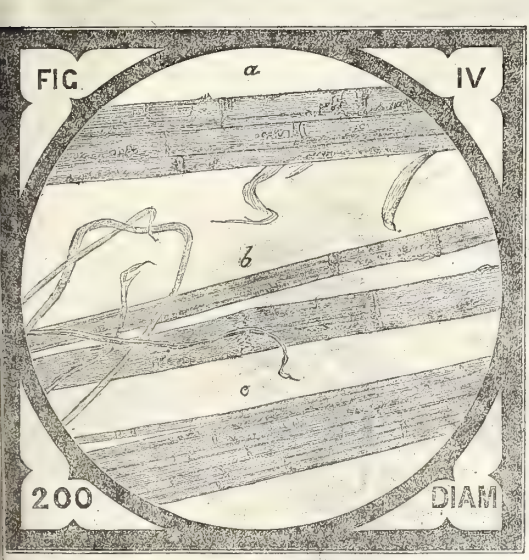
The *Crotalaria* has been known for its fibre-yielding qualities frem the earliest times, and illustrates forcibly the effects of variety of climate upon the same plant. Although sometimes rather harsh, it is, nevertheless, admi-

Fig 10.



Hemp (*Cannabis sativa*).

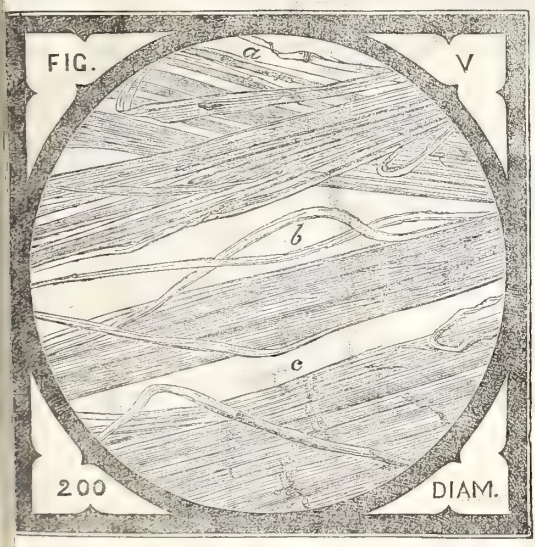
rably adapted for many cordage purposes, when a light and white colour is principally looked for.



a. Russian hemp. *b.* Himalayan „ *c.* Italian „ } (*Cannabis.*)

The following is an extract from a letter received from Mr. Manning, of the establishment of the Messrs. Noble, on the uses of the different Indian fibres now imported into this country:—"It is chiefly worked up in Ireland. The quantity, however, has within the last two years fallen off so much, and Italian hemp become so much lower in price, that the latter has been substituted. The unskilfully prepared Bombay hemp is found to be much less enduring than that from Madras and Bengal, and on this account rope made from it is carefully avoided by all first-class ship-chandlers."

The fibre is prepared in the ordinary way by steeping. On account of its low price, the economical application of machinery becomes difficult. Yet, if the Bombay trade in Sunn hemp is to continue at all, more attention must be paid to its preparation. (For an admirable *resumé* of various interesting details connected with this plant, Royle's work must be consulted.)



a. Sunn (*Crotalaria*). *b.* Jetee (*Marsdenia*). *c.* Dhunchee (*Sesbania*).

Viewed under the microscope, the fibres of the Sunn (Fig. V. *a*) appear rather like those of hemp, but straighter and more rough in appearance, without any cross markings whatever.

And now a few words with regard to the Dhunchee, *Sesbanea aculeata*. For rope-making purposes, the fibre of this plant is much valued, and is spoken of in the highest terms by Mr. Thomas Watson, late of Calcutta, who made many experiments on its power of resisting the action of various chemicals. He considers it one of the best for resisting the action of protracted exposure to water, and therefore admirably suited for cables and ropes. It is said to contract much when wetted. These points, however, require further investigation.

I have not been able to secure a figure of the plant, but *c*, in Fig. V., represents the microscopic appearance of its fibres, which are very regular in diameter. Its structure is what will be understood by the term woody.

Marsdenia tenacissima is the Jetee fibre, or Rajmahal bowstring creeper. This elegant plant was first made known by Mr. W. Roxburgh, who found it growing wild, in 1800, in the hills of Rajmahal. Fig. 12 conveys an excellent idea of the plant. It is a perennial climber, with few branches, and young downy shoots. The leaves are opposite, very remote, cordate, acute-pointed. They are placed on long leaf stalks, and are about 4 feet 6 inches long and 3 feet 4 inches broad. The panicles are interfoliaceous, large and drooping, composed of alternate drooping branches of numerous little umbellets of pretty greenish-yellow flowers. The *calyx* is deeply five-cleft; the *corolla*, *a*, Fig. 12, salver shaped; divisions of the border, *b*, obliquely oval, with rounded apexes, greenish towards the centre, with the exterior half yellow. Seeds very numerous.

On account of their strength and silken beauty, the fibres are much valued. During the rains, says Roxburgh, the natives cut the shoots into lengths at the insertion of the leaves, pull off the bark, and with their nails, or a bit of stick on a board, remove the pulpy part. A person accustomed to the work will clean as much as 6 lbs. of fibre in a day.

It is a plant which might be readily cultivated, but there are many difficulties connected with the successful growth of creepers, as I have already mentioned when speaking of the *Pederia fœtida*. These, to a great extent, are equally applicable in the present case.

The ultimate fibres of this plant are regular in diameter, but present slight rugosities on the surface. See *b*, Fig. V.

We come now in natural course to the details connected with the second great division of fibre-yielding plants, viz., that of Endogens, and as the space already occupied by the first division is greater than I had anticipated, I propose, in enumerating certain plants, to deal only with those points which have a more immediate interest.

The pine-apple *Ananassa sativa*, is too well known to need description. Fig. 13 (p. 470) is inserted to impress on the mind the nature of the leaf which furnishes the beautiful fibre I am able to produce, and which I have already distinguished as being the only one from an indigenous plant ever likely to be employed for spinning. It has become completely indigenous, and now covers large tracts of country in various directions. It flourishes in Assam, and abounds on the Khasia hills, and in the vicinity of Rangoon, as well as in the Tenasserim provinces, and near to Singapore. Its fibres are of great strength, and as divisible as those of flax, besides which, its lustre fits it pre-eminently for the manufacture of dress fabrics. The samples on the table are valued at £50 per ton. It is thought, however, that if it could be introduced as a regular article of import, it would fetch a higher price.

Fig. VI. represents the fibres as seen under the microscope. They have a somewhat opalescent, glass-like appearance. Viewed with an inch object-glass, they appear to refract the light in a peculiar manner.

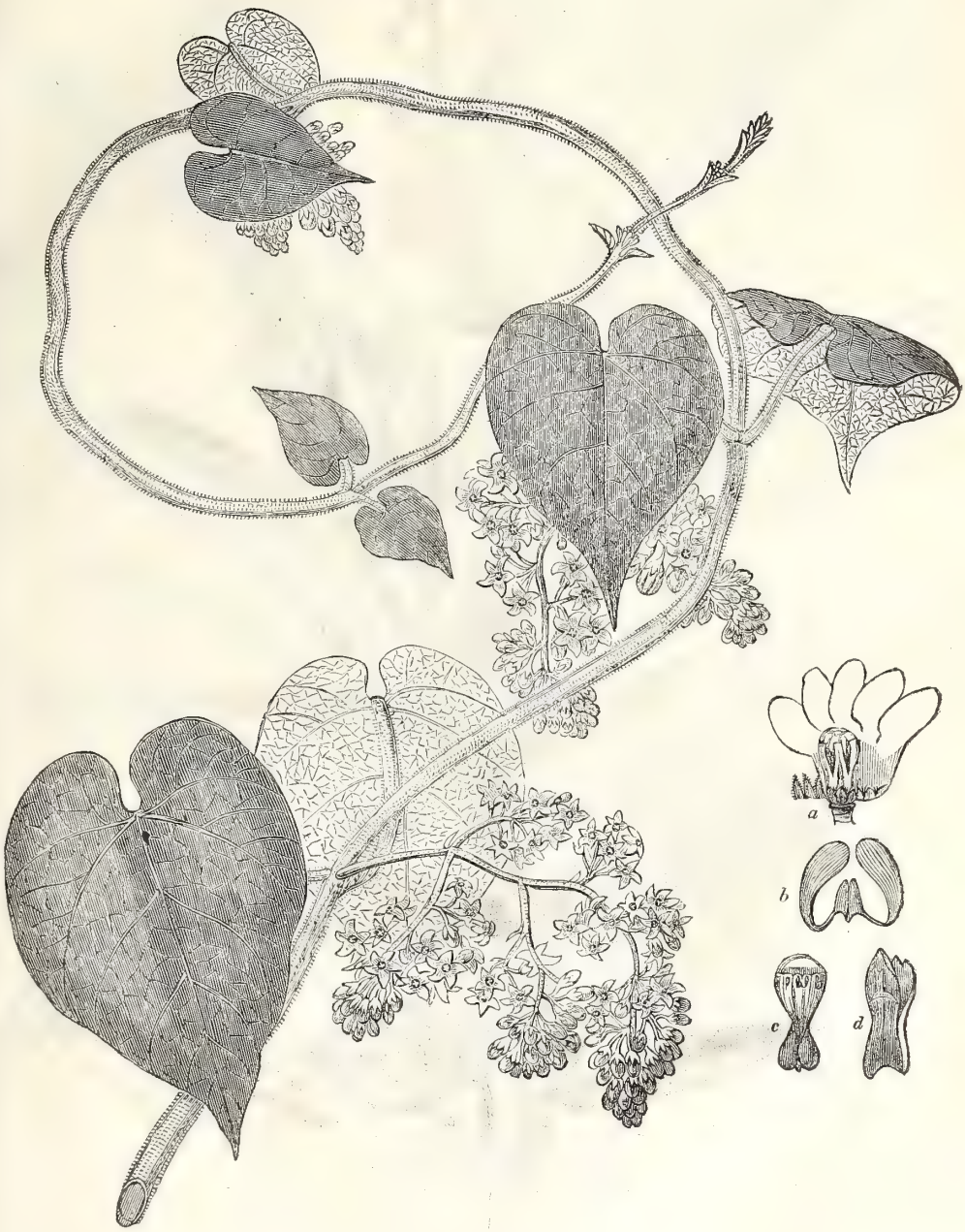
As regards the mode of preparing the fibre of endogens for the market, a few words must suffice. In the case of the more or less fleshy leaves and leaf-stalks, a system of crushing followed by scraping is adopted; the sooner

Fig. 11.

Sunn (*Crotalaria juncea*).

after the leaf has been pulled, the better. The natives usually first beat and then scrape off the extraneous substances until the fibres are left. Dr. Hunter strongly recommends that the bundles of fibres should be at once cleansed and dried after removal. Machinery is essential. Even a cheap hand-crusher would be a great boon, for when the leaf is thoroughly bruised, the removal and cleansing of the fibre is not difficult.

Fig. 12.



Jetee (*Marsdenia tenacissima*).

The *Moorva* fibre is from the *Sanseviera zeylanica*. Fig. 14, from Dr. Roxburgh's Coromandel plants is an excellent representation. It is also called Marool, Murva and Maral. It is a liliaceous plant, growing all along the Bay of Bengal, around Ceylon, Java and the coast of China. There are several species, all closely allied to each other, perennial, with stoles as thick as the little finger running underground. All the leaves are radical, the outermost being both shortest and thickest, the interior leaves almost upright and from 1 to 4 feet long. They are somewhat spinated and clouded with blue. The flowers are greenish-white, erect, and collected in bundles of 4 to 6 on the raceme. Calyx there is none. The corolla *a* is one-petaled, funnel-shaped, half six-cleft; the filaments are about the length of the divisions of the corolla. The style is of the same length as the stamina. The berries *b* are globular; one, two, or three slightly united above; they are orange-coloured, and of the size of a pea.

It grows under bushes in the jungle, in almost every kind of soil. The plant is a perennial, and readily propo-

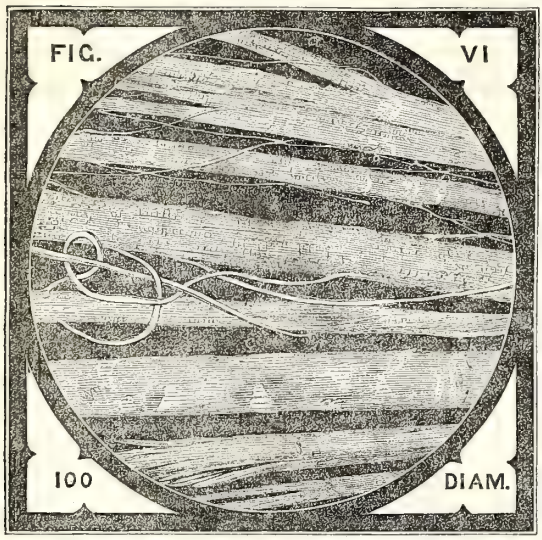
Fig. 13.

Pine Apple (*Ananassa sativa*).

FIG. 14.

MOORVA (*Sansevera Zeylanica*).

gated from slips. It flowers in the cold season and beginning of the hot; therefore, from January to May. When the plants are even moderately watered, they grow from three to four feet high. The leaves contain a number of



a. Pine-apple (*Ananassa*). *b.* New Zealand Flax (*Phormium*).
c. Manilla Hemp (*Musa*).

fine, strong, longitudinal, white fibres, which the natives strip off from the pulpy parts. They lay a single leaf on a smooth board, and fastening one end by the great toe, they scrape the leaf from them with a thin slice of wood held by both hands. According to Roxburgh, about 80lbs. of fresh leaves afford 1lb. of clean fibre, which would be at the rate of 1,613lbs. per acre for one gathering. Two crops are, however, obtainable in one year. Full grown leaves, however, have occasionally yielded a much larger per centage of fibre.

The strength of the fibre is very great. According to Dr. Wight it bore a weight of 316lbs. A cheaper mode of cleaning the fibre is much wanted. Steeping seems both to weaken and discolour it.

The fibres are worth about £40 per ton, and are admirably adapted for the manufacture of the finer qualities of string and twine.

Under the microscope, it presents an appearance very like that of the pine-apple, but its ultimate fibres are fully twice as large. Nevertheless, the opalescence is almost absent, and the fibres more opaque.

Figs. 15 and 16 are from Col. Sykes's Deccan plants. They were executed by a native artist, and afford fair representations of a most useful class of fibre-yielding plants, called *Agave*, and frequently mis-named aloes. Fig. 15 is *A. americana*, and Fig. 16 the *Agave vivipara* or *Fourcroya gigantea*. Both plants are now tolerably abundant, and might be cultivated extensively for the sake of their fibres. Even now they are employed in the manufacture of cloth in imitation of horsehair. The length of the fibre has much to do with its price; the samples before the meeting are of the respective values of £18, £28, and £45 per ton.

The appearance of opalescence is much more marked than in the pine-apple, than which, however, the fibre is three times larger.

The *Yucca*, or Adam's needle, is also worthy of cultivation, as it yields a valuable fibre. Fig. 17 (p. 474) represents the *Yucca gloriosa*. There are other species, all of which

TABLE

SHOWING THE QUANTITY AND VALUE OF **OTHER FIBRES*** OF THE NATURE OF HEMP, BUT EXCLUSIVE OF HEMP AND JUTE, IMPORTED INTO THE UNITED KINGDOM, AND THE PRICES OF DIFFERENT KINDS OF FIBRES IN THE LONDON MARKET.

Years.	Quantity.		Value.	PRICES OF DIFFERENT FIBRES IN LONDON MARKET.											
				"Sunn Hemp."		"Bombay Hemp."		"Manilla Hemp."		New Zealand Flax.					
										Undressed.			Dressed.		
	lbs.	tons.	£	per lb. d.	per ton. £	per lb. £	per ton. £	per lb. d.	per ton. £	per lb. d.	per ton. £	per lb. d.	per ton. £
1850	...	...	...	1 7/8 to 2 1/8	18 to 20	1 5/8 to 1 7/8	15 to 17	3 1/4 to 3 7/8	33 to 37	2 1/8	23	3 3/8	31
1851	...	...	...	1 7/8 to 2 1/8	18 10s. to 19 10s.	1 7/8 to 2 1/8	17 19	4 1/4 5 1/8	42 50	2 1/4	21	3 3/4	30
1852	...	...	...	1 7/8	18 10s.	1 7/8 2	17 19	4 5 1/4	38 49	2 3/8	22 10s.	3 3/8	32
1853	...	...	...	2 to 2 5/8	19 to 24	1 3/8 1 7/8	13 18	4 1/8 4 5/8	39 43	2 1/8 2 3/8	25		
1854	1,886,080	842	21,462	2 1/8	20 23	1 7/8 2	17 19	4 1/8 4 7/8	39 45	2 7/8 to 3 1/8	27 to 29	3 7/8 to 4 1/8	36 to 39
1855	963,200	430	10,309	2 1/4 2 1/2	21 23	1 7/8 2	17 19	2 7/8 3 1/8	27 36	2 5/8	25	3 1/2	33
1856	615,900	275	6,534	1 1/2	14 17	1 7/8 2 1/8	18 20	3 1/4 5	33 47	2 1/4 2 1/8	20 10s.	3 1/4	30
1857	3,064,320	1,368	33,567	2 2 3/8	19 22	1 5/8 2 1/8	16 23	3 3 1/4	28 35	2 1/8	20	2 3/4 to 2 7/8	26 to 27
1858	2,033,920	908	20,987	1 5/8 2 3/8	16 22	1 7/8 2 1/8	17 23	2 5/8 4 1/8	24 38	2	19	2 5/8 2 3/4	25 10s. to 26
1859	1,169,280	522	10,699	1 7/8 2 1/2	17 23	1 5/8 2 1/8	16 23	2 1/4 3 1/4	21 30	1 7/8	17 to 18		

* Not distinguished in Board of Trade Returns until 5th April, 1852. Before then included with Hemp.

furnish fibres from two to four feet in length. The shorter samples are worth from £24 to £25, the longer from £34 to £35 per ton.

The PLANTAIN, *Musa paradisiaca*, Fig. 18, (p. 475) so universally cultivated for the sake of its fruit, has leaves which furnish a tolerable fibre, suitable to certain purposes. It is, however, weaker than either of the former. Whether it will pay to prepare, except by machinery, depends upon the per centage of fibre, a point yet to be accurately determined. Proximately, it may be said to yield from four to six per cent. The value of the samples upon the table is £22 per ton. They would be worth more were it not for the large stocks on hand of another Musa, the *Musa textilis*, or Manilla hemp.

The microscopic appearance of the plantain is similar to that presented by other indigenous fibres, but it has in addition distinct cross-markings. It is rather brittle, and not easily separable.

Although not an Indian plant, the *Musa textilis* must not be entirely overlooked. Its fibre is chiefly useful for the manufacture of cordage for the standing rigging of ships, for which its lightness and great strength admirably adapt it. It is almost entirely produced in the Philippine Islands. Exports of hemp, under the head of Philippine Islands, in Table V., consist almost entirely of this Manilla hemp. The Table (p. 472) gives the price per lb.

FIG. 15.

(*Agave Americana.*)

FIG. 16.

(*Fourcroya gigantea.*)

and per ton since 1850, and indicates great fluctuations in price, dependent on the at present limited demand.

As a subject of general interest, I have introduced an illustration of another plant, which at times has received much attention on account of its great strength. This is the *Phormium tenax*, or New Zealand flax, represented in Fig. 19 (p. 477). Its leaves are radical, in bundles, like the Iris. It grows from 3 to 5 feet high. The raceme

Fig. 17.

(*Yucca gbriosa*).

Fig. 18.

Plantain (*Musa paradisiaca.*)

rises from the midst of a bundle of leaves to a height of more than 6 feet. *a* is a flower, *b* a flower stripped, *c* pistil, *d* transverse section of ovarium, *e* entire capsule of transverse section, *g* seeds. Its leaves furnish the so-called flax. In appearance it is much like the former, with the same great disadvantage as a cordage material that it will not bear to be knotted. Its price in the undressed and dressed condition for the past ten years may be inferred from the Table at page 472.

The fibre of New Zealand flax presents under the microscope a peculiar flossy appearance. In other respects it is similar to those of the same class.

Coir, the product of the cocoa-nut palm, needs but be mentioned. It is imported, as will be seen by the Table below, in considerable quantities. Coir yarn has been, and is likely to be in great demand, the matting trade having lately so much increased. Table VII. refers to this fibre. Yarn from Cochin (which maintains its character as the port for shipment of the best quality of coir-yarn) has this season already been shipped to the extent of about 24,000 cwt. That coming from Bombay is received with suspicion, as some years ago it arrived falsely packed and "country damaged," which has prejudiced the sale of this class of yarn. The demand for coir-rope has much fallen off, and only the best kind of Cochin is likely to pay importers. Coir fibre (for mats), and the stiffer kinds for the brush manufacturers, meet with regular demand, some of the "bristles" of this fibre lately received from Colombo, having been sold to brush makers at £60 per ton, and they are substituted for some purposes for the more expensive "Russian bristles."

TABLE

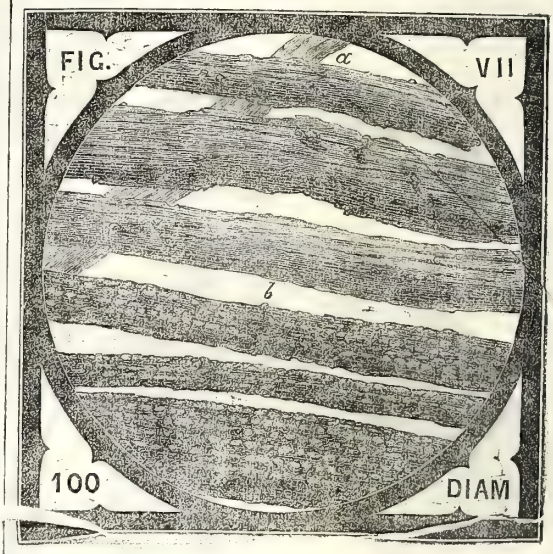
Showing the QUANTITY and VALUE of COIR* and COIR YARN Imported into the UNITED KINGDOM, and the PRICE of COIR YARN in the LONDON MARKET.

Years.	Quantity.		Value.	Price of Yarns.	
				per lb. d.	per ton. £
	lbs.	tons.	£		
1850	...	...	...	$1\frac{5}{8}$ to $3\frac{1}{4}$	15 to 30
1851	...	...	...	$2\frac{5}{8}$ $2\frac{3}{4}$	24 26
1852	...	...	...	$1\frac{6}{8}$ 3	16 28
1853	...	...	...	$2\frac{1}{2}$ $4\frac{7}{8}$	23 45
1854	10,223,360	4,564	96,996	$1\frac{7}{8}$ $3\frac{1}{2}$	17 33
1855	9,248,960	4,129	78,453	$1\frac{6}{8}$ 4	16 37
1856	5,078,080	2,267	50,996	$2\frac{7}{8}$ $3\frac{5}{8}$	27 34
1857	8,458,240	3,776	101,939	$2\frac{1}{2}$ $4\frac{1}{2}$	23 42
1858	9,087,680	4,057	103,880	$1\frac{7}{8}$ $4\frac{5}{8}$	17 43
1859	10,082,240	4,501	129,510	2 $4\frac{7}{8}$	19 46

*Although a duty was imposed on Coir as early as 1842, there were no statistics published of the article until 1853. A great increase resulted, in 1854, from the abolition of the duty.

The next Indian plant to which I would refer is the *Pandanus odoratissimus*. I quote it on account of its furnishing two kinds of fibre, the one from its roots and the other from its leaves. The fusiform roots (Fig. 20, p. 478) are composed of tough fibres used for scrubbing. Sometimes, too, a plant may be found with a single erect trunk, but usually it is in the form of a very large, spreading bush. The leaves (Fig. 21, p. 479) are confluent and stem-clasping, closely imbricated in three spiral rows, and bowing. They are from three to five inches long, tapering to a very long, fine, triangular point, very smooth and glossy, margins and back armed with very fine, sharp spines. The female flowers are on a different plant. More especially, the male flowers emit an exquisite perfume. The leaves furnish long, longitudinal, tough fibres.

The Ejoo or Gomuto fibre, known under the name of vegetable bristles, would probably answer as a substitute for horse hair. This plant, *Arenga saccharifera*, Fig. 22, p. 480 is from 20 to 30 feet high, exclusive of foliage, which is nearly as long. The leaves are pinnate, 20 to 25 feet. The trunk is straight. Each tree produces about six leaves annually, according to Dr. Roxburgh, and each leaf affords about three-quarters of a pound of fibres. As the black fibres issue from the sides of the sheaths, they surround the stem and may be cut off without injury to the tree. They are said to be more durable and stronger than coir. Under the microscope they present a very characteristic appearance. (See *b*, Fig. VII.)



a. Coir (*Cocos*). *b*. Ejoo (*Arenga*).

The *Chamaerops Ritchiana*, called Pfees in Sind, furnishes fibres which might be employed for the manufacture of a "vegetable horse-hair," similar to that furnished by the dwarf palm of Algiers, the *C. humilis*.

Lastly we have, also in Sind, amongst other valuable products, a grass called *Moong*. It is very abundant there, and is used for making drag ropes for the native boats upon the River Indus. A sample of fibre from this was lately sent to Dundee, by Colonel Clarke, and favourably reported on. If shipped at Kurrachee for £15, it would probably meet with a ready sale at Dundee. It takes dye well.

Having now reviewed, however briefly and imperfectly, some of the facts connected with the fibres which I have ventured more or less to recommend to your attention, I would wish to refer to the subject of materials for the paper manufacture. It cannot have passed unobserved that I have but once mentioned the name of paper in enumerating the various useful applications of fibres. But the question of the supply of raw materials—apart from the difficulties in the way of converting them into suitable pulp, is entirely one of the cost of production of the half-stuff from which the paper is eventually elaborated. True it is that the vast majority of plants contain fibres, and that these are available for certain purposes; but all fibres are not of equal value. The tenacity of those furnished by the Exogens, as a rule, far exceeds that from the Endogens. And the innate quality to resist strain, depends entirely upon the strength and toughness of the fibre. Thus, I find, that a Bank of England note, which is, I believe, chiefly manufactured from clean unmixed linen rags, will sustain a weight of 35lbs., but a similar sheet of paper, made from the Rheea, precisely the same in every respect, will carry a weight of nearly 60lbs. These results, for which I am indebted to Mr.

FIG. 19.

NEW ZEALAND FLAX (*Phormium tenax*).

Fig. 20.

(Pandanus odoratissimus.)

Wyndham Portal, prove the difference in the relative strength of the Rheea as compared with flax to be nearly as two to one.

Nevertheless, we are all agreed about the suitability of linen for paper, and it may not be amiss to say a word on the great "rag question." The definition of a rag I take to be this: the perfection in the arrangement of a raw fibre for the production, under mechanical operations, of a paper pulp of uniform density. The best fibres are, of course, employed in the loom, but cotton rags of any description are superior to the sweepings of a cotton-mill.

With a due appreciation of the importance of rags, I doubt whether the supply will meet the demand for half paper stuff. For the manufacture of paper, in the sense in which that substance used to be understood, from linen and cotton rags, if a proper system of collecting them were established, there would be abundance, and I firmly believe that, for the mere inculcation of thrifty habits in domestic matters, it would be very important to advocate their careful preservation. But when it becomes a question of such an extension of manufacture as is likely to result in consequence of the repeal of the paper duty—from match boxes to omnibuses—then indeed it is high time to inquire what we are to substitute.

That there is no lack of materials may be gathered from the variety of substances which have been proposed as substitutes. I find that no less than 120 have been recommended, and a fair proportion of these have formed subjects for special patents. Some of them form excellent pulp, but are practically useless, because of insufficient supply. Others are so defective as to fibre, that the resulting paper is incapable of resisting strain; whilst perfectly suited for giving body to the paper, they require the admixture of a more tenacious material. In the latter category we must place straw and other stems which contain at best but a small proportion of indifferent fibre, and whose apparent strength is owing rather to silica than to fibre. Although we fully admit the possibility of removing the great body of the silica by chemical agents, yet do we injure the strength of the paper almost in the same proportion. Certain it is that those newspapers which are printed on straw paper still contain a considerable quantity of silica. Comparing a straw paper with one made from rags, Dr. Bernays found:—

	Ash.	
In the *Morning Star*	4·15	per cent.
In the *Times*	0·88	,, ,,

And of silica:—

In the *Morning Star*	1·460	,, ,,
In the *Times*	0·145	,, ,,

Now, my object is not to depreciate straw paper. I admit its full value, and believe it of extensive applicability. But in many cases I cannot but think that it would pay better to substitute a more promising material than to use a very inferior one of which larger bulk is required. Thus, the strength of the Rheea is so great that it might, perhaps, be used with advantage in small quantities to supply the defectiveness of materials partaking of the characteristics of straw. In practice, this is already acknowledged, and it is only for principles that we are contending, for almost all paper consists of rags with varying proportions of raw fibres. Possibly, then, some of our best and strongest Indian fibres may be employed to give tenacity, but it is improbable that any could be imported specially for the paper manufacture, as those which would have to compete with rags would not be of sufficient strength to compete with the articles to be had nearer home. If suitable machinery could be established in India, so as to turn to better account her boundless resources, then her superior class of fibres might probably be obtained at a cheaper rate; but the proposal to introduce the domestic manufacture of half-stuff into India is not likely to take root, for many reasons.

The Tables VIII. and IX., of the quantity and prices of rags, per ℔ and per ton, received from the Messrs. Cohen, per Mr. Wm. Stones (who has kindly afforded me every assistance in making them as complete as possible), are particularly useful at the present time, not only for themselves, but also by way of comparison with the other Tables showing the prices of raw fibres in the London market.

The quantity of rags imported from India is at present comparatively small, being not more than 85 tons during last year. The annexed Table gives the exact quantities.

TABLE

Showing the QUANTITY and VALUE of **RAGS**, Exported from BRITISH INDIA to the UNITED KINGDOM and AMERICA, from 1855-6 to 1858-9 inclusive.

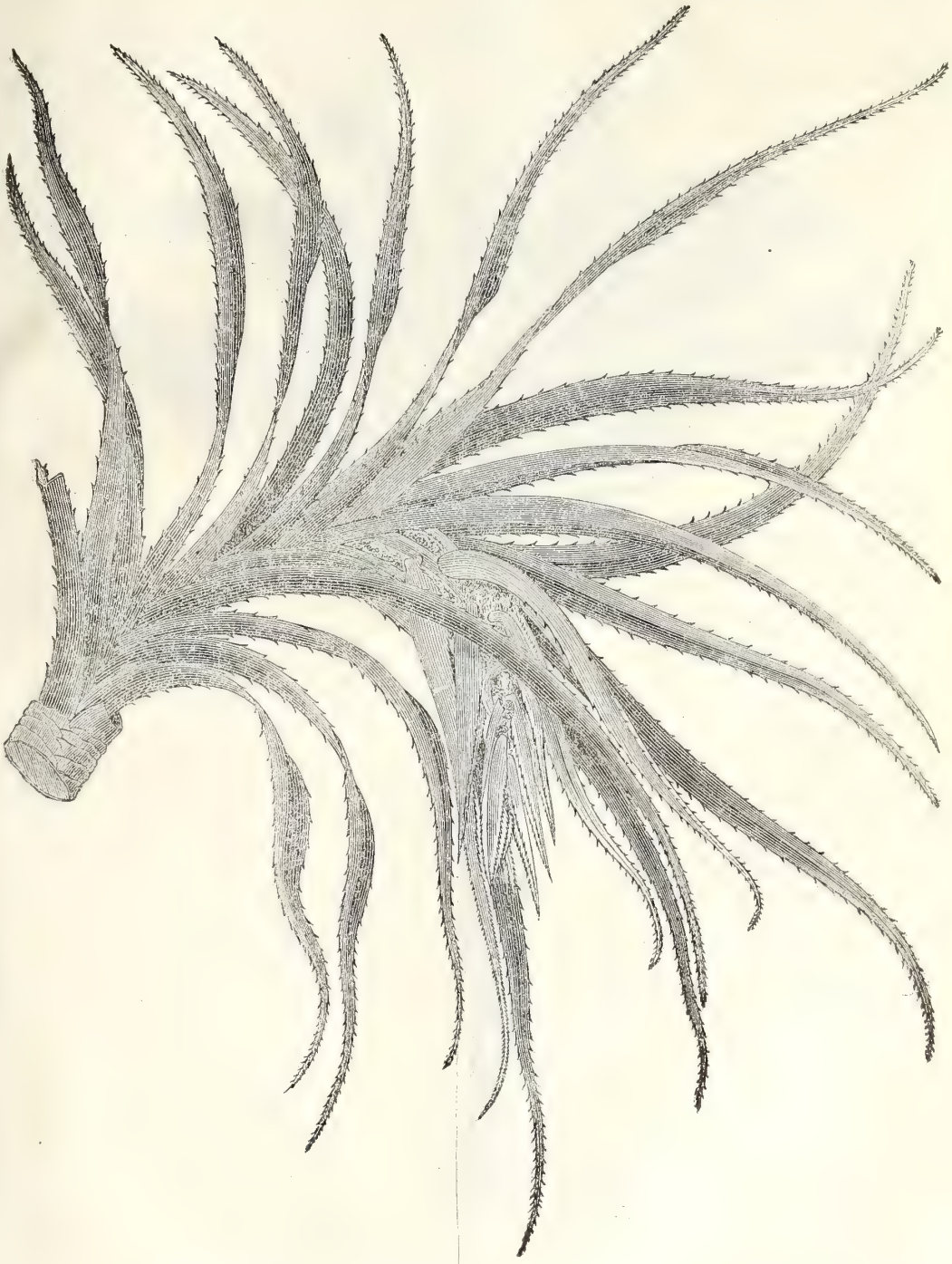
Years.	Whither Exported.					
	United Kingdom.			America.		
	Quantity.		Value.	Quantity.		Val.
	lbs.	tons.	£	lbs.	tons.	£
1853–4	...	...	...	...	...	...
1854–5	...	...	...	...	...	...
1855–6	190,288	85	340	...	...	...
1856–7	184,688	82	320	...	...	..
1857–8	253,904	113	622	22,400	10	60
1858–9	191,296	85	512	34,384	15	92

* According to the returns received at the India House, no rags have as yet been exported from either Bengal or Madras. The Trade and Navigation returns for 1858–9 for Bengal, have, however, not yet been received.

(See also Table X.) What we are to expect in the way of rags from India is yet an unsolved problem.

I must now hasten to consider in the second place our various wants with respect to supplies of raw textiles, without which our manufactures could not flourish. We possess in our coal, and iron, and mechanical skill, the chief elements which constitute a great manufacturing nation; but we are, to a considerable extent, dependent upon foreign sources for the materials we require. By the

FIG. 21.



LEAVES OF *Pandanus odoratissimus.*

Fig. 22.

Fjoo (*Arenge saccharifera*).

MAP OF INDIA

BY

JOHN WALKER

Bengal & Assam
N.W. Provinces
Punjab
Sinde
Bombay
Madras
Arracan, Tenasserim Provinces & Straits Settlements
Railways completed
in progress
Trunk Roads
Navigable Canals & Portions of Rivers Navig.
Barriers in the Godavery

J & C. Walker, Lith.

BENGAL.

Divisions.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 Acres.	Area. In Acres.	Population. Total.	Population. Number of Persons to the square mile.
							Average
Patna	Patna	44	A. Hope	1,828	1,169,920	1,200,000	656
	Shahabad	36	A. A. Swinton	4,403	2,817,920	1,600,000	363
	Behar	37	D. Cunliffe	5,694	3,644,160	2,500,000	439
	Sarun, with Chumparun	35	A. Pigou	6,394	4,092,160	1,700,000	266
Bhaugulpore	Bhaugulpore	31	J. R. Muspratt	7,803	4,993,920	2,000,000	257
	Dinajpore	28	F. A. Dalrymple	3,820	2,444,800	1,200,000	314
	Monghyr	32	R. O. Haywood	3,592	2,298,880	800,000	223
	Poorneah	30	R. Alexander	5,712	3,655,680	1,600,000	280
	Tirhoot	33	W. H. Broadhurst	6,114	3,912,960	2,400,000	393
	Maldah	29	J. S. Spankie	1,28[illegible]	824,320	431,000	335
Moorshedabad	Moorshedabad	26	F. A. B. Glover	1,856	1,187,840	1,045,000	563
	Bagoorah	24	A. Abercrombie	2,160	1,382,400	900,000	417
	Rungpore	25	A. G. Macdonald	4,130	2,643,200	2,559,000	620
	Rajishahye	23	F. A. Dashington	2,084	1,333,760	671,000	322
	Pubna	22	G. Bright	2,506	1,707,840	600,000	240
	Beerbhoom	27	H. A. R. Alexander	3,114	1,992,960	1,040,876	334
Dacca	Dacca	10	A. E. Russell	1,960	1,254,400	600,000	306
	Furreedpore	11	J. H. Ravenshaw	2,052	1,313,280	855,000	417
	Mymensing	9	C. H. Campbell	4,712	3,015,680	1,487,000	316
	Sylhet including Jyntea	8	W. J. Longmore	8,424	5,391,360	380,000	45
	Backergunge	12	W. T. Tucker	3,794	2,428,160	733,800	193
Jessore	Jessore	13	F. Tucker	3,512	2,247,680	2,458,400	700
	24 Pergunnahs including Calcutta	16	C. F. Carnac; C. Chapman	2,277	1,457,280	701,182	307
	Burdwan	17	C. P. Hobhouse	2,224	1,423,360	1,854,152	834
	Hooghly	16	C. S. Bell	2,007	1,284,480	1,520,840	758
	Nuddea	17	E. E. Woodcock	2,942	1,882,880	298,736	102
	Bancoorah	18	R. H. Russell	1,476	944,640	480,000	325
	Baraset	14	Hon. A. Eden	1,424	911,360	522,000	364
Sunderbunds.	From Sangor Island on the West, to the Ramnabad Channel on the East		A. Grote, Commissioner of Revenue and Circuit	6,500	4,160,000	not known	
Chittagong.	Chittagong	21	R. J. Richardson	2,717	1,738,880	1,000,000	368
	Tipperah and Bullooah	19, 20	E. Sandys	4,850	3,104,000	806,950; 600,000	290
Cuttack.	Cuttack and Pooree	41	A. Money	4,829	3,090,560	1,000,000	207
	Balasore	40	V. H. Schaleh	1,706	1,091,840	454,322	266
	Koorlah	39	R. N. Shore	930	595,200	571,160	612
	Midnapore and Hidjellee	38	T. B. Mactier	5,029	3,218,560	666,328	133
Assam.	Jorhat or Seebpoor	1	... ...	2,825	1,808,000	159,573	56
	Luckimpoor	2	... ...	2,950	1,888,000	85,206	29
	Kamroop	5	Col. F. Jenkins, Commissioner	2,768	1,784,320	387,775	139
	Nowgong	4	... ...	2,000	1,280,000	111,300	58
	Durrung	3	... ...	2,866	1,834,240	141,636	93
	Goalpara	6	... ...				49
Cachar	... ...	7	... ...	4,000	2,560,000	60,000	15
	Territory resumed from Toola Ram Senahputtee		... ...	2,160	1,382,400	5,015	2
	Nagpore or Berar	50	Major E. K. Elliott, 43rd N. I.	76,432	48,916,880	4,650,000	61
South West Frontier.	Ramghur	43	... ...	8,524	5,455,360	372,216	44
	Palamow	42	... ...	3,468	2,139,520	482,900	55
	Chota Nagpore	44	... ...	5,308	3,397,120		
	Pachete	45	... ...	4,792	3,066,880	772,340	136
	Barabhoom	46	... ...	860	550,400		
	Singhbhoom	47	... ...	2,944	1,884,160	200,000	61
	Sumbulpore	48	... ...	4,693	3,003,520	274,000	58
	Odeypore	49	... ...	2,306	1,775,840	133,748	58
				259,039	116,045,360	47,428,116	275

EASTERN TERRITORIES PRESENTLY UNDER BENGAL.

Divisions.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 acres.	Area. In Acres.	Population. Total.	Population. Number of Persons to the square mile.
Arracan	Akyab	1	Capt. H. Hopkinson, 70th N. I.	32,250	20,640,000	125,745	9
	Sandoway	3				37,888	
	Ramree	2				112,068	
Pegu	Rangoon	9	Lt.-Col. A. P. Phayre, Commissioner	9,800	6,272,000	201,633	21
	Bassein	8		8,900	5,696,000	183,137	21
	Prome	4		5,500	3,520,000	194,250	35
	Henzada	7		2,200	1,408,000	116,412	53
	Toungoo	5		3,900	2,496,000	41,563	11
	Tharawaddy	6		1,950	1,248,000	103,208	53
Martaban	Martaban	10	... ...	11,000	7,040,000	95,055	9
Tenasserim Provinces.	Amherst	11	Capt. H. Hopkinson, 70th N. I.	29,168	18,667,520	219,221	8
	Ye	12					
	Tavoy	13					
	Mergui	14					
Straits Settlements	Penang	15	... ...	300	192,000	120,000	400
	Singapore	17	... ...	275	176,000	57,421	209
	Malacca	16	... ...	1,000	640,000	54,021	54
				106,243	67,995,520	1,661,622	73

* Application having lately been made for a list of the "Collectors" in charge of the different Indian Districts, their names have been here inserted in accordance with the latest available information. No suitable designation, in lieu of that of "Collector," has yet been adopted. The term "Local Governor" is merely inserted to indicate, in some measure, the *actual* functions of the "Collector."

NORTH WESTERN PROVINCES.

Division.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 acres.	Area. In Acres.	Population. Males.	Population. Females.	Population. Total.	Population. No. of Persons to the square mile.
									Average
Meerut.	Saharunpore	36	R. Spankie	11,238	7,192,320	454,086	347,239	801,325	402
	Mozufferuggur	35	R. M. Edwards			364,759	308,102	672,861	
	Meerut	34	H. Sapte			616,301	519,771	1,135,072	
	Bolundshuhur	33	H. P. Fane			410,979	367,363	778,342	
	Allyghur	32	J. H. Prinsep			605,875	528,690	1,134,565	
Rohilcund.	Bijnoor	31	A. Shakespear	1,900	1,216,000	377,234	318,287	695,521	366
	Moradabad	30	J. Strachey	2,699	1,727,360	606,472	531,989	1,138,461	422
	Budaon	29	A. Swinton	2,402	1,537,280	552,935	466,226	1,019,161	424
	Bareilly	28	J. F. D. Inglis	3,119	1,996,160	733,425	644,843	1,378,268	442
	Shahjehanpore	27	W. S. Paterson	2,308	1,477,120	529,749	456,347	986,096	427
Agra.	Mutra	24	M. B. Thornhill	1,613	1,032,320	463,967	398,942	862,909	535
	Agra	23	A. L. Phillips	1,865	1,193,600	548,421	453,540	1,001,961	537
	Furruckabad	26	C. J. H. Richardes	2,123	1,358,720	585,889	478,718	1,064,607	501
	Mynpooree	25	E. J. Boldero	2,029	1,292,800	464,878	367,836	832,714	412
	Etawah	22	A. O. Hume	1,677	1,073,280	338,634	272,331	610,965	364
Allahabad.	Cawnpore	9	J. W. Sherer	2,348	1,502,720	622,093	552,463	1,174,556	500
	Futtehpore	8	J. Power	1,583	1,013,120	357,302	322,485	679,787	429
	Banda	10	F. O. Mayne	3,010	1,926,400	390,158	353,714	743,872	247
	Allahabad	7	M. H. Court	2,788	1,784,320	722,798	656,990	1,379,788	494
Benares.	Goruckpore	1	F. B. Pearson	7,340	4,697,600	1,614,990	1,472,883	3,087,874	420
	Azimgurh	2	E. C. Bayley	2,516	1,610,240	885,134	768,117	1,653,251	657
	Jounpore	4	C. Horne	1,552	993,280	608,207	535,542	1,143,749	737
	Mirzapore	6	C. B. Denison	5,152	3,297,280	568,749	535,566	1,104,315	214
	Benares	5	F. M. Lind	996	637,440	444,778	406,979	851,757	855
	Ghazeepore	3	A. Ross	2,181	1,395,840	828,773	767,551	1,596,324	732
Jubbulpore or Saugor and Nerbudda.	Jubbulpore	20	Major W. C. Erskine, 73d. N. I., Commissioner & Agent; J. A. Craigie, Judge	6,237	3,991,680	...	...	442,771	71
	Saugor	15		1,857	1,188,480	...	...	305,594	165
	Hoshungabad	17		1,916	1,226,240	...	...	242,641	127
	Seonee	21		1,459	813,760	...	...	227,070	156
	Damoh	16		2,428	1,553,920	...	...	363,584	150
	Nursingpore	19		501	320,640	...	...	254,486	508
	Baitool	18		990	633,600	...	...	93,441	94
Jhansi.	Jhansi	13	Capt. F. W. Pinkney, M.E. Com.	1,394	874,160	...	...	376,297	118
	Jalaun	12		1,778	1,133,520	...	...		
	Humeerpoor	11	G. H. Freeling	2,364	1,512,960	...	...	605,589	256
	Chundegree	14	... ...	556	355,840	...	...	not stated.	
	Kumaon, including Gurwhal	...	Maj. H. Ramsay, 53d. N.I. Com.	6,972	4,462,080	...	...	605,910	87
	Jowusar and Bewar	...	... ...	579	370,560	...	...	24,684	43
	Dehra Dhoon	...	H.G. Keene, Super.	673	430,720	...	...	32,083	48
	Kote Kassim	...	... ...	70	44,800	...	...	13,767	197
	Ajmere	...	... ...	2,029	1,298,560	...	...	294,601	144
	Bhairwarrah (British)	...	... ...	282	180,480	...	...	37,715	134
	Nimaur (British)	...	... ...	302	193,280	...	...	25,400	84
	Oude	...	C. J. Wingfield, Chief-Com.	25,000	16,000,000	...	...	5,000,000	200
	Bairseeah (Central India)	...	Col. Sir R. C. Shakespeare, Knt., Act. Agent	456	291,840	...	...	not known.	
				120,273	76,832,320	14,695,586	12,832,515	36,404,024	304

BOMBAY.

Division.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 acres.	Area. In Acres.	Population. Males.	Population. Females.	Population. Total.	Population. No. of Persons to the square mile.
	Ahmedabad	1	J. W. Hadow	4,402	2,817,280	...	...	653,730	149
	Kaira	2	A. Gray	1,375	880,000	325,755	254,876	580,631	422
	Broach	3	B. H. Ellis	1,351	864,640	152,282	138,702	290,984	215
	Surat	4	G. Inverarity	1,482	948,480	...	...	493,934	333
	Tannah	7	J. R. Morgan	5,400	3,456,000	451,460	420,110	874,570	162
	Candeish	5	A. D. Robertson	12,078	7,729,920	...	...	785,744	65
	Bombay and Colaba Islands, including the town of Bombay	8	L. Reid	20	12,800	...	...	520,758	26,037
	Poonah	9	D. Davidson	5,250	3,360,000	...	...	698,587	133
	Ahmednuggur	6	C. E. F. Tytler	10,078	6,449,920	...	...	1,002,733	99
	Sholapoor	10	W. A. Goldfinch	8,565	5,481,600	...	...	685,587	80
	Rutnagherry	11	L. H. B. Tucker	4,500	2,880,000	350,151	315,087	665,238	148
	Belgaum	12	G. B. Seton-Karr	6,515	4,169,600	...	...	1,035,728	159
	Dharwar	13	T. Ogilvy	3,790	2,425,600	...	...	757,849	200
				64,806	41,475,840			9,046,073	180†

* Application having lately been made for a list of the "Collectors" in charge of the different Indian Districts, their names have been here inserted in accordance with the latest available information. No suitable designation, in lieu of that of "Collector," has yet been adopted. The term "Local Governor" is merely inserted to indicate, in some measure, the *actual* functions of the "Collector."
† Exclusive of town of Bombay.

PUNJAUB AND SCINDE.

Division.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 acres.	Area. In Acres.	Population. Males.	Population. Females.	Population. Total.	Population. No. of Persons to the square mile.
									Average
Delhi.	Bhutteeana	6	— Oliver	3,017	1,930,880	...	...	112,974	37
	Paneeput	3	C. P. Elliot, C.S.	1,270	812,800	215,666	173,419	389,085	306
	Hissar	5	Gen. Van Cortlandt.	3,294	2,108,160	183,211	147,641	330,852	100
	Delhi	2	P. Egerton, C.S.	790	505,600	235,203	200,541	435,744	552
	Rhotuck	4	... ...	1,340	869,600	202,279	174,734	377,013	281
	Goorgaon	1	— Ford, C.S.	1,939	1,240,960	356,016	307,470	662,486	342
Lahore.	Lahore	16	R. Egerton, C.S.	2,826	1,808,640	337,143	254,540	591,683	209
	Umritsur	15	F. Cooper, C.S.	2,024	1,295,360	498,417	386,012	884,429	437
	Gourdaspoor	14	J. Naesmyth, C.S.	1,675	1,072,000	437,737	349,680	787,417	470
	Goojranwalla	17	Captain Eliott	3,752	2,401,280	305,181	248,202	553,383	147
	Sealkote	18	E. Prinsep, C.S.	1,350	864,000	354,574	287,208	641,782	475
Jhelum.	Rawul Pindee	22	.. ...	5,996	3,837,440	302,786	250,964	553,750	92
	Jhelum	21	Captain Breston	5,350	3,424,000	226,119	203,301	429,420	80
	Goojrat	19	— Hardinge, C.S.	1,916	1,226,240	279,537	238,089	517,626	270
	Shahpore	20	D. Macnabb, C.S.	3,500	2,240,000	139,554	122,138	261,692	75
Mooltan.	Mooltan	30	Major Vogle	5,634	3,605,760	229,423	181,963	411,386	73
	Khangurh	29	Captain Maxwell	1,027	657,280	116,405	95,515	211,920	206
	Jhung	31	... ...	5,718	3,659,520	139,149	112,620	251,769	44
	Gougaira	32	— Thomas	4,142	2,650,880	175,633	132,387	308,020	74
Leia.	Leia	27	Captain Fendall	6,122	3,918,080	166,807	142,889	309,696	51
	Dehra Ghazee Khan	28	.. ...	4,000	2,560,000	134,631	104,333	238,964	60
	Dehra Ismael Khan	26	Captain Coxe	4,123	2,638,720	193,598	168,443	362,041	88
Peshawur.	Peshawur	24	... ...	2,324	1,487,360	254,981	195,118	450,099	194
	Hazarah	23	Captain Adams	2,424	1,551,360	161,861	134,503	296,364	122
	Kohat	25	Captain Munro	2,840	1,817,600	56,956	44,276	101,232	36
Jullundur.	Jullundur	11	Captain Mercer	1,381	883,840	...	...	567,991	411
	Hoshairpoor	12	Captain Young	2,204	1,410,560	...	...	749,283	339
	Kangra	13	R. Saunders	3,207	2,052,480	...	...	558,915	174
Cis-Sutlej States.	Umballah	8	Captain Busk	1,832	1,172,480	440,559	341,458	782,017	427
	Thaneysur	7	Captain Elphinstone	2,336	1,495,040	271,329	225,419	496,748	213
	Loodiana	9	Captain McNeile	1,377	881,280	292,699	235,023	527,722	383
	Ferozepore	10	... ...	2,545	1,628,800	268,710	206,914	475,624	187
				93,275	59,708,000	6,975,164	5,664,800	14,629,125	217
Scinde, at present under Bombay.	Shikarpore	1	... ...	11,532	7,380,480	359,463	290,841	650,303	56
	Frontier District	2	J. D. Inverarity, Com. of Scinde.	2,147	1,374,080	25,951	17,004	42,955	20
	Hydrabad	3	J. Elphinston	26,760	17,126,400	391,756	311,540	703,296	26
	Kurrachee	4	A. F. Bellasis	19,240	12,313,600	183,002	138,107	321,109	17
	Thur & Packur	5	... ...	3,920	2,508,800	29,160	21,913	51,073	13
				63,599	40,703,360	989,332	779,405	1,768,737	27

MADRAS.

Division.	Collectorates or Districts.	No. on Map.	Names of Collectors.* (Local Governors.)	Area. In square miles of 640 acres.	Area. In Acres.	Population. Total.	Population. No. of Persons to the square mile.
	Rajahmundry	3	A. Purvis	4,316	2,762,240	1,081,703	251
	Masulipatam	4	W. Knox	5,000	3,200,000	623,808	125
	Guntoor	5	H. Wood	4,915	3,145,600	593,213	121
	Kurnool	12	Hon. D. Arbuthnot	2,643	1,691,520	287,726	109
	Cuddapah	7	Mackenzie Murray	12,970	8,300,800	1,351,151	104
	Nettore	6	F. B. Elton	9,345	5,980,800	952,032	102
	Bellary	13	A. Hathaway	13,056	8,355,840	1,181,087	90
	Arcot, North	8	C. Whittingham	5,250	3,360,000	1,588,104	302
	Arcot, South	9	A. Hall	5,000	3,200,000	1,135,961	227
	Chinglepat	10	C. J. Shubrick	2,993	1,915,520	605,221	202
	Madras, City	11	B. Cunliffe	27	17,280	720,000	26,666
	Salem	18	H. A. Brett	8,100	5,184,000	1,268,200	157
	Coimbatore	17	E. B. Thomas	8,417	5,386,880	1,176,831	139
	Canara	14	W. Fisher	7,152	4,577,280	1,126,938	158
	Malabar	16	P. Grant	6,050	3,872,000	1,602,914	265
	Trichinopoly	19	I. Bird	3,243	2,075,520	809,580	250
	Tanjore	20	W. M. Cadell	3,900	2,496,000	1,657,285	425
	Madura	21	T. Clarke	9,427	6,033,280	1,792,737	190
	Tinnevelly	22	I. Silver	5,700	3,648,000	1,328,147	233
	Ganjam	1	G. S. Forbes	5,385	3,496,400	949,747	176
	Vizagapatam	2	E. G. R. Fane	7,808	4,997,120	1,284,243	164
	Coorg	15	... ...	2,116	1,354,240	135,600	64
				132,813	85,050,320	23,252,228	169†

* Application having lately been made for a list of the "Collectors" in charge of the different Indian Districts, their names have been here inserted in accordance with the latest available information. No suitable designation, in lieu of that of "Collector," has yet been adopted. The term "Local Governor" is merely inserted to indicate, in some measure, the *actual* functions of the "Collector."
† Exclusive of Madras City.

NATIVE AND OTHER POSSESSIONS NOT BRITISH.

Locality.	Native States.	Area. In square miles of 640 acres.	Area. In Acres.	Population. Total.	Population. Number of Persons to the square mile.
Central India	Allee Mohun or Rajpoor	708	453,120	69,384	98
	Anjiherra	584	373,760	57,232	98
	Burwance	1,280	883,200	22,217	16
	Bhojal	6,764	4,328,960	663,656	98
	Bundelcund	8,394	5,372,160	824,000	98
	Dewas	256	163,840	25,088	98
	Dhar	1,050	684,800	104,860	98
	Dholpore	1,626	1,040,640	550,000	338
	Gwalior (Scindia)	33,116	21,195,520	3,228,512	97
	Indore (Holkar)	9,660	6,186,240	947,268	98
	Koorwace and Joura	1,652	686,080	105,056	98
	Omutwarra	1,348	874,720	132,104	98
	Rutlam	936	599,040	91,728	98
	Saugor and Nerbudda	12,244	7,836,160	1,560,000	127
	Seeta Mow	208	133,120	20,384	98
	Tonk, and other dependencies of Ameer Khan	1,864	1,192,960	182,672	98
Cis-Sutlej	Bhawlpore	25,200	16,128,000	925,000	37
	Hill States	5,000	3,200,000	430,703	86
	Sikh Protected States	7,366	4,714,040	1,894,800	256
Near to Delhi	Bullubgurh	190	121,600	57,000	300
	Furrucknuggur	22	14,080	4,400	200
	Jhujhur	1,230	787,200	110,700	90
	Lohatoo	200	128,000	18,000	90
	Patowdee	74	47,360	6,660	90
	Deeojaua	71	45,440	6,390	90
	Bahadoorgurh	48	30,720	14,400	300
Agra	Bhurtpore	1,978	1,265,920	600,000	303
	Cashmere	60,000	38,400,000	3,000,000	50
Trans-Sutlej	Chumba	3,216	2,058,240	101,631	32
	Meodhee	1,082	692,480	139,259	128
	Sokhut	420	268,800	44,552	107
	Kupoortullah	598	382,720	212,721	355
N. E. Frontier	Cooch Behar	1,364	872,960	136,400	100
	Cossya and Garrow-hills	4,347	2,782,080	65,205	15
	Munneepoor	7,584	4,853,760	73,840	10
The Deccan	Hyderabad	95,337	61,015,680	10,666,080	112
Rajpootana	Rajpoot States	114,391	73,210,240	7,412,426	64
Orissa	Cuttack Mehals	16,929	10,834,560	761,805	45
	South West Frontier	23,125	14,800,000	1,111,907	48
Near Burmah	Tipperah	7,632	4,884,480	...	...
Nrthn. Bengal	*Sickkim*	1,670	1,068,800	61,766	37
	Nepaul	54,500	34,880,000	1,940,000	35
Rohilcund	Rampore	720	460,800	320,400	445
Malabar	Cochin	1,988	1,272,320	288,176	145
Orissa	Jeypoor and Hill Zemindars	13,041	8,346,240	391,230	30
Southern India	Mysore	27,000	17,280,000	3,647,788	138
	Pooloocottah	1,165	745,600	61,745	53
	Travancore	4,722	3,022,080	1,011,824	214
Guzerat	Baheemore	258	165,120	19,092	74
	Banesda	325	208,000	24,050	74
	Baroda	4,399	2,815,360	1,710,404	388
	Cantay	500	320,000	37,000	74
	Daung Rajahs	950	608,000	70,300	74
	Dhurrumpore	225	144,000	16,650	74
	Guzerat Petty States	4,580	2,931,200	240,800	53
	Kattywar Petty Chiefs	19,850	12,704,000	1,468,900	74
	Mynee Caunta	3,400	2,176,000	150,000	44
	Rewa Caunta	4,879	3,122,560	361,046	74
	Sucheen	300	192,000	22,200	74
	Wusravee (Bheels)	450	288,000	33,300	74
Western India	Cutch	6,764	4,328,960	500,536	74
Scinde	Khyrpore	5,000	3,200,000	105,000	21
South Mahratta	Kolapore	3,445	2,204,800	500,000	145
Ahmednuggur	Peint and Hursool	750	480,000	55,500	74
Sattara	Sattara Jagheers	cannot be given.		cannot be given.	
South Concan	Sawunt Warree	800	512,000	120,000	150
	Southern Mahratta Jagheers	3,700	2,368,000	410,470	111
		624,024	399,387,060	49,948,217	115

FRENCH POSSESSIONS.

		Area. In square miles of 640 acres.	Area. In Acres.	Population. Total.	Population. Number of Persons to the square mile.
On Banks of Hooghly	Chandernagore	4	2,330	32,670	8,167
Coromandel Coast	Pondicherry	188	120,320	171,217	911
	Kavical	63	40,320	49,307	782
Malabar	Mahé	2	1,280	2,616	2,308
Orissa Coast	Yanaon	13	8,147	6,881	529
		270	172,397	262,691	2,339

PORTUGUESE POSSESSIONS.

		Area. In square miles of 640 acres.	Area. In Acres.	Population. Total.	Population. Number of Persons to the square mile.
Northern Concan	Demaun (A Sea-port)	...	...	...	...
Kattywar	Diu	...	...	...	...
West Coast	Goa	1,066	682,240	313,262	243

diagrams appended to the walls (repeated in the pages of the *Journal*) the various facts connected with the question are placed before the eye and mind in a sufficiently striking manner; a short allusion to them will indicate the most important deductions to be drawn therefrom.

Diagram A shows the relative proportions of the quantities of raw textile materials exported by each of the producing countries of the world. The top squares have areas proportionally representative of the total quantities exported from all countries; whilst, on the other hand, the lower series of squares indicate the relative quantities furnished by the various countries there indicated.

Starting, for instance, with cotton, we see at a glance the huge proportional quantity exported by the United States as compared with that supplied by any or all other countries put together. Next to America, however, as a cotton-supplying country, stands India, and we believe the day is not so far distant when the square which represents those exports from India will have to be considerably enlarged. (See Tables XI. and XII.)

With respect to wool, which is the only raw textile largely produced in these islands, a similar class of facts can be deduced from the same diagram, whilst diagram C, which represents the proportion of raw textiles imported into the United Kingdom compared with that of all countries, shows the much smaller requirements as compared with cotton, for which we are altogether dependent upon foreign sources. (See Tables XIII. and XIV.)

Turning to flax, the much larger proportional quantity exported by Russia than by any other country is brought into bold relief; and, as before, diagram C illustrates to what a large extent we are customers for the purchase of this most important fibre. (See Table XV.)

Then, as regards hemp and other fibres of a similar nature, we find the same remarks apply as in the case of flax, with this exception, that the proportion of that which we require is more than one-third less than that taken by other countries. (See Table XVI.)

Lastly, we have jute, which is entirely furnished by our Indian empire, of which we ourselves consume the greater proportion, although a very large quantity in the manufactured form of gunnies and gnnny bags reaches this and other countries. (See Tables III., IV., and V.)

In diagram B we have another, but not less instructive class of facts educed after the same plan. By it the relative proportions of the imports into the United Kingdom are shown for each ten years since 1821. It illustrates admirably the enormous increase since then of our demand for cotton as compared with every other textile. In addition to cotton, the steady increase in the amounts of wool, silk, and especially of jute, forms a striking contrast to those of flax, which may be considered almost stationary; and, in addition to other considerations this bears out the complaints now so frequent with respect to the difficulties in obtaining adequate supplies of this important fibre. The two most prominent questions which influence our textile manufactures, are the obtaining of flax in adequate quantities, and cotton from sources which will remove our present anxieties with respect to our dependence on one source of supply. On a former occasion I endeavoured to show grounds for the belief that India could and eventually will accomplish this desirable end with respect to cotton: and other facts brought forward this evening, seem to us sufficient to warrant the same presumption, with reference to flax.

I have not time to dwell upon some points of interest with respect to the marked improvement in Indian cotton; there are fresh evidences, however, of the capabilities of that great country to furnish us with every quality of it which we may require. These I have obtained, and they will shortly be made public. No doubt of the fact is however entertained; and it adds a further incentive to use our utmost exertion to take those steps which would appear to be necessary in order to meet the special requirements of our case.

For the statistics of Silk see Tables XVII. and XVIII.; Table XIX. gives the value of British Textile exports.

The absolute necessity for other sources of supply of flax is admitted on all hands, and is amply proved by the reports of the three great Chambers of Commerce more immediately interested in the matter.

Broadly viewed, it must, I think, be conceded that, whatever may have been the case with respect to years some time past, at least latterly the exports of some articles from India have increased with all but unexampled rapidity. Look to the facts as to *jute*. In 1841, the quantity of jute sent from India to this country amounted to about 3,000 tons, whereas that received last year reached upwards of 53,000 tons! Wool likewise affords another instance of the same kind; and taking another class of substances, viz., sugar and oil seeds, we find an equally rapid increment in the amounts exported in these later years. And then with respect to cotton; a table which I had the honour last year to submit in this room, conclusively showed that, in those places near the coast where facilities of export existed the exports of cotton had increased to a great extent. The transit difficulties presented by India have hitherto formed one great barrier to the development of her resources. What would England be without her railways; and with the railways now in progress, and other proposed means of communication opened up, what, I ask, is a country with such unbounded resources as India possesses, likely to become? At even this present rate of development of the resources of the country, India will, in ten years from this time, have enormously increased her exports; but as our necessities are urgent, we cannot, and ought not, to wait until, in the ordinary course of things, this takes place. The Government has given abundant evidence of its anxiety to aid in the good work; and various experiments which at one time or other it has instituted, have cost, I believe, hundreds of thousands of pounds. The results, in a commercial point of view, may not have equalled expectation, but they have at least shown a desire, on the part of our rulers, to assist in the good work. The hitherto practically insurmountable transit difficulties are in course of rapid removal, and the Government is, on every occasion, manifesting the utmost anxiety to give attention and countenance to every feasible scheme; and there is no doubt that, should those in this country more directly interested in increased production come forward with the view of *aiding themselves* in this matter, every legitimate encouragement will be warmly afforded on the part of the Indian government, as well as of the officials who practically are the governors of our various Indian districts, and on whose countenance and support much undoubtedly depends. And the facts already mentioned with reference to the success which has attended the cultivation of flax in the Punjab, and which has mainly arisen from the warm support given to it by various officials in that important district, affords sufficient answer to those who assert that such measures are by them treated with indifference. All evidence, whether parliamentary or otherwise, whatever the opinions of the witnesses with respect to land tenure and the other assumed deterrent causes of more or less value, tends to one conclusion, and that is, that if those in this country who are more immediately interested, wish to be rapidly supplied with the various raw products we require, they must be prepared to put their hands into their own pockets and take special steps to make their wants felt and realized by the native cultivator himself, in the substantial form of a part of what now passes into the hands of the much-abused middle-man, who acts as many people do in other parts of the world as well as in India.

The introduction of European agents prepared to play the part of honest middle-men, is, as matters stand in India, an absolute necessity. It is an inconvenient and disagreeable thing to have to make cash advances for what we shall not receive for perhaps months, but it is the universal custom of the country, and one not unknown to us

here, as advances to a large amount have to be made to the Russian flax merchant long before that commodity has been received in Dundee or elsewhere. However unfortunate it may be that such a plan should be necessary in the case of the Indian cultivator, it is a common experience that, when fairly dealt with, their engagements are strictly kept.

If then these premises are correct, seeing that our present European commercial connection with the producing districts in India scarcely exists, it logically follows that those here immediately interested in the matter should take steps to bring about this most important and essential object. And it seems to me clear that the initiation of such action should take its rise in those great seats of commerce which are most concerned in the matter.

As a rule the action of a number of directly interested parties is generally more effective than that of companies, because each one interests himself more in the general success, and because authority is less delegated; but after all a company does represent private interest in an organized form, and in the case we have to deal with, is, perhaps, a necessity. Its operations, while surely and cautiously conducted, must be of extended grasp, and involve a larger amount of responsibility than a few individuals would be likely to take upon themselves.

The matter of increased supplies of cotton and flax, and that too at an early period is of national moment; and while recognising the importance of the high political functions with which some of our Chambers of Commerce chiefly occupy themselves, I hold that this subject now pressing upon our consideration is likewise worthy of their attention; and, with respect to cotton, it may be fairly held that the great Cotton Supply Association of Manchester—which has done and is doing much to effect this good thing—might be expected to take some lead in a matter of such vital interest.

And although, looking to the facts before us, and to the large outlays incurred by the experiments already instituted by the Indian Government, I do not think that it ought to be called upon to initiate; still there can be no doubt that, were associations formed—the one for the encouragement of the growth of cotton, the other for that of flax—on a basis of such unquestionable respectability as that here indicated, its countenance would be warmly vouchsafed. I hold, then, that the day for deputations has gone by and that for action has arrived; and that if the premises here so imperfectly touched upon be correct, the nature of that action should be in the direction here indicated.

TABLE TO ACCOMPANY DIAGRAM A. REPRESENTING THE RELATIVE PROPORTIONS OF THE QUANTITIES OF THE RAW TEXTILES EXPORTED FROM EACH OF THE PRODUCING COUNTRIES OF THE WORLD.

WHENCE EXPORTED.	COTTON.	WOOL.	SILK.	FLAX.	HEMP. and other fibres exclusive of Jute.	JUTE.
United States of America	1,172,000,000	...	...	...	...	...
East Indies	272,000,000	17,000,000	1,600,000	...	12,000,000	88,000,000
Russia	...	30,000,000	...	147,000,000	98,000,000	...
Italy	9,000,000	92,000,000	13,000,000	13,000,000	53,000,000	...
Egypt	50,000,000	...	...	8,000,000	...	...
Australia	...	53,000,000	...	..	...	...
Brazil	30,000,000	...	...	...	...	...
Africa	4,000,000	22,000,000	...	...	...	...
West Indies	3,500,000	...	...	...	...	...
South America	3,000,000	23,000,000	...	...	...	...
Ceylon	2,000,000	...	...	...	...	...
South of Europe, excl. of Italy.	...	46,000,000	...	...	...	...
North of ditto, excl. of Russia.	...		...	...	...	...
Prussia	...	35,000,000	...	31,000,000	18,000,000	...
Holland	...		...	22,000,000	...	...
Belgium	...		...	19,000,000	...	...
Great Britain	...	16,000,000	...	...	...	...
France	...	...	1,500,000	...	...	...
China	...	...	12,000,000	...	...	...
Philippine Islands	...	...	...	...	48,000,000	...
Other countries	5,000,000	30,000,000	2,000,000	10,000,000	25,000,000	...
Total ..... lbs.	1,550,500,000	364,000,000	30,100,000	250,000,000	254,000,000	88,000,000

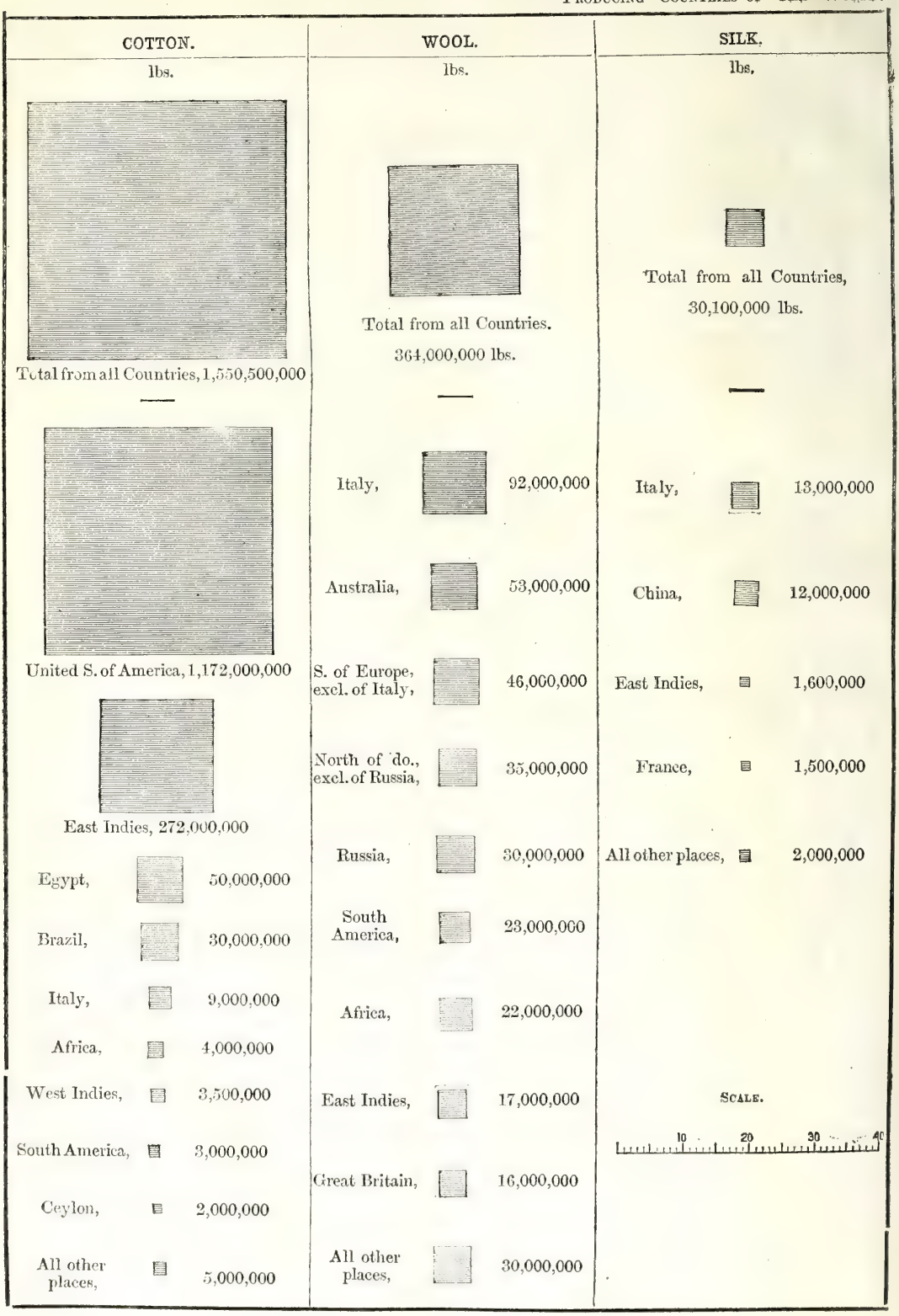
NOTE.—The figures in this Table represent the average of 3 years.

TABLE TO ACCOMPANY DIAGRAM B. SHOWING THE QUANTITY (IN POUNDS AVOIRDUPOIS AND TONS) OF THE **RAW TEXTILES** IMPORTED INTO THE UNITED KINGDOM, DECENNIALLY SINCE 1821; THE RATE OF INCREASE IN SAME; AS FAR AS CAN BE GIVEN, THE PRICE PER lb. AND PER TON; AND THE TOTAL COMPUTED REAL VALUE OF EACH KIND IN THE SAME PERIODS.

DESCRIPTION OF PRODUCE.	Years.	QUANTITY IMPORTED.		PER CENTAGE OF INCREASE.		ANNUAL AVERAGE PRICE.				TOTAL COMPUTED REAL VALUE.	Years.	DESCRIPTION OF PRODUCE.
						"UNITED STATES UPLAND."		"EAST INDIA SURAT."				
		lbs.	Tons.	As compared with each former period.	As compared with 1821.	Per lb. d.	Per ton. £ s.	Per lb. d.	Per ton. £ s.			
COTTON.	1821	132,536,620	59,168	...	...	9½	88 13	7⅞	73 10	5,246,241	1821	COTTON.
	1831	288,674,853	128,873	118	118	6	56 0	4⅝	43 3	7,216,871	1831	
	1841	487,992,355	217,854	69	268	6¼	58 6	4⅜	43 3	13,078,195	1841	
	1851	757,379,749	338,116	55	471	5¾	53 13	4	37 6	18,707,279	1851	
	1859	1,225,989,072	547,316	62	825	6¼	58 6	4¾	44 6	34,559,636	1859	
						1ST QUALITY, AUSTRALIAN.						
WOOL.	1821	9,794,620	4,373	...	...	Per lb. d.		Per ton. £			1821	WOOL.
	1831	31,652,029	14,130	223	223						1831	
	1841	56,170,974	25,076	77	473	19		177			1841	
	1851	83,311,975	37,193	48	750	19½		182			1851	
	1859	133,284,634	59,502	60	1,261	23		214		9,831,007	1859	
						No. 3.—TSATLEE.						
SILK.	1821	2,641,866	1,179	...	...	Per lb. s. d.		Per ton. £			1821	SILK.
	1831	4,621,874	2,063	75	75						1831	
	1841	4,966,098	2,217	7	88						1841	
	1851	6,597,178	2,945	33	150	18 10		2,108			1851	
	1859	12,578,849	5,615	91	376	21 6		2,408		10,596,676	1859	
						ST. PETERSBURGH.				ARCHANGEL. 4th sort.	RIGA.	
						12 Head.		9 Head.				
						Per lb. d.	Per ton. £ s.	Per lb. d.	Per ton. £	Per lb. d. / Per ton. £	Per lb. d. / Per ton. £	
FLAX.	1821	42,827,568	19,119	...	...							FLAX.
	1831	104,878,032	46,820	145	145	5¼	49 0	...	...	... ...	... ...	
	1841	150,846,416	67,342	44	252	4½	42 10	4	37	3⅞ 36	4⅛ 38	
	1851	133,748,608	59,709	— 11*	212	4¼	40 0	3⅞	36	4¼ 40	3½ 33	
	1859	160,388,144	71,602	20	274	6¼	58 0	4½	42	5⅞ 55	5⅜ 50	3,769,058
						HEMP, ST. PETERSBURGH, "CLEAN."						
HEMP, And other Fibres of the nature of Hemp, exclusive of Jute.	1821	47,730,256	21,308	...	...	Per lb. d.		Per ton. £ s.			1821	HEMP.
	1831	58,654,195	26,185	23	23	3½		33 0			1831	
	1841	66,350,098	29,621	13	39	3⅜		37 0			1841	
	1851	81,616,416	36,436	23	71	3¼		30 5			1851	
	1859	123,053,504	54,935	51	158	3¼		30 10		1,561,548	1859	
	1821				As comp. with 1831.	JUTE OF MEDIUM QUALITY.					1821	
JUTE.	1831	797,645	356	...	...	Per lb. d.		Per ton. £ s.			1831	JUTE.
	1841	6,692,382	2,988	739	739						1841	
	1851	63,245,728	28,235	845	7,831	1⅜		13 10			1851	
	1859	118,864,256	53,064	88	14,806	1⅞		18 0		790,383	1859	

* In 1851, we received eleven per cent. less of Flax than in 1841.

Diagram **A**, Showing the Relative Proportion of the Quantities Producing Countries of the World.



OF **RAW TEXTILE MATERIALS,** EXPORTED BY EACH OF THE
(*Average of years* 1856-7-8.)

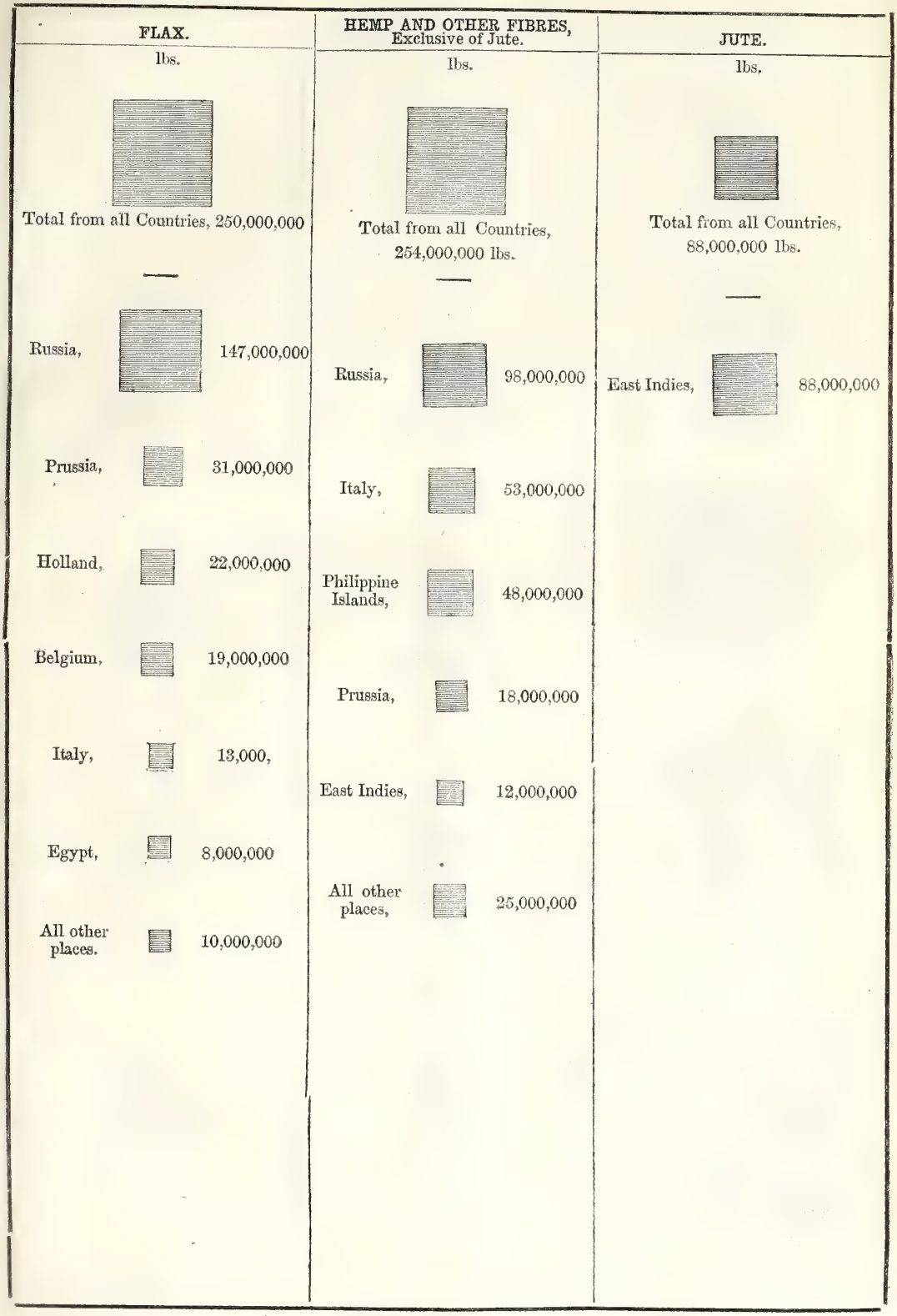


DIAGRAM **B**, SHOWING THE RELATIVE PROPORTIONS
THE UNITED KINGDOM

COTTON.	WOOL.	SILK.
1821. 132,536,620 lbs.	1821. 9,794,620 lbs.	1821. 2,641,866 lbs.
1831. 288,674,853 lbs.	1831. 31,652,029 lbs.	1831. 4,621,874 lbs.
1841. 487,992,355 lbs.	1841. 56,170,974 lbs.	1841. 4,966,098 lbs.
1851. 757,379,749 lbs.	1851. 85,311,975 lbs.	1851. 6,597,178 lbs.
1859. 1,225,989,072 lbs.	1859. 133,284,634 lbs.	1859. 12,578,849 lbs.

OF THE IMPORTS OF **RAW TEXTILES** INTO
DECENIALLY SINCE 1821.

FLAX.	HEMP AND OTHER FIBRES of the Nature of Hemp, exclusive of Jute.	JUTE.
1821. 42,827,568 lbs.	1821. 47,730,256 lbs.	1821. NO RETURNS.
1831. 104,878,032 lbs.	1831. 58,654,195 lbs.	1831. 797,645 lbs.
1841. 150,846,416 lbs.	1841. 66,350,098 lbs.	1841. 6,692,382 lbs.
1851. 133,748,608 lbs.	1851. 81,616,416 lbs.	1851. 63,245,728 lbs.
1859. 160,388,144.	1859. 123,053,504 lbs.	1859. 118,864,256 lbs.

Diagram C, Showing Proportion of **RAW TEXTILES** Imported into the UNITED KINGDOM, compared with that into all OTHER COUNTRIES.—(*Average of years* 1856-7-8.)

Material.	EXPORTED from the Producing Countries.	IMPORTED into the United Kingdom.	Taken by all other Countries.
COTTON	1,550,500,000 lbs.	1,010,000,000 lbs.	540,500,000 lbs.
WOOL ...	364,000,000 lbs.	124,200,000 lbs.	239,800,000 lbs.
SILK.....	30,000,000 lbs.	11,300,000 lbs.	18,800,000 lbs.
FLAX ...	250,000,000 lbs.	180,000,000 lbs.	70,000,000 lbs.
HEMP ...	254,000,000 lbs.	94,200,000 lbs.	159,800,000 lbs.
JUTE ...	88,000,000 lbs.	77,600,000 lbs.	18,800,000 lbs.

TABLE I. INDIAN SOILS,* CONTRASTED WITH EUROPEAN FLAX SOILS.—1. INDIAN SOILS.

WHENCE PROCURED. Territory.	District or Tract of Country.	Locality.	REMARKS.	COMPOSITION. Water above 212° and Organic Matter.	Potash.	Soda.	Lime.	Magnesia.	Alumina.	Iron. (peroxide.)	Chloride of Sodium.	Chlorine in Chloride of Sodium.	Phosphoric Acid.	Sulphuric Acid.	Carbonic Acid.	Silica. (readily soluble.)	Silica as Silex and as Silicates.	MOISTURE.	CAPACITY FOR MOISTURE. Soil dried at 212° and exposed for 12 hours in air at 80°, saturated with moisture absorbed.	ANALYST.
				per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	
PUNJAB	Baree Doab, between the Ravee and Sutlej	Lahore	Cultivated and irrigated	0·930	1·029	0·722	3·290	1·910	12·660	10·000	0·036	0·0218	0·132	0·024	1·760	...	63·800	3·930	4·070	Bernays. *a*
,, ...	,, ,,	,, ...	From 5 ft. below surface of last.	0·500	1·820	1·313	4·670	2·010	14·630	4·100	0·033	0·0200	0·097	0·030	2·400	0·740	65·970	2·160	2·160	,, *b*
,, ...	,, ,,	Serdar poor	Cultivated	2·000	0·933	0·410	2·439	1·001	11·230	11·700	trace	trace.	0·100	trace	1·631	...	69·240	2·000	1·250	Manning.
,, ...	,, ,,	Mooltan	Uncultivated—covered with grass	1·520	2·240	0·801	2·150	0·443	12·980	8·010	0·055	0·0323	0·117	0·041	0·720	0·970	69·030	1·860	2·340	Bernays. *c*
,, ...	,, ,,	,, ...	From 3 ft. below surface	1·370	2·130	1·232	2·480	0·590	14·150	6·340	0·078	0·0475	0·109	0·055	1·400	...	68·670	1·090	1·380	,, *d*
,, ...	Jetch Doab, between the Jhelum and Chenab ...	Kot Isa Shah	Cultivated, not manured	2·410	0·520	0·213	5·493	1·330	12·260	6·310	trace	trace.	0·043	trace	4·317	...	66·640	1·750	2·000	Manning.
,, ...	Sind Saugur Doab, between the Indus and Jhelum ...	Near Rawul Pindee...	Ordinary cultivated soil	2·840	1·038	0·404	7·480	0·720	17·890	5·110	0·074	0·0449	0·107	0·075	0·512	1·870	57·630	4·430	4·100	Bernays. *e*
SIND	West of Indus	Larkhana	Good cultivated soil	2·300	1·103	0·620	5·331	0·569	15·850	14·720	trace	trace.	0·060	trace	4·208	...	54·940	3·000	4·000	Manning.
EASTERN BENGAL	Near the Megna	Five miles east of Koralea	Regularly inundated—Cultivated during 8 months of the year	1·190	0·598	1·656	1·490	1·430	17·440	4·890	0·020	0·0120	0·132	0·052	...	...	67·000	4·160	4·120	Bernays. *f*
,, ,,	On the Surma, near to junction with Brahmapootra .	Rajaganj	Cultivated — inundated during rains	1·730	0·786	0·686	0·890	1·240	16·270	3·460	0·016	0·0090	0·082	0·004	...	1·400	70·600	2·930	2·460	,, *g*
,, ,,	Left-side of Brahmapootra .	Opposite Jairampoor.	Cultivated—inundated	1·950	0·664	0.513	trace.	0·240	22·240	5·230	0·053	0·0320	0·015	0·020	trace.	0·650	61·855	6·750	5·130	,, *h*
,, ,,	Most Northern Part of Brahmapootra Delta ...	Jumalpoor	Cultivated—inundated at period of removal of specimen	1·780	0·450	0·253	0·084	0·232	14·010	7·040	0·041	0·0247	0·125	0·005	0·130	0·380	71·170	4·700	5·030	,, *i*
ASSAM...	Brahmapootra river system.	Near to Debroogurh .	Used for tea cultivation	0·020	0·820	0·758	2·530	0·740	16·550	7·850	0·022	0·0133	0·115	0·001	trace.	...	65·046	5·700	4·150	,, *j*
,, ,,	,, ,,	,,	Occasionally cultivated—never manured	0·130	1·810	1·795	0·890	1·450	17·470	4·530	0·029	0·0176	0·042	0·003	0·006	3·720	64·980	3·330	3·240	,, *k*
,, ,,	Island in the Brahmapootra	Machulee, near to village called Salamara	"Plastic Clay"—cultivated ...	3·500	0·620	0·167	trace.	1·210	29·630	3·670	0·025	0·0152	0·058	0·004	0·080	...	55·330	5·830	5·040	,, *l*
,, ,,	Eastward of Debroogurh ...	Bijitoilia	Indifferent tea soil, from close to the shore	1·440	0·700	0·043	0·224	0·500	12·830	9·660	0·033	0·0200	0·063	0·006	0·040	0·400	69·260	3·030	2·680	,, *m*
BENGAL	Three miles east of Bhagulpore	Rajpoor	Cultivated—not manured—extends over a large surface ..	1·130	1·570	1·162	0·208	0·400	9·100	5·410	0·041	0·0247	0·088	0·018	...	0·345	79·325	1·470	1·360	,, *n*
N. W. PROVINCES	Ganges river system	Cawnpore	Cultivated—not manured... ..	0·370	0·445	0·582	3·930	0·240	13·560	3·770	0·051	0·0309	0·121	0·003	1·200	...	72·842	3·170	2·780	,, *o*
OUDE	,, ,,	Lucknow	"Fertile soil"	2·400	0·193	0·050	36·405	0·270	2·870	3.270	trace	trace.	trace	trace	26·202	...	28·290	1·500	2·000	Manning.
BUNDELCUND ...	72 miles N.W. from Saugor	Teree	Good wheat soil—covers large area	0·140	0·578	0·383	0·224	0·308	11·930	1·400	0·033	0·0200	0·023	0·001	0·200	1·300	80·130	2·850	2·770	Bernays. *p*
,, ...	93 ,, ,, from ,,	Bomoree	Good, but rather stoney—extends over a large surface ..	1·247	0·614	0·590	1·420	0·100	9·180	1·350	0·023	0·0139	0·041	0·021	trace.	0·050	83·950	1·083	0·847	,, *q*
MALWA	Central India	Gurchamer	Good cotton soil—not manured	0·200	0·720	0·529	2·190	1·440	23·292	13·438	0·055	0·0333	0·008	0·003	0·200	0·720	41·210	16·000	13·090	,, *r*
SAUGOR AND NERBUDDA	,, ,, ...	Between Panaguri and Jubbulpore ...	Good cotton soil of great extent—not manured	none	0·573	1·719	1·680	0·720	16·660	6·000	0·053	0·0320	0·166	0·071	0·200	1·000	60·500	10·700	7·460	,, *s*
DECCAN	Right-shore of Kistnah ..	Khamlepur	Good black cotton soil—not manured	0·460	0·813	0·779	5·610	0·143	19·930	11·406	0·053	0·0320	0·038	0·014	0·980	2·640	39·098	17.000	12·441	,, *t*
MYSORE	Southern India	Bellary	Good black cotton soil	0·260	0·332	0·774	6·350	0·290	13·330	5·330	0·035	0·0333	0·101	0·034	4·060	...	57·330	12·000	9·045	,, *u*
			2.—EUROPEAN FLAX SOILS.																	
RUSSIA	Lievland	...	...	4·717	0·501	...	0·375	0·201	12·990	1·807	0·045	0·0273	0·140	0·154	...	...	79·342	...	...	Mayer & Brazier.
,, ...	Courland	...	...	4·030	0·324	0·132	2·651	0·130	7·987	2·376	0·024	0·0145	0·054	0·028	...	...	81·500	...	...	
,, ...	Lithuania	...	...	4·344	0·546	0·045	1·375	0·180	24·593	3·190	0·042	0·0254	0·080	0·120	...	...	85·200	...	...	
...	Estland	...	...	4·868	0·372	0·048	2·807	0·361	7·765	2·020	0·079	0·0479	0·159	0·162	...	...	80·560	...	...	
BELGIUM	Heestert...	...	...	3·123	0·160	0·298	0·357	0·262	17·022	3·298	0·017	0·0103	0·121	0·025	...	...	75·080	...	...	Kane.
,, ...	Escamaffles	...	...	2·361	0·123	0·146	0·227	0·153	10·663	1·663	0·330	0·0181	0·152	0·017	...	...	84·065	...	...	
,, ...	Hamme Zog	...	...	4·209	0·068	0·110	0·481	0·140	5·885	1·202	0·067	0·0406	0·064	0·013	...	...	86·797	...	...	
,, ...	Not named	...	...	3·672	0·151	0·206	0·366	0·142	5·388	1·543	0·009	0·0054	0·193	0·026	...	...	88·385	...	...	
HOLLAND	,, ,, ...	...	...	5·841	0·583	0·306	3·043	0·105	22·706	6·047	0·023	0·0139	0·159	0·023	...	...	60·947	...	...	

* A portion of those which have been selected for analysis from an extensive collection made for the Indian Government by the Messrs. Schlagintweit.

a A light-drab coloured impalpable soil. *b* A very light-drab coloured soil—almost impalpable. *c* A light-drab coloured impalpable soil. *d* Very similar to 6 in colour and properties. *e* A drab coloured soil; very dense, but reducible by water to a paste. *f* A drab coloured soil, with a reddish hue—almost impalpable. *g*. A very light-brown soil—somewhat lumpy—reducible by water to a paste. *h* A red soil, lumpy, with much silex—stiff. *i* A yellowish-brown soil, with much silex. *j* A very peculiar micaceous soil of red colour. *k* A drab coloured soil approaching whiteness—impalpable almost. *l* A drab coloured soil, approaching whiteness—almost impalpable—very stiff. *m* A light reddish-brown soil, micaceous; very fine, but not impalpable. *n* A very light brown soil, almost impalpable. *o* A drab coloured micaceous soil, very finely divided. *p* A deep-drab—very lumpy, much silex. *q* A light sienna-brown soil—much silex. *r* An olive-brown soil, rather gritty, yet very dense. *s* A brown lumpy soil, much silex. *t* A deep sepia-brown soil, with some coarse silex. *u* A deep slate coloured soil, with silex and chalk particles, &c.

TABLE II., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **LINSEED** EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850–1 TO 1857–8 INCLUSIVE:—

Years.	Whence Exported	Countries whither exported. United Kingdom. Quantity.	United Kingdom. Value.	France. Quantity.	France. Value.	Other Parts of Europe. Quantity.	Other Parts of Europe. Value.	North America. Quantity.	North America. Value.	China. Quan.	China. Val.	Arabian and Persian Gulf. Quan.	Arabian and Persian Gulf. Value.	Islands and Shores of the Indian Seas. Quantity.	Islands and Shores of the Indian Seas. Value.	All other Places. Quantity.	All other Places. Value.	Total exported to all parts. Quantity.	Total exported to all parts. Quantity.	Total exported to all parts. Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850–1.	Bengal...	24,521,504	59,601	3,701,712	8,997	72,688	177	34,675,760	84,277	...	...	...	...	2,016	5	15,568	38	62,989,248	28,120	153,095
	Madras ..	89,264	226	...	...	...	...	...	...	...	...	...	...	..	...	448	1	89,712	40	227
	Bombay..	5,611,424	17,051	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,611,424	2,505	17,051
	All India.	**30,222,192**	**76,878**	**3,701,712**	**8,997**	**72,688**	**177**	**34 675,760**	**84,277**	...	...	...	...	**2,016**	**5**	**16,016**	**39**	**68,690,384**	**30,665**	**170,373**
1851–2.	Bengal...	70,467,488	171,275	1,452,528	6,330	2,262,064	5,498	42,039,648	102,181	...	...	...	...	...	...	31,808	77	116,253,536	51,899	285,361
	Madras ..	114,464	277	...	...	...	...	...	...	...	...	...	...	...	...	...	...	114,464	51	277
	Bombay..	10,822,672	28,989	...	...	672	2	1,066,352	3,332	...	...	...	...	...	...	448	3	11,890,144	5,308	32,326
	All India.	**81,404,624**	**200,541**	**1,452,528**	**6,330**	**2,262,736**	**5,500**	**43,106,000**	**105,513**	...	...	...	...	...	...	**32,256**	**80**	**128,258,144**	**57,258**	**317,964**
1852–3.	Bengal...	55,871,424	135,798	573,440	1,394	50,624	123	50,433,600	105,916	...	...	...	...	3,360	8	10,640	26	106,943,088	47,742	243,265
	Madras ..	116,032	306	...	...	...	...	...	...	...	...	...	...	...	...	1,008	3	117,040	52	309
	Bombay..	12,802,608	34,293	560	1	...	...	...	...	...	...	...	...	...	...	33,712	90	12,836,880	5,731	34,384
	All India.	**68,790,064**	**170,397**	**574,000**	**1,395**	**50,624**	**123**	**50,433,600**	**105,916**	...	...	...	...	**3,360**	**8**	**45,360**	**119**	**119,897,008**	**53,525**	**277,958**
1853–4.	Bengal...	36,017,968	87,544	1,510,320	3,671	224,560	546	47,370,400	114,892	448	1	...	...	...	...	81,872	199	85,205,568	38,038	206,853
	Madras ..	315,952	933	...	...	...	...	...	...	...	...	...	...	...	...	1,904	6	317,856	142	939
	Bombay..	5,782,672	69,586	30,128	362	...	...	...	...	...	...	...	...	...	...	9,408	113	5,822,208	2,599	70,061
	All India.	**42,116,592**	**158,063**	**1,540,448**	**4,033**	**224,560**	**546**	**47,370,400**	**114,892**	**448**	**1**	...	...	...	...	**93,184**	**318**	**91,345,632**	**40,779**	**277,853**
1854–5.	Bengal...	126,898,464	307,460	3,618,832	8,796	8,176	20	...	...	2,576	15	...	...	58,576	107	...	...	130,586,624	58,298	316,398
	Madras ..	192,864	591	...	...	...	...	...	...	...	...	...	...	...	...	...	...	192,864	86	591
	Bombay..	5,972,176	71,380	31,472	377	64,512	1,050	...	...	...	...	...	...	...	...	...	...	6,068,160	2,709	72,807
	All India.	**133,063,504**	**379,431**	**3,650,304**	**9,173**	**72,688**	**1,070**	...	...	**2,576**	**15**	...	...	**58,576**	**107**	...	...	**136,847,648**	**61,093**	**389,796**
1855–6.	Bengal...	124,002,144	301,430	3,630,144	8,823	...	...	87,189,872	211,921	...	...	...	...	72,352	176	235,312	572	215,129,824	96,040	522,922
	Madras ..	204,064	650	...	..	...	...	...	...	...	...	...	...	...	...	...	...	204,064	91	650
	Bombay..	7,183,792	116,770	264,992	4,308	3,360	54	...	...	...	...	...	...	...	...	..	...	7,452,144	3,327	121,132
	All India.	**131,390,000**	**418,850**	**3,895,136**	**13,131**	**3,360**	**54**	**87,189,872**	**211,921**	...	...	...	...	**72,352**	**176**	**235,312**	**572**	**222,786,032**	**99,458**	**644,704**
1856–7.	Bengal...	20,463,632	66,071	2,002,000	4,858	505,344	1,228	145,506,480	353,667	...	...	...	...	3,248	8	247,296	601	168,728,000	75,325	426,433
	Madras ..	717,472	2,003	13,664	38	7,280	13	...	...	...	...	...	...	...	...	7,280	21	745,696	333	2,075
	Bombay..	7,654,640	124,034	434,336	7,039	127,680	2,070	...	..	...	...	...	...	...	...	...	...	8,216,656	3,668	133,143
	All India.	**28,835,744**	**192,108**	**2,450,000**	**11,935**	**640,304**	**3,311**	**145,506,480**	**353,667**	...	...	...	...	**3,248**	**8**	**254,576**	**622**	**177,690,352**	**79,326**	**561,651**
1857–8.	Bengal...	74,057,088	187,925	2,296,672	5,582	136,528	332	89,848,752	218,382	...	...	...	...	229,712	558	22,512	55	166,591,264	74,371	412,834
	Madras ..	703,696	2,469	20,384	62	...	...	...	...	...	...	...	...	...	...	...	...	724,080	323	2,531
	Bombay..	8,875,776	177,837	284,256	5,346	342,048	7,369	1,737,792	30,792	...	...	...	...	...	...	...	...	11,239,872	5,018	221,344
	All India.	**83,636,560**	**368,231**	**2,601,312**	**10,990**	**478,576**	**7,701**	**91,586,544**	**249,174**	...	...	...	...	**229,712**	**558**	**22,512**	**55**	**178,555,216**	**79,712**	**636,709**

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE III.,[5] SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **JUTE** AND **JUTE ROPE** EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850-1 TO 1857-8 INCLUSIVE :—

Years.	Whence Exported.	Countries whither exported. United Kingdom. Quantity.	United Kingdom. Value.	France. Quantity.	France. Value.	Other Parts of Europe. Quantity.	Other Parts of Europe. Value.	North America. Quantity.	North America. Value.	China. Quantity.	China. Val.	Arabian and Persian Gulf. Quantity.	Arabian and Persian Gulf. Val.	Islands and Shores of the Indian Seas. Quantity.	Islands and Shores of the Indian Seas. Value.	All Other Places. Quantity.	All Other Places. Value.	Total Exported. To all Parts. Quantity.	Total Exported. To all Parts. Quantity.	Total Exported. To all Parts. Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850-1.	Bengal...	63,273,168	191,069	1,146,320	3,441	43,568	130	760,480	2,282	...	...	...	...	...	...	4,480	14	65,228,016	29,120	196,936
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	63,273,168	191,069	1,146,320	3,441	43,568	130	760,480	2,282	...	...	...	...	...	...	4,480	14	65,228,016	29,120	196,936
1851-2.	Bengal...	55,947,920	168,974	1,874,768	5,623	...	...	2,126,432	6,379	...	...	...	...	...	...	...	...	59,949,120	26,763	180,976
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	55,947,920	168,974	1,874,768	5,623	...	...	2,126,432	6,379	...	...	...	...	...	...	...	...	59,949,120	26,763	180,976
1852-3.	Bengal...	35,278,544	101,380	1,817,984	5,178	30,016	85	2,028,208	5,804	...	...	...	...	27,440	127	784	4	39,182,976	17,492	112,578
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	35,278,544	101,380	1,817,984	5,178	30,016	85	2,028,208	5,804	...	...	...	...	27,440	127	784	4	39,182,976	17,492	112,578
1853-4.	Bengal...	41,498,240	117,982	4,596,704	12,908	...	...	10,833,648	30,452	...	...	112	1	49,840	167	86,240	259	57,064,784	25,475	161,769
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	41,498,240	117,982	4,596,704	12,908	...	...	10,833,648	30,452	...	...	112	1	49,840	167	86,240	259	57,064,784	25,475	161,769
1854-5.	Bengal...	63,363,888	184,588	3,870,720	12,280	...	...	10,494,400	30,432	...	...	...	...	44,128	300	578,256	1,641	78,351,392	34,978	229,241
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	63,363,888	184,588	3,870,720	12,280	...	...	10,494,400	30,432	...	...	...	...	44,128	300	578,256	1,641	78,351,392	34,978	229,241
1855-6.	Bengal...	85,751,568	285,499	6,220,368	20,705	118,720	393	6,085 520	20,223	173,152	560	...	...	255,248	818	166,768	600	98,771,344	44,094	328,798
	Madras...	92 736	278	...	...	...	...	...	...	...	...	...	...	...	...	...	...	92,736	41	278
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	85,844,304	285,777	6,220,368	20,705	118,720	393	6,085,520	20,223	173,152	560	...	...	255,248	818	166,768	600	98,864,080	44,135	329,076
1856-7.	Bengal...	55,164,816	201,122	7,277,200	26,483	10,864	40	12,569,984	45,824	137,088	500	...	...	35,168	110	268,352	978	75,463,472	33,689	275,057
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	55,164,816	201,122	7,277,200	26 483	10,864	40	12,569,984	45,824	137,088	500	...	...	35,168	110	268,352	978	75,463,472	33,689	275,057
1857-8.	Bengal...	75,065,312	251,275	5,042,240	24,274	70,448	235	7,709,520	25,884	...	...	...	...	31,024	189	429,072	1,435	88,347,616	39,441	303,292
	Madras...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	All India.	75,065,312	251,275	5,042,240	24,274	70,448	235	7,709,520	25,884	...	...	...	...	31,024	189	429,072	1,435	88,347,616	39,441	303,292

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE IV., SHOWING THE NUMBER AND VALUE* (AS FAR AS CAN BE ASCERTAINED) OF **GUNNY BAGS** AND OF **"GUNNIES"** (PIECES OF GUNNY CLOTH) EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850–1 TO 1857–8 INCLUSIVE :—

Years.	Whence Exported.	PLACES WHITHER EXPORTED. United Kingdom.			France.			Other Parts of Europe.			North America.			China.			Arabian and Persian Gulf.			Islands and Shores of the Indian Seas.			All other Parts.			Total Exported to All Parts.		
		Number of		Value.	Number of		Val.	Number of		Val.	Number of		Value.	Number of		Val.	Number of		Val.	Number of		Value.	Number of		Value	Number of		Value.
		Bags	Pieces.	£	Bags	Pieces.	£	Bags	Pieces.	£	Bags	Pieces.	£	Bags	Pieces.	£	Bags.	Pieces.	£	Bags.	Pieces.	£	Bags.	Pieces.	£	Bags.	Pieces.	£
1850-1.	Bengal ...	...	69,636	1,565	...	..	...	...	2,180	94	...	2,290,427	130,249	...	...	...	...	4,000	44	...	1,286,150	17,685	...	701,145	8,456	...	4,353,538	158,087
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	27,700	...	292	27,700	...	292
	Bombay ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	550	8	...	...	...	...	1,150	34	...	1,700	42
	All India..	...	69,636	1,565	...	...	...	...	2,180	94	...	2,290,427	130,249	...	...	...	...	4,550	52	...	1,286,150	17,685	27,700	702,295	8,776	27,700	4,355,238	158,421
1851-2.	Bengal ...	...	67,650	789	...	...	...	...	100	20	...	8,391,719	260,865	...	17,375	211	...	...	...	...	690,918	10,179	...	561,710	7,206	...	9,729,472	279,270
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	2,500	...	25	39,050	...	399	41,550	...	424
	Bombay ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	154	7	...	...	...	...	445	19	...	599	26
	All India..	...	67,650	789	...	...	...	...	100	20	...	8,391,719	260,865	...	17,375	211	...	154	7	2,500	690,918	10,204	39,050	562,155	7,624	41,550	9,730,071	279,720
1852-3.	Bengal ...	...	5,100	52	...	25,000	256	...	274	11	...	3,347,580	169,648	...	245,750	2,518	...	...	...	...	1,128,323	20,026	...	664,269	8,770	...	5,416,296	201,281
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	. .	...	...	...	...	...	...	17,870	...	236	17,870	...	236
	Bombay ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6,000	150	...	...	...	...	...	..	...	6,000	150
	All India..	...	5,100	52	...	25,000	256	...	274	11	...	3,347,580	169,648	...	245,750	2,518	...	6,000	150	...	1,128,323	20,026	17,870	664,269	9,006	17,870	5,422,296	201,667
1853-4.	Bengal ...	...	16,124	193	...	...	...		17,100	289	...	5,539,788	138,489	...	19,700	244	...	6,400	106	...	1,017,660	18,251	...	1,264,746	16,794	...	7,881,518	174,366
	Madras ...	...	...	...	...	...	...	...	...	...	. .	...	...	...	...	...	...	...	...	...	...	...	34,950	...	379	34,950	...	379
	Bombay ...	. .	...	...	...	...	...	...	...	..	..	...	...	...	...	...	...	4,370	90	...	...	...	...	6,010	91	...	10,380	181
	All India..	...	16,124	193	...	...	...	...	17,100	289	...	5,539,788	138,489	...	19,700	244	...	10,770	196	...	1,017,660	18,251	34,950	1,270,756	17,264	34,950	7,891,898	174,926
1854-5.	Bengal ...	...	50,300	515	...	...	...	...	...	...	...	9,138,141	180,954	...	1,000	11	...	...	...	...	778,076	14,732	...	1,262,146	17,414	...	11,229,663	213,626
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	115,440	...	1,381	115,440	...	1,381
	Bombay ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10,500	...	208	...	...	...	850	. .	131	11,350	...	339
	All India..	...	50,300	515	...	...	...	...	...	...	...	9,138,141	180,954	...	1,000	11	10,500	...	208	...	778,076	14,732	116,290	1,262,146	18,926	126,790	11,229,663	215,346
1855-6.	Bengal ...	...	89,616	3,160	...	8,300	115	...	...	...	...	9,251,758	273,660	...	29,000	375	...	400	10	...	970,553	14,301	...	510,789	10,493	...	10,860,416	302,114
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17,010	...	222	17,010	...	222
	Bombay ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	364	...	4	...	...	...	...	...	...	364	...	4
	All India..	...	89,616	3,160	...	8,300	115	...	...	...	...	9,251,758	273,660	...	29,000	375	364	400	14	...	970,553	14,301	17,010	510,789	10,715	17,374	10,860,416	302,340
1856-7.	Bengal ...	...	37,830	418	..	3,705	57	...	380	60	...	6,355,142	324,752	...	3,000	75	...	1,990	22	...	2,046,189	36,223	...	933,046	14,474	...	9,381,282	376,081
	Madras ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2,643	...	167	2,643	...	167
	Bombay ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20	...	5	...	...	...	...	...	...	20	...	5
	All India..	...	37,830	418	...	3,705	57	...	380	60	...	6,355,142	324,752	...	3,000	75	20	1,990	27	...	2,046,189	36,223	2,643	933,046	14,641	2,663	9,381,282	376,253
1857-8.	Bengal ...	...	72,000	1,139	...	21,000	275	...	...	...	...	4,155,890	167,094	...	...	...	...	5,900	83	...	574,273	31,563	...	1,063,016	16,423	...	5,892,079	216,577
	Madras ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	8,683	...	469	8,683	...	469
	Bombay ...	...	...	...	...	...	...	...	...	.	...	...	...	...	...	...	Cwt. 10	...	21	...	...	...	2,172	...	25	2,172	...	46
	All India..	...	72,000	1,139	...	21,000	275	...	...	...	...	4,155,890	167,094	...	...	...	Cwt 10	5,900	104	...	574,273	31,563	10,855	1,063,016	16,917	10,855	5,892,079	217,092

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE V.

SHOWING THE QUANTITY OF **HEMP, JUTE,** AND **OTHER FIBRES** OF THE NATURE OF HEMP, IMPORTED INTO THE UNITED KINGDOM FROM EACH COUNTRY, THEIR COMPUTED REAL VALUE, AND THE ANNUAL AVERAGE PRICE OF HEMP AND JUTE SINCE 1831.

Years.	Russia.	Italy.	British East Indies.	Philippine Islands.	Other Countries.	Total Quantity.		Computed Real Value.	Annual Average Price. Hemp, St. Petersburg "clean."			Annual Average Price. Jute.			Years.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	tons.	£	per lb. d.	per ton. £	s.	per lb. d.	per ton. £	s.	
1831	**56,761,936**	**829,360**	**1,060,864**	**253,344**	**546,336**	**59,451,840**	**26,541**	NOT OFFICIALLY RECORDED UNTIL 1854.	**3½**	**33**	**0**	...	...		**1831**
1832	55,143,648	3,690,176	6,203,568	653,408	788,368	66,479,168	29,678		3⅛	29	0	...	...		1832
1833	52,635,408	1,834,336	3,808,896	11,088	785,680	59,075,408	26,373		3	28	0	...	...		1833
1834	65,390,080	3,463,152	5,827,920	...	785,568	75,466,720	33,690		3	27	10	...	...		1834
1835	68,378,128	2,119,712	4,575,648	1,070,048	863,072	77,006,608	34,378		2¾	26	0	...	...		1835
1836	62,323,296	535,808	2,058,560	299,824	418,096	65,635,584	29,302		3¼	30	0	...	...		1836
1837	66,267,600	350,112	18,859,232	206,640	961,968	86,645,552	38,681		3⅜	31	0	...	...		1837
1838	65,072,000	554,400	12,095,328	2,622,032	1,458,352	81,802,112	36,519		3¾	35	0	...	...		1838
1839	87,473,344	1,645,392	15,489,712	3,215,632	3,693,536	111,517,616	49,785		3⅞	37	0	...	...		1839
1840	67,070,080	741,664	6,225,296	1,728,272	850,304	76,615,616	34,203		4⅛	39	0	...	...		1840
1841	**60,789,568**	**1,427,328**	**8,116,528**	**1,880,368**	**828,688**	**73,042,480**	**32,608**		**3⅞**	**37**	**0**	...	...		**1841**
1842	46,543,280	3,718,400	14,407,904	621,488	330,288	65,621,360	29,295		3½	32	0	...	...		1842
1843	51,862,832	2,461,760	25,514,944	2,167,648	396,032	82,403,216	36,787		3¼	30	0	...	...		1843
1844	73,466,848	2,169,328	23,675,904	1,581,664	1,388,352	102,282,096	45,662		3	28	10	...	...		1844
1845	67,568,032	1,983,296	30,683,856	454,272	3,677,744	104,367,200	46,593		3⅛	29	0	...	...		1845
1846	69,513,472	2,416,512	21,354,928	1,523,872	4,075,344	98,884,128	44,145		3½	32	0	...	...		1846
1847	60,799,984	3,662,736	20,808,256	1,963,584	3,660,720	90,895,280	40,578		4	38	0	2¼	20	15	1847
1848	60,076,800	840,112	28,922,656	3,759,168	1,127,616	94,726,352	42,289		3½	32	10	1¾	17	0	1848
1849	71,337,056	2,918,160	40,338,256	3,988,432	350,112	118,932,016	53,095		3¼	30	0	1⅝	15	5	1849
1850	67,311,104	2,001,440	44,726,640	1,751,344	1,656,592	117,447,120	52,432		3¼	30	10	1⅝	15	0	1850
1851	**74,432,960**	**1,149,680**	**66,149,888**	**2,557,520**	**572,096**	**144,862,144**	**64,671**		**3¼**	**30**	**5**	**1½**	**13**	**10**	**1851**
1852	60,313,456	2,991,632	52,141,600	2,823,184	2,139,984	120,409,856	53,754		3⅜	31	0	1⅜	13	0	1852
1853	93,673,664	4,511,808	35,644,112	2,189,600	5,419,232	141,438,416	63,142		4	37	10	2¼	21	10	1853
1854*	2,337,216	9,722,608	65,238,768	5,227,712	55,005,664	137,531,968	61,398	2,384,578	6¼	58	0	2¾	26	0	1854
1855*	143,920	18,267,088	67,701,984	10,470,544	48,957,552	145,541,088	64,974	1,973,511	5⅜	50	0	2⅛	19	10	1855
1856	60,497,360	4,276,720	85,068,256	3,159,296	18,103,680	171,105,312	76,386	1,984,907	3⅞	37	0	1⅞	18	0	1856
1857	65,038,064	3,227,728	65,423,792	6,256,432	21,153,888	161,099,904	71,920	1,953,444	3¾	35	0	2½	23	0	1857
1858	68,597,088	3,164,672	91,067,536	16,301,600	4,365,424	183,496,320	81,918	1,873,399	3⅛	29	0	2	19	0	1858
1859	**81,946,032**	**13,404,496**	**124,175,184**	**19,355,504**	**3,036,544**	**241,917,760**	**107,999**	**2,362,630**	**3¼**	**30**	**10**	**1⅞**	**18**	**0**	**1859**

* Note.—1854-5 were the years of the Russian war and blockade of the Russian Ports, consequently the falling off in the Import from that quarter, and the simultaneous increase from other countries, made up in the greater part of indirect shipments of Russian hemp through Prussia.

TABLE VI.

Showing (as far as can be ascertained) the NUMBER OF ACRES under CULTIVATION of **JUTE*** and **HEMP** or Fibres of the Nature of Hemp, in EACH PRESIDENCY in INDIA; (distinguishing each District) and the QUANTITY and VALUE of the produce in the year 1857.

BENGAL.	Under Cultivation.	Average Value of Produce.
	Acres.	£
Azimghur	512	Not stated.
Jounpore	6,521	
Benares	252	
Futtehpore	10,150	
Chumparun	130	277
Chittagong	1,040	2,873
Tipperah	600	400
Bogra	24,000	70,000
Dinajpore	7,000	20,000
Rungpore	20,000	24,000
Pubna	1,000	1,800
Rajishahye	1,570	477
Goalpara	1,830	5,487
Kamroop	800	160
Nowgong	259	621
Luckimpore	10	6
Backergunge	300	2,500
Mymensing	256	160
Dacca	1,040	1,151
Furreedpore	577	296
Sylhet	476	355
Cachar	24	17
Monghyr	1,000	2,000
Bhaugulpore	1,400	2,940
Hazareebaugh	116	72
Maunbhoom	35	33
Bancoorah	6	3
Burdwan	150	191
Hooghly	377	22,766
Midnapore	239	114
Baraset	4,262	6,805
Nuddea	2,424	2,294
24 Pergunnahs	1,889	...
Moorshedabad	318	380
Raedpore (Nagpore)	368	92
Chanda (Nagpore)	225	40
Chindwarra (Nagpore)	194	89
Berar north (Hyderabad)	339	205
Do. south (Hyderabad)	484	260
Dharacco (Hyderabad)	117	24
Raichoor Doab (Hyderabad)	18	19
Total	92,308	£168,907
PUNJAB.		
Umballa	1,296	772
Loodiana	2,072	1,237
Ferozepore	436	178
Jullundhur	2,303	1,123
Hoshiarpore	1,529	907
Kangra	1,254	663
Umritsur	300	544
Goordaspore	2,027	502
Goojranwala	164	82
Sealkote	1,735	694
Jhelum	313	36
Rawul Pinde	5	1
Goojrat	164	155
Huzara	32	96
Mooltan	12	24
Googaira	7	7
Total	13,649	£7,021

BOMBAY.	Under Cultivation.	Quantity Produced.	Value of Produce.
	Acres.	lbs.	£
Poona	270	35,503	236
Ahmednuggur	24,122	3,448,910	15,282
Sholapore	21,462	2,066,730	5,177
Rutnagherry	3,034	568,260	3,155
Belgaum	1,432	286,160	2,503
Dharwar	348	30,092	449
Sattara	4,687	549,944	2,501
Ahmedabad	15	6,242	7
Tannah	320	228,676	1,047
Colaba	62	51,539	325
Scinde	70	...	100
Total	55,822	7,272,056	£30,782
MADRAS.			
Vizagapatam	687	Not stated.	Not stated.
Rajahmundry	2,094		
Masulipatam	2,578		
Cuddapah	7,695		
Kurnool	4,899		
Arcot north	231		
Tinnevelly	284		
Coimbatore	1,000		
Salem	328		
Bangalore (Mysore)	114	77,408	94
Chittledroog (Mysore)	35	146,042	108
Astragam (Mysore)	11	7,400	7
Nuggur (Mysore)	401	198,112	190
Total	20,357	428,962	£399

No returns have been received of the Maldah and Shahabad districts in Bengal, nor from any of the districts in the North-West Provinces. This is attributable to the disturbed state of the country at the time this information was collected.

* The growth of Jute is almost confined to Bengal. The Sunn, *Crotalaria juncea*, constitutes the great proportion of the other hemp-like fibres furnished by the other districts here mentioned.

TABLE VII., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **COIR** AND **COIR ROPE** EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850-1 TO 1857-8 INCLUSIVE:—

Years.	Whence Exported.	Countries whither exported. United Kingdom. Quantity.	United Kingdom. Value.	France. Quantity.	France. Value.	Other Parts of Europe. Quantity.	Other Parts of Europe. Value.	North America. Quantity.	North America. Value.	China. Quantity.	China. Val.	Arabian and Persian Gulf. Quantity.	Arabian and Persian Gulf. Value.	Islands and Shores of the Indian Seas. Quantity.	Islands and Shores of the Indian Seas. Value.	All other places. Quantity.	All other places. Value.	Total exported. To all parts. Quantity.	Quantity.	Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850-1.	Bengal.....	32,704	212	...	...	...	...	52,528	498	10,416	126	...	...	1,008	10	56,000	475	152,656	68	1,321
	Madras	1,745,072	3,258	88,816	182	...	...	...	...	...	...	681,856	1,767	10,304	19	539,280	1,179	3,065,328	1,369	6,405
	Bombay.....	4,196,304	12,751	...	...	...	...	97,552	166	...	...	247,968	735	...	...	86,912	266	4,628,736	2,066	13,918
	All India. ...	**5,974,080**	**16,221**	**88,816**	**182**	...	...	**150,080**	**664**	**10,416**	**126**	**929,824**	**2,502**	**11,312**	**29**	**682,192**	**1,920**	**7,846,720**	**3,503**	**21,644**
1851-2.	Bengal.....	...	...	...	...	...	...	...	...	5,488	68	...	...	...	...	35,952	328	41,440	18	396
	Madras	2,707,824	5,097	59,472	122	...	...	113,904	310	...	...	810,096	1,974	...	...	372,960	834	4,064,256	1,814	8,337
	Bombay.....	896,896	3,610	...	...	...	...	124,880	558	6,944	31	291,424	1,290	18,480	83	94,192	394	1,432,816	640	5,966
	All India. ...	**3,604,720**	**8,707**	**59,472**	**122**	...	...	**238,784**	**868**	**12,432**	**99**	**1,101,520**	**3,264**	**18,480**	**83**	**503,104**	**1,556**	**5,538,512**	**2,472**	**14,699**
1852-3.	Bengal.....	11,200	68	...	...	...	...	5,264	25	5,264	26	...	...	...	...	896	7	22,624	10	126
	Madras	3,270,400	5,722	9,408	23	...	...	61,600	137	25,312	70	927,360	3,688	31,808	101	310,688	944	4,636,576	2,070	10,685
	Bombay.....	1,277,248	4,055	..	...	...	...	...	...	22,064	98	426,384	1,776	20,160	93	106,288	467	1,852,144	827	6,489
	All India. ...	**4,558,848**	**9,845**	**9,408**	**23**	...	...	**66,864**	**162**	**52,640**	**194**	**1,353,744**	**5,464**	**51,968**	**194**	**417,872**	**1,418**	**6,511,344**	**2,907**	**17,300**
1853-4.	Bengal.....	3,808	48	...	...	...	...	107,408	691	26,656	360	...	...	21,728	229	13,776	159	173,376	77	1,487
	Madras	4,734,912	8,928	14,672	27	141,568	247	...	...	12,992	36	841,232	2,000	11,200	77	345,744	1,243	6,102,320	2,724	12,558
	Bombay.....	2,499,056	9,079	169,792	569	...	..	...	...	...	...	307,888	1,277	...	...	185,024	671	3,161,760	1,412	11,596
	All India. ...	**7,237,776**	**18,055**	**184,464**	**596**	**141,568**	**247**	**107,408**	**691**	**39,648**	**396**	**1,149,120**	**3,277**	**32,928**	**306**	**544,544**	**2,073**	**9,437,456**	**4,213**	**25,641**
1854-5.	Bengal.....	119,840	1,524	...	...	...	...	74,704	460	14,784	90	...	...	...	...	248,864	2,107	458,192	205	4,181
	Madras	3,899,616	9,268	10,752	20	79,744	132	...	...	...	...	660,016	1,787	...	...	730,576	3,227	5,380,704	2,402	14,434
	Bombay.....	1,918,784	6,532	66,528	277	...	...	136,640	607	9,184	41	12,768	557	...	...	95,760	409	2,239,664	999	8,423
	All India. ...	**5,938,240**	**17,324**	**77,280**	**297**	**79,744**	**132**	**211,344**	**1,067**	**23,968**	**131**	**672,784**	**2,344**	...	...	**1,075,200**	**5,743**	**8,078,560**	**3,606**	**27,038**
1855-6.	Bengal.....	9,072	66	...	...	...	...	34,720	321	28,560	267	336	4	71,120	713	75,376	618	219,184	98	1,989
	Madras	1,875,328	4,549	21,280	39	142,016	359	74,032	444	...	...	512,288	1,464	66,976	223	658,336	4,105	3,350,256	1,496	11,183
	Bombay.....	1,498,112	6,251	...	...	...	...	...	...	42,448	178	180,208	1,037	1,008	4	67,648	277	1,789,424	799	7,747
	All India. ...	**3,382,512**	**10,866**	**21,280**	**39**	**142,016**	**359**	**108,752**	**765**	**71,008**	**445**	**692,832**	**2,505**	**139,104**	**940**	**801,360**	**5,000**	**5,358,864**	**2,393**	**20,919**
1856-7.	Bengal.....	70,672	601	55,664	474	...	...	1,568	13	11,984	102	...	...	38,304	327	172,928	1,470	351,120	157	2,987
	Madras	2,210,768	4,703	17,360	31	195,776	494	158,480	436	8,064	22	474,320	1,168	...	...	1,581,104	3,768	4,645,872	2,074	10,622
	Bombay.....	2,784,656	9,961	...	...	...	...		...	64,512	288	277,872	1,214	61,376	274	108,304	482	3,296,720	1,472	12,219
	All India. ...	**5,066,096**	**15,265**	**73,024**	**505**	**195,776**	**494**	**160,048**	**449**	**84,560**	**412**	**752,192**	**2,382**	**99,680**	**601**	**1,862,336**	**5,720**	**8,293,712**	**3,703**	**25,828**
1857-8.	Bengal.....	...	...	7,056	76	...	...	163,520	1,216	2,016	17	...	...	35,056	283	18,928	257	226,576	101	1,849
	Madras	3,327,744	6,729	50,064	133	169,456	415	...	...	...	...	520,128	1,254	...	...	706,944	1,968	4,774,336	2,131	10,499
	Bombay.....	4,170,880	18,756	...	...	10,864	39	87,584	370	...	...	194,880	984	80,192	400	57,792	284	4,602,192	2,055	20,833
	All India. ...	**7,498,624**	**25,485**	**57,120**	**209**	**180,320**	**454**	**251,104**	**1,586**	**2,016**	**17**	**715,008**	**2,238**	**115,248**	**683**	**783,664**	**2,509**	**9,603,104**	**4,287**	**33,181**

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE VIII.*

SHOWING AVERAGE PRICE OF **ENGLISH RAGS** IN LONDON, PER lb. AND PER TON, FROM 1830 TO 1860.

YEARS.	FINES.		SECONDS.		THIRDS.		COLOURS.	
	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.
1830	$3\frac{7}{16}$ to $3\frac{5}{8}$	32 to 34	$1\frac{13}{16}$ to $1\frac{15}{16}$	17 to 18	$1\frac{11}{16}$	16	$1\frac{1}{16}$	10
1831	$3\frac{5}{8}$	34	$1\frac{13}{16}$ $1\frac{15}{16}$	17 18	$1\frac{11}{16}$	16	$1\frac{1}{16}$	10
1832	Book missing.							
1833	$3\frac{5}{8}$	34	$1\frac{15}{16}$	18	$1\frac{11}{16}$	16	$\frac{15}{16}$	8 10s.
1834	3	28	$1\frac{13}{16}$ $1\frac{15}{16}$	17 18	$1\frac{1}{2}$	14	$\frac{15}{16}$	8 10s.
1835	$2\frac{3}{4}$	26	$1\frac{13}{16}$ $1\frac{15}{16}$	17 18	$1\frac{3}{16}$ to $1\frac{5}{16}$	11 to 12	$\frac{5}{8}$	6
1836	$3\frac{3}{16}$ $3\frac{7}{16}$ $3\frac{5}{8}$	30 32 34	$1\frac{11}{16}$ $1\frac{15}{16}$	16 18	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12	$\frac{5}{8}$	6
1837	$3\frac{7}{16}$	32	$1\frac{11}{16}$ $1\frac{15}{16}$	16 18	$1\frac{5}{16}$	12	$\frac{9}{16}$ $\frac{5}{8}$	5 10s. to 6
1838	$3\frac{5}{8}$ $4\frac{1}{16}$ $4\frac{5}{16}$	34 38 40	$1\frac{11}{16}$ $1\frac{15}{16}$	16 18	$1\frac{5}{16}$	12	$\frac{9}{16}$	5 10s.
1839	$3\frac{3}{8}$ $4\frac{1}{16}$ $4\frac{5}{16}$	34 38 40	$1\frac{15}{16}$	18	$1\frac{1}{8}$	10 10s.	$\frac{9}{16}$	5 10s.
1840	$3\frac{3}{16}$	30	$1\frac{5}{16}$	18	$1\frac{5}{16}$	12	$\frac{9}{16}$ $\frac{5}{8}$	5 10s. 6
1841	$2\frac{3}{4}$	26	$1\frac{11}{16}$	16	$1\frac{5}{16}$	12	$\frac{3}{4}$	7
1842	$2\frac{3}{4}$	26	$1\frac{3}{8}$	15	$1\frac{5}{16}$	12	$\frac{11}{16}$	6 10s.
1843	$2\frac{11}{16}$	25	$1\frac{1}{2}$	14	$1\frac{1}{16}$ $1\frac{1}{8}$	10 10 10s.	$\frac{11}{16}$	6 10s.
1844	$2\frac{3}{4}$	26	$1\frac{11}{16}$	16	$1\frac{3}{16}$	11	$\frac{3}{4}$	7
1845	$3\frac{3}{16}$	30	$1\frac{15}{16}$	18	$1\frac{3}{8}$	13	$\frac{13}{16}$	7 10s.
1846	Book missing.							
1847	$3\frac{1}{16}$	29	$1\frac{7}{8}$	17 10s.	$1\frac{5}{16}$	12	$\frac{13}{16}$	7 10s.
1848	$2\frac{9}{16}$	24	$1\frac{11}{16}$	16	$1\frac{5}{16}$	12	$\frac{13}{16}$	7 10s.
1849	$2\frac{7}{16}$	23	$1\frac{11}{16}$ $1\frac{15}{16}$	16 18	$1\frac{1}{4}$	11 10s.	$\frac{11}{16}$	6 10s.
1850	$2\frac{1}{2}$ $2\frac{9}{16}$	23 10s. 24	$1\frac{15}{16}$	18	$1\frac{1}{4}$	11 10s.	$\frac{3}{4}$	7
1851	$2\frac{3}{4}$ 3	26 28	$1\frac{11}{16}$	16	$1\frac{5}{16}$	12	$\frac{7}{8}$	8
1852	$2\frac{3}{4}$ 3	26 28	$1\frac{3}{4}$	16 10s.	$1\frac{5}{16}$	12	$\frac{3}{4}$ $\frac{7}{8}$	7 8
1853	$2\frac{3}{4}$ 3	26 28	$1\frac{3}{4}$	16 10s.	$1\frac{5}{16}$ $1\frac{3}{8}$	12 13	$\frac{15}{16}$ $1\frac{1}{16}$	9 10
1854	$3\frac{3}{16}$ $3\frac{7}{16}$ $3\frac{5}{8}$	30 32 34	$1\frac{13}{16}$ $2\frac{1}{16}$	17 19	$1\frac{1}{2}$	14	$1\frac{3}{16}$	11
1855	$2\frac{11}{16}$ 3 $3\frac{3}{16}$	25 28 30	$1\frac{13}{16}$ $2\frac{1}{16}$	17 19	$1\frac{5}{8}$	15	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1856	$2\frac{9}{16}$ $2\frac{3}{4}$ $2\frac{7}{8}$	24 26 27	$1\frac{11}{16}$ $1\frac{15}{16}$	16 18	$1\frac{1}{4}$ $1\frac{5}{16}$ $1\frac{3}{8}$	11 10s. 12 13	$\frac{15}{16}$ $1\frac{1}{8}$	9 10 10s.
1857	$2\frac{11}{16}$ $2\frac{7}{8}$ 3	25 27 28	$1\frac{7}{8}$ 2 $2\frac{1}{16}$	17 10s. 18 10s. 19 10s.	$1\frac{1}{4}$ $1\frac{5}{16}$	11 10s. 12	$1\frac{1}{8}$ $1\frac{5}{16}$	10 10s. 12
1858	$2\frac{13}{16}$ 3	26 10s. 28	$1\frac{15}{16}$ $2\frac{1}{16}$	18 19	$1\frac{1}{4}$ $1\frac{5}{16}$	11 10s. 12	$\frac{15}{16}$ $1\frac{1}{8}$	9 10 10s.
1859	$2\frac{15}{16}$ $3\frac{1}{8}$	27 10s. 29 10s.	$1\frac{15}{16}$ $2\frac{1}{8}$	18 20	$1\frac{1}{4}$ $1\frac{3}{8}$	11 10s. 13	$1\frac{1}{16}$ $1\frac{1}{4}$	10 11 10s.
1860	$3\frac{1}{8}$ $3\frac{5}{16}$	29 10s. 31	$2\frac{1}{16}$ $2\frac{1}{4}$	19 21	$1\frac{3}{8}$ $1\frac{7}{16}$	13 13 10s.	$1\frac{3}{16}$ $1\frac{1}{4}$	11 11 10s.

Fines consist of such goods as clean white linen or cotton shirts, &c. Seconds, of dirty or soiled white garments, as linings of ladies' dresses. Thirds, of Corderoys and similar articles. Colours, of printed cotton pieces.

* Received per Mr. W. Stones from Messrs. A. Cohen and Co.

TABLE IX.*

SHOWING AVERAGE PRICE OF **ENGLISH RAGS** IN LONDON, PER lb. AND PER TON, FROM 1830 TO 1860.

Years.	NEW PIECES.		GOVERNMENT CANVAS FINE.		MERCHANT CANVAS FINE.		BAGGINGS.	
	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.	per lb. in pence.	per ton in £.
1830	$4\frac{13}{16}$ to $4\frac{1}{4}$	45 to 40	...	No data.	$1\frac{14}{16}$ $2\frac{1}{8}$ $2\frac{1}{4}$	18 20 21	$\frac{15}{16}$ to $1\frac{1}{16}$	9 to 10
1831	$4\frac{13}{16}$ $5\frac{1}{8}$	44 48	...	...	...	No data.	$\frac{15}{16}$ $1\frac{1}{16}$	9 10
1832	$4\frac{1}{16}$ $4\frac{1}{4}$	38 40	...	...	...	...		
1833	$4\frac{1}{16}$ $4\frac{1}{4}$	38 40	$2\frac{9}{16}$	24	$2\frac{3}{16}$	20 10s.	$1\frac{3}{16}$	11
1834	$4\frac{1}{16}$	38	$2\frac{9}{16}$	24	$2\frac{1}{4}$ $2\frac{5}{16}$	22 22 10s.	$1\frac{3}{16}$ $1\frac{1}{4}$	11 11 10s.
1835	$3\frac{13}{16}$ $3\frac{1}{4}$	36 38	$2\frac{9}{16}$	24	$2\frac{1}{8}$ $2\frac{5}{16}$	20 22	$1\frac{3}{16}$	11
1836	$4\frac{1}{4}$	40	$2\frac{9}{16}$	24	$2\frac{1}{4}$	22	$1\frac{3}{16}$	11
1837	$4\frac{1}{2}$ $4\frac{13}{16}$	42 44	$2\frac{10}{16}$	25 10s.	$2\frac{1}{8}$ $2\frac{5}{16}$	20 22	$1\frac{3}{16}$	11
1838	$4\frac{13}{16}$ $5\frac{1}{8}$	44 48	...	No data.	$2\frac{6}{16}$	23	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1839	$4\frac{1}{4}$	40	$2\frac{10}{16}$	25	$2\frac{1}{4}$	21	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1840	$3\frac{3}{4}$ $3\frac{13}{16}$ $4\frac{1}{4}$	35 36 40	...	No data.	$2\frac{1}{4}$	21	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1841	$3\frac{3}{4}$ $3\frac{13}{16}$ $4\frac{1}{4}$	35 36 40	...	No data.	$2\frac{5}{16}$	22	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1842	$3\frac{3}{4}$	35	$2\frac{9}{16}$	24	$2\frac{5}{16}$	22	$1\frac{1}{16}$ $1\frac{3}{16}$	10 11
1843	$3\frac{3}{4}$	35	$2\frac{9}{16}$	24	$2\frac{5}{16}$	22	$1\frac{1}{8}$ $1\frac{3}{16}$	10 10s. 11
1844	$3\frac{3}{4}$	35	$2\frac{9}{16}$	24	$2\frac{5}{16}$	22	$1\frac{3}{16}$	11
1845	$3\frac{13}{16}$	34 36	$2\frac{9}{16}$	24	$2\frac{1}{8}$ $2\frac{1}{4}$	20 21	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1846	$4\frac{1}{4}$	40	$2\frac{10}{16}$	24 10s.	$2\frac{5}{16}$ $2\frac{6}{16}$	22 23		
1847	$3\frac{13}{16}$ $4\frac{1}{4}$	36 40	...	No data.	$2\frac{5}{16}$	22	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1848	$4\frac{1}{2}$ $4\frac{13}{16}$	40 44	...	No data.	$2\frac{1}{8}$ $2\frac{5}{16}$	20 22	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1849	$3\frac{3}{4}$ $4\frac{1}{4}$	35 40	$2\frac{9}{16}$ $2\frac{10}{16}$	24 25	$2\frac{1}{4}$	21	$1\frac{3}{16}$ $1\frac{5}{16}$	11 12
1850	$3\frac{13}{16}$ $4\frac{1}{16}$ $3\frac{3}{4}$	36 38 35	$2\frac{10}{16}$	25	$2\frac{5}{16}$	22 10s.	$1\frac{5}{16}$	12
1851	$4\frac{1}{4}$ $4\frac{13}{16}$ $4\frac{1}{2}$ $3\frac{13}{16}$	40 45 42 36	$2\frac{10}{16}$ $2\frac{3}{4}$	25 26	$2\frac{5}{16}$ $2\frac{6}{16}$ $2\frac{9}{16}$	22 10s. 23 24	$1\frac{5}{16}$	12
1852	$4\frac{1}{2}$ $4\frac{1}{16}$ $3\frac{3}{4}$	42 38 35	$2\frac{5}{16}$ $2\frac{7}{16}$	22 23	$2\frac{5}{16}$ $2\frac{6}{16}$ $2\frac{1}{4}$	23 22 21	$1\frac{5}{16}$	12
1853	$4\frac{1}{4}$ $4\frac{1}{16}$ $4\frac{1}{2}$	40 38 42	$2\frac{10}{16}$	25	$2\frac{1}{4}$ $2\frac{5}{16}$	21 22	$1\frac{5}{16}$	12
1854	$4\frac{1}{2}$ $4\frac{1}{4}$	42 40	$2\frac{13}{16}$ 3	26 10s. 28	$2\frac{9}{16}$ $2\frac{3}{4}$	24 26	$1\frac{3}{16}$ $1\frac{3}{8}$	11 13
1855	$4\frac{1}{16}$ $4\frac{1}{2}$	38 42	$2\frac{3}{4}$	26	$2\frac{3}{4}$ $2\frac{6}{16}$ $2\frac{9}{16}$	26 23 24	$1\frac{3}{16}$ $1\frac{3}{8}$	11 13
1856	$4\frac{1}{16}$	38	$2\frac{10}{16}$ $2\frac{3}{4}$	25 26	$2\frac{9}{16}$ $2\frac{10}{16}$ $2\frac{3}{4}$	24 25 26	$1\frac{1}{4}$ $1\frac{3}{8}$	11 10s. 13
1857	$4\frac{1}{16}$ $4\frac{1}{16}$	38 39	$2\frac{10}{16}$ $2\frac{3}{4}$	25 26	$2\frac{9}{16}$ $2\frac{10}{16}$ $2\frac{3}{4}$	24 25 26	$1\frac{1}{8}$ $1\frac{5}{16}$	10 10s. 12
1858	4 $4\frac{1}{16}$	37 38	$2\frac{15}{16}$	27 10s.	$2\frac{3}{4}$ $2\frac{10}{16}$ $2\frac{9}{16}$	26 25 24	$1\frac{1}{16}$ $1\frac{5}{16}$	10 12
1859	4 $4\frac{1}{16}$	37 38	$2\frac{15}{16}$	27 10s.	$2\frac{1}{2}$ $2\frac{9}{16}$ $2\frac{10}{16}$	23 10s. 24 25	$1\frac{1}{16}$ $1\frac{1}{8}$	10 10 10s.
1860	4 $4\frac{1}{16}$	37 38 10s.	$3\frac{1}{16}$	29	$2\frac{1}{2}$ $2\frac{10}{16}$	23 10s. 25	$1\frac{1}{16}$ $1\frac{3}{16}$	10 11

New Pieces consist of clippings of new material, as collars, shirts, &c., and with these, in value, may be classed the ends of cotton pieces. Canvas from the Royal and Commercial Navies also meets with a ready sale for paper-making purposes.

* Received per Mr. W. Stones, from Messrs. A. Cohen and Co.

TABLE X., SHOWING THE QUANTITY OF **RAGS** (AND OTHER MATERIAL FOR MAKING PAPER) IMPORTED, EXPORTED, AND LEFT FOR CONSUMPTION IN THE UNITED KINGDOM; AND THE QUANTITY OF **PAPER** MANUFACTURED, EXPORTED, AND CONSUMED IN THE UNITED KINGDOM SINCE 1820.

Years.	Rags and other Material for Making Paper.						Paper (Including Pasteboard and Millboard Paper).						Years.
	Imported.		Exported.		Consumed.		Manufactured.		Consumed.		Exported.		
	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	lbs.	tons.	
1820	11,150,720	4,978	...	...	10,693,760	4,774	48,178,501	21,508	NOT OFFICIALLY RECORDED.	NOT OFFICIALLY RECORDED.	NOT OFFICIALLY RECORDED.	NOT OFFICIALLY RECORDED.	1820
1821	**10,949,120**	**4,888**	...	...	**11,719,680**	**5,232**	**52,153,263**	**23,283**					**1821**
1822	13,955,200	6,230	...	...	13,932,800	6,220	55,578,014	24,812					1822
1823	19,093,760	8,524	4,480	2	18,650,240	8,326	58,497,603	26,115					1823
1824	19,884,480	8,877	...	...	20,083,840	8,966	62,634,965	27,962					1824
1825	23,262,400	10,385	44,800	20	22,355,200	9,980	67,527,061	30,146					1825
1826	14,380,800	6,420	20,160	9	14,940,800	6,670	53,731,857	23,987					1826
1827	18,049,920	8,058	6,720	3	18,150,720	8,103	64,885,071	28,967					1827
1828	17,704,960	7,904	29,120	13	17,808,000	7,950	70,037,731	31,267					1828
1829	20,554,240	9,176	...	...	20,126,400	8,985	64,517,285	28,802					1829
1830	21,519,680	9,607	...	...	20,758,080	9,267	69,127,650	30,860					1830
1831	**16,125,760**	**7,199**	**351 680**	**157**	**16,661,120**	**7,438**	**67,494,416**	**30,131**					**1831**
1832	14,943,040	6,671	253,120	113	15,146,880	6,762	69,804,071	31,163					1832
1833	21,369,600	9,540	...	...	21,459,200	9,580	73,644,324	32,877					1833
1834	24,551,600	10,960	246,400	110	22,494,080	10,042	76,137,793	33,990					1834
1835	22,182,720	9,903	784,000	350	22,926,400	10,235	79,617,114	35,543					1835
1836	25,269,440	11,281	40,320	18	25,240,320	11,268	86,179,027	38,473					1836
1837	29,296,960	13,079	275,520	123	27,560,960	12,304	88,950,845	39,710					1837
1838	18,081,280	8,072	1,099,840	491	18,426,240	8,226	93,466,286	41,726					1838
1839	20,690,880	9,237	...	...	20,744,640	9,261	97,643,823	43,591					1839
1840	20,731,200	9,255	...	...	20,608,000	9,200	97,237,358	43,409					1840
1841	**14,723,520**	**6,573**	**20,160**	**9**	**14,434,560**	**6,444**	**97,103,548**	**43,349**					**1841**
1842	14,714,560	6,569	...	...	15,023,680	6,707	96,693,322	43,167					1842
1843	17,816,960	7,954	324,800	145	17,528,000	7,825	103,449,625	46,183					1843
1844	15,816,640	7,061	250,880	112	16,130,240	7,201	109,495,148	48,882					1844
1845	16,072,160	7,175	...	...	16,372,160	7,309	124,247,070	55,467					1845
1846	22,713,600	10,140	44,800	20	22,668,800	10,120	127,442,480	56,894					1846
1847	14,745,920	6,583	103,040	46	14,642,880	6,537	121,965,312	54,449					1847
1848	16,107,840	7,191	112,000	50	15,995,840	7,141	121,820,227	54,384	116,639,943	52,071	5,180,286	2,313	1848
1849	15,574,720	6,953	78,400	35	15,496,320	6,918	132,132,657	58,988	126,166,341	56,324	5,966,319	2,664	1849
1850	18,197,760	8,124	185,920	83	18,011,840	8,041	141,032,474	62,961	133,267,940	59,495	7,764,534	3,466	1850
1851	**23,775,360**	**10,614**	**76,920**	**34**	**23,701,440**	**10,581**	**150,903,544**	**67,368**	**142,597,945**	**63,659**	**8,305,598**	**3,708**	**1851**
1852	17,239,040	7,696	347,200	155	16,891,840	7,541	154,469,211	68,959	147,140,325	65,688	7,328,886	3,272	1852
1853	21,698,880	9,687	51,520	23	21,647,360	9,664	177,633,009	79,300	164,336,135	73,364	13,296,874	5,936	1853
1854	25,569,600	11,415	4,032,000	1,800	21,537,600	9,615	177,896,224	79,418	161,784,204	72,225	16,112,020	7,193	1854
1855	21,087,360	9,414	4,892,160	2,184	16,195,200	7,230	166,776,394	74,454	155,657,843	69,490	11,118,551	4,964	1855
1856	23,036,160	10,284	6,843,200	3,055	16,192,960	7,229	187,716,575	83,802	172,917,596	77,195	14,798,979	6,606	1856
1857	27,219,040	12,151	7,042,560	3,144	20,276,480	9,052	191,721,620	85,590	175,690,557	78,433	16,031,063	7,157	1857
1858	25,488,996	11,379	2,786,560	1,244	22,702,400	10,135	192,847,825	86,093	176,298,997	78,705	16,548,828	7,388	1858
1859	**32,699,520**	**14,598**	**6,787,200**	**3,030**	**25,912,320**	**11,568**	**217,827,197**	**97,244**	**197,759,448**	**88,285**	**20,067,749**	**8,959**	**1859**

Weight of Rags Imported into the United States of America in the following years:—1852, 18,288,458 lbs.=8,165 tons; 1853, 22,766,001 lbs.=10,163 tons; 1854, 32,615,753 lbs.=14,561 tons; 1855, 40,013,516 lbs. =17,864 tons; 1856, 38,727,017 lbs.=17,289 tons; 1857, 44,582,080 lbs.=19,903 tons.

The Exports of Rags from the United Kingdom are made almost wholly to the United States of Ame rica.

TABLE XI., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **COTTON**, EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850–1 TO 1857–8 INCLUSIVE:—

Years and Whence Exported.	Countries whither exported.																Total exported.		
	United Kingdom.		France.		Other Parts of Europe.		North America.		China.		Arabian and Persian Gulf.		Islands and Shores of the Indian Seas.		All other Places.		To all Places.		
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quant.	Val.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.		Value.
	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	Tons.	£
1850–1.																			
Bengal..	985,026	12,010	2,497,850	30,369	60,042	730	...	...	18,248,478	221,865	...	...	1,290,009	15,684	49,761	605	23,131,166	10,326	281,263
Madras.	9,037,889	116,342	255,900	3,837	...	...	...	...	9,155,350	117,349	2,216	27	299,400	3,267	687,765	9,683	19,438,520	8,678	250,505
Bombay	131,423,883	1,931,366	496,941	38,128	...	...	...	...	49,646,801	821,150	331,008	4,697	1,868,723	145,842	136,641	1,838	183,903,997	82,100	2,943,021
All India	**141,446,798**	**2,059,718**	**3,250,691**	**72,334**	**60,042**	**730**	...	...	**77,050,629**	**1,160,364**	**333,224**	**4,724**	**3,458,132**	**164,793**	**874,167**	**12,126**	**226,473,683**	**101,104**	**3,474,789**
1851–2.																			
Bengal..	642,537	7,812	47,952	583	...	...	...	...	38,151,251	463,840	...	...	1,909,269	23,214	8,143	88	40,759,152	18,196	495,537
Madras.	4,632,380	61,540	48,000	571	...	...	...	...	10,737,153	135,706	26,322	213	1,568,800	17,873	368,864	5,209	17,381,519	7,760	221,112
Bombay	75,829,306	1,101,928	...	...	...	...	...	...	111,829,247	1,692,381	953,433	11232	6,571,359	95,023	228,815	2,776	195,412,160	87,237	2,903,340
All India	**81,104,223**	**1,171,280**	**95,952**	**1,154**	...	...	...	...	**160,717,651**	**2,291,927**	**979,755**	**11445**	**10,049,428**	**136,110**	**605,822**	**8,073**	**253,552,831**	**113,193**	**3,619,989**
1852–3.																			
Bengal..	6,853,728	83,328	...	...	131,928	1,604	...	...	24,848,383	302,108	14,969	182	1,635,130	19,880	...	...	33,484,138	14,948	407,102
Madras.	16,575,197	191,872	...	...	...	...	34944	687	13,026,102	164,528	56,602	577	796,575	9,723	1,269,827	17,789	31,759,247	14,178	385,176
Bombay	157,932,069	2,249,986	...	...	...	...	...	..	37,797,257	559,808	1,121,918	14819	717,420	11,516	96,124	1,087	197,664,788	88,243	2,837,216
All India	**181,360,994**	**2,525,186**	...	...	**131,928**	**1,604**	**34944**	**687**	**75,671,742**	**1,026,444**	**1,193,489**	**15578**	**3,149,125**	**41,119**	**1,365,951**	**18,876**	**262,908,173**	**117,369**	**3,629,494**
1853–4.																			
Bengal..	2,065,056	25,153	...	...	350,448	4,257	...	...	11,663,904	140,036	...	...	...	...	16,800	204	14,096,208	6,293	169,650
Madras.	8,721,984	113,999	...	...	97,360	2,002	...	...	2,480,400	34,726	66,428	631	146,100	1,746	694,744	9,635	12,207,016	5,450	162,739
Bombay	127,396,389	1,808,625	598,288	6,440	...	...	...	...	41,632,704	633,809	1,357,540	14908	246,288	3,286	227,332	2,692	171,458,541	76,544	2,469,760
All India	**138,183,429**	**1,947,777**	**598,288**	**6,440**	**447,808**	**6,259**	...	...	**55,777,008**	**808,571**	**1,423,968**	**15539**	**392,388**	**5,032**	**938,876**	**12,531**	**197,761,765**	**88,287**	**2,802,149**
1854–5.																			
Bengal..	59,136	730	...	...	...	...	...	...	7,436,128	90,489	...	...	134,512	1,636	1,456	18	7,631,232	3,407	92,873
Madras.	8,006,035	104,491	32,400	666	...	...	...	...	1,711,500	23,961	25,439	229	2,066,500	25,194	1,084,639	14,949	12,926,513	5,771	169,490
Bombay	111,448,366	1,578,923	224,140	3,257	904,120	9,625	...	...	36,746,295	524,694	1,051,534	10858	2,256,308	31,819	591,684	7,227	153,222,447	68,403	2,166,403
All India	**119,513,537**	**1,684,144**	**256,540**	**3,923**	**904,120**	**9,625**	...	...	**45,893,923**	**639,144**	**1,076,973**	**11087**	**4,457,320**	**58,649**	**1,677,779**	**22,194**	**173,780,192**	**77,581**	**2,428,766**
1855–6.																			
Bengal..	598,192	7,270	...	...	896	10	...	...	12,372,080	150,357	...	...	22	1	42,280	477	13,013,470	5,809	158,115
Madras.	4,792,388	58,900	1,800	37	...	...	...	...	54,000	600	1,148	12	1,052,032	12,204	1,248,196	17,608	7,149,564	3,192	89,361
Bombay	165,380,930	2,320,454	736,172	9,584	1,497,048	19,079	...	...	44,265,032	651,468	401,240	3,203	4,633,355	62,482	103,138	1,205	217,016,915	96,883	3,067,475
All India	**170,771,510**	**2,386,624**	**737,972**	**9,621**	**1,497,944**	**19,089**	...	...	**56,691,112**	**802,425**	**402,388**	**3,215**	**5,685,409**	**74,687**	**1,393,614**	**19,290**	**237,179,949**	**105,884**	**3,314,951**
1856–7.																			
Bengal..	3,434,928	41,744	63,728	775	508,592	6,158	..	...	12,610,864	153,260	...	...	605,696	7,361	3,024	36	17,226,832	7,690	209,334
Madras.	19,597,302	261,080	5,999	72	309,000	4,223	...	...	1,003,200	14,045	410	8	232,799	3,268	2,404,636	33,666	23,553,346	10,515	316,362
Bombay	230,377,806	3,189,377	1,803,984	23,581	10,698,416	138,107	...	...	35,170,497	548,547	192,726	2,533	574,196	9,326	55,721	782	278,873,346	124,497	3,912,253
All India	**253,410,036**	**3,492,201**	**1,873,711**	**24,428**	**11,516,008**	**148,488**	...	...	**48,784,561**	**715,852**	**193,136**	**2,541**	**1,412,691**	**19,955**	**2,463,381**	**34,484**	**319,653,524**	**142,702**	**4,437,949**
1857–8																			
Bengal..	164,948	1,950	29,988	365	...	...	...	...	635,488	7,723	...	...	106,944	1,291	2,996	36	940,364	420	11,365
Madras.	11,699,984	161,148	4,260,594	58,520	1,527,500	21,306	...	...	651,600	9,122	...	...	151,200	2,309	1,928,667	27,002	20,219,545	9,027	279,407
Bombay	185,356,315	3,133,600	9,853,292	133,501	18,175,090	260,336	13888	405	19,237,031	376,647	537,211	7,842	5,738,292	94,930	283,024	3,735	239,194,143	106,783	4,010,996
All India	197,221,247	3,296,698	14,143,874	192,386	19,702,590	281,642	13888	405	20,524,119	393,492	537,211	7,842	5,996,436	98,530	2,214,687	30,773	260,354,052	116,230	4,301,768

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE XII., SHOWING THE QUANTITY AND VALUE OF **RAW COTTON*** IMPORTED INTO THE UNITED KINGDOM FROM EACH SOURCE; WITH THE ANNUAL AVERAGE PRICE OF U. S. UPLANDS, BRAZILIAN AND PERNAMBUCO, AND EAST INDIA SURAT COTTON IN THE LIVERPOOL MARKET, SINCE 1820.

Years.	United States.	Brazil.	Mediterranean.	B. East Indies.	B. W. Indies and B. Guiana.	Other Countries.	Grand Total Quantities.		Annual Average Price. U. S. Uplands.	Brazil and Pernamb.	E. I Surat.	Computed Real Value.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	tons.	at per lb.	at per lb.	at per lb.	£
1820	89,999,174	20,198,155	472,684	23,125,825	6,836,816	2,040,001	151,672,655	67,711	11½d.	15½d.	8½d.	
1821	**93,470,745**	**19,535,786**	**1,131,567**	**8,827,107**	**7,138,980**	**2,432,435**	**132,536,620**	**59,168**	**9½**	**12⅝**	**9⅞**	
1822	101,031,766	24,705,206	518,804	4,554,225	10,295,114	1,732,513	142,837,628	63,767	8¼	11⅛	6⅞	
1823	142,532,112	23,514,641	1,492,413	14,839,117	7,034,793	1,989,427	191,402,503	85,448	8¾	12	6¾	
1824	92,187,662	24,849,552	8,699,924	16,420,005	6,269,306	953,673	149,380,122	66,688	8½	11⅜	6⅝	
1825	139,908,699	33,180,491	22,698,075	20,005,872	8,193,948	4,018,206	228,005,291	101,788	11⅝	15⅛	6⅞	1854.
1826	130,858,203	9,871,092	10,308,617	20,985,135	4,751,070	833,284	177,607,401	79,289	6¾	10½	5⅛	
1827	216,924,812	20,716,162	5,372,562	20,930,542	7,165,881	1,338,950	272,448,909	121,629	6½	9¾	5⅛	
1828	151,752,289	29,143,279	7,039,574	32,187,901	5,893,800	1,743,799	227,760,642	101,679	6⅜	8⅜	4⅝	
1829	157,187,396	28,878,386	6,049,597	24,857,800	4,640,414	1,153,818	222,767,411	99,449	5¾	7¼	4	
1830	210,885,358	33,092,072	3,428,798	12,481,761	3,429,247	644,216	263,961,452	117,840	6⅛	8¼	5	
1831	**219,333,628**	**31,695,761**	**8,460,559**	**25,805,153**	**2,401,685**	**978,067**	**288,674,853**	**128,873**	**6**	**7¼**	**4⅝**	
1832	219,756,753	20,169,560	9,163,692	35,178,625	2,040,428	583,467	286,832,525	128,050	6⅝	9	5	
1833	237,506,758	28,463,821	1,020,268	32,755,164	2,084,862	1,825,964	303,656,837	135,561	8½	10¾	6⅛	
1834	269,203,075	19,291,396	1,681,625	32,920,865	2,293,794	1,484,670	326,875,425	145,927	8⅝	11⅞	6⅝	
1835	284,455,812	24,986,409	8,451,630	41,429,011	1,815,270	2,564,831	363,702,963	162,367	10¼	14⅛	7½	
1836	289,615,692	27,501,272	8,226,029	75,949,845	1,714,337	3,951,882	406,959,057	181,678	9⅞	12⅞	6¾	
1837	320,651,716	20,940,145	9,326,979	51,532,072	1,595,702	3,240,169	407,286,783	181,824	7	9¾	4⅞	
1838	431,437,888	24,464,505	6,409,466	40,217,734	1,529,356	3,791,628	507,850,577	226,719	7	9⅜	5	
1839	311,597,798	16,971,979	6,429,671	47,172,939	1,248,164	5,976,008	389,396,559	173,838	7⅞	10	5¾	
1840	487,856,504	14,779,171	8,324,937	77,011,839	866,157	3,649,402	592,488,010	264,504	6	9¼	4⅝	
1841	**358,240,964**	**16,671,348**	**9,097,180**	**97,388,153**	**1,533,197**	**5,061,513**	**487,992,355**	**217,854**	**6¼**	**8¾**	**4⅝**	
1842	414,030,779	15,222,828	4,489,017	92,972,609	593,603	4,441,250	531,750,086	237,388	5⅜	7¼	4	
1843	574,738,520	18,675,123	9,674,076	65,709,729	1,260,444	3,135,224	673,193,116	300,533	4⅝	6⅜	3⅝	
1844	517,218,622	21,084,744	12,406,327	88,639,776	1,707,194	5,054,641	646,111,304	288,443	4⅞	6⅜	3⅝	
1845	626,650,412	20,157,633	14,614,699	58,437,426	1,394,447	725,336	721,979,953	322,312	4⅜	6⅜	3	
1846	401,949,393	14,746,321	14,278,447	34,540,143	1,201,857	1,140,113	467,856,274	208,864	4⅞	7⅜	3⅜	
1847	364,599,291	19,966,922	4,814,268	83,934,614	793,933	598,587	474,707,615	211,923	6¾	7⅜	4½	
1848	600,247,488	19,971,378	7,231,861	84,101,961	640,437	827,036	713,020,161	318,313	4¼	6	3¼	
1849	634,504,050	30,738,133	17,369,843	70,838,515	944,307	1,074,164	755,469,012	337,263	5⅝	5½	3⅞	
1850	493,153,112	30,299,982	18,931,414	118,872,742	228,913	2,090,698	663,576,861	296,239	7½	7⅞	5⅛	
1851	**596,638,962**	**19,339,104**	**16,950,525**	**122,626,976**	**446,529**	**1,377,653**	**757,379,749**	**338,116**	**5¾**	**7½**	**4**	
1852	765,630,544	26,506,144	48,058,640	84,922,432	703,696	3,960,992	929,782,448	415,081	5⅜	7	3¾	
1853	658,451,796	24,190,628	28,353,575	181,848,160	350,428	2,084,162	895,278,749	399,678	5⅝	7	3½	
1854	722,151,346	19,703,600	23,503,003	119,836,009	409,110	1,730,081	887,333,149	396,131	5⅜	7	3½	20,175,395
1855	681,629,424	24,577,952	32,904,153	145,179,216	468,452	6,992,755	891,751,952	398,104	5¾	7	3⅞	20,848,515
1856	780,040,016	21,830,704	34,616,848	180,496,624	462,784	6,439,328	1,023,886,304	457,092	6	7⅛	4⅜	26,448,224
1857	654,758,048	29,910,832	24,882,144	250,338,144	1,443,568	7,986,160	969,318,896	432,732	7¼	8¾	5⅜	29,288,827
1858	833,237,776	18,617,872	38,248,112	132,722,576	367,808	11,148,032	1,034,342,176	461,760	6¼	8¼	4¾	30,106,968
1859	**961,707,264**	**22,478,960**	**38,106,096**	**192,330,880**	**592,256**	**10,773,616**	**1,225,989,072**	**547,317**	**6¼**	**8⅜**	**4⅝**	34,559,636

* IMPORTS COTTON.—1781, 5,198,778 lbs.—1791, 28,706,675 lbs.—1801, 56,004,305 lbs.—1811, 91,576,535 lbs.—1821, 132,536,620 lbs.—1831, 288,674,853 lbs.—1841, 487,992,355 lbs.—1851, 757,379,749 lbs.—1859, 1,225,989,072.

NOT OFFICIALLY RECORDED UNTIL 1854.

TABLE XIII., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **WOOL** EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850–1 TO 1857–8 INCLUSIVE:—

Years.	Whence Exported.	Countries whither exported. United Kingdom. Quantity.	United Kingdom. Value.	France. Quantity.	France. Value.	Other Parts of Europe. Quantity.	Other Parts of Europe. Value.	North America. Quantity.	North America. Value.	China. Quantity.	China. Value.	Arabian and Persian Gulf. Quantity	Arabian and Persian Gulf. Value.	Islands and Shores of the Indian Seas. Quantity.	Islands and Shores of the Indian Seas. Value.	All other Places. Quantity.	All other Places. Value.	Total exported. To all Places. Quantity.	Total exported. To all Places. Quantity.	Total exported. To all Places. Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850–1.	Bengal...	...	...	...	...	...	...	...	...	...	...	...	...	164	50	...	...	164	...	50
	Madras ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	4,492,794	65,525	...	...	...	...	189,114	2,758	...	...	...	...	...	...	2	2	4,681,910	2,090	68,285
	All India.	4,492,794	65,525	...	...	...	...	189,114	2,758	...	...	...	...	164	50	2	2	4,682,074	2,090	68,335
1851–2.	Bengal...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Madras ..	30,985	236	...	...	...	...	...	...	...	...	...	...	...	...	...	...	30,985	14	236
	Bombay..	7,025,728	100,370	...	...	...	...	448	6	...	...	...	...	...	...	...	...	7,026,176	3,137	100,376
	All India.	7,056,713	100,606	...	...	...	...	448	6	...	...	...	...	...	...	...	...	7,057,161	3,151	100,612
1852–3.	Bengal...	† 17,600	285	...	...	...	...	† 8,000	123	...	...	...	...	† 7,800	114	† 26,400	407	† 59,800	27	929
	Madras ..	79,072	856	...	...	...	...	...	...	...	...	...	..	...	...	...	...	79,072	35	856
	Bombay..	11,921,927	170,313	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11,921,927	5,322	170,313
	All India.	12,018,599	171,454	..	...	...	...	8,000	123	...	...	...	...	7,800	114	26,400	407	12,060,799	5,384	172,098
1853–4.	Bengal...	54,096	875	...	...	...	...	...	...	...	...	...	...	...	...	...	...	54,096	24	875
	Madras ..	128,088	1,578	...	...	...	...	...	...	...	...	...	...	...	...	...	...	128,088	57	1,578
	Bombay..	14,165,069	202,359	28,281	304	...	...	...	...	...	...	...	...	...	...	33,945	485	14,227,295	6,351	203,148
	All India.	14,347,253	204,812	28,281	304	...	...	...	...	...	...	...	...	...	...	33,945	485	14,409,479	6,432	205,601
1854–5.	Bengal...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2,576	35	2,576	1	35
	Madras ..	120,762	1,682	...	...	...	...	...	...	...	...	...	...	...	...	...	...	120,762	54	1,682
	Bombay..	12,964,065	205,136	13,272	190	...	...	13,052	221	...	...	...	...	...	...	...	...	12,990,389	5,799	205,547
	All India.	13,084,827	206,818	13,272	190	...	...	13,052	221	...	...	...	...	...	...	2,576	35	13,113,727	5,854	207,264
1855–6.	Bengal...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...
	Madras ..	† 70,000	840	...	...	...	...	...	...	..	...	...	...	...	...	...	...	† 70,000	31	840
	Bombay..	15,953,942	270,647	85,786	1,455	...	...	...	...	...	...	...	...	...	...	...	...	16,039,728	7,161	272,102
	All India.	16,023,942	271,487	85,786	1,455	...	...	...	...	...	...	...	...	...	...	...	...	16,109,728	7,192	272,942
1856–7.	Bengal...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Madras ..	11,566	121	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11,566	5	121
	Bombay..	18,084,762	306,795	273,557	5,352	114,781	1,947	...	...	...	...	...	...	...	...	...	...	18,473,100	8,247	314,094
	All India.	18,096,328	306,916	273,557	5,352	114,781	1,947	...	...	...	...	...	...	...	...	...	...	18,484,666	8,252	314,215
1857–8.	Bengal...	26,962	393	...	...	2,576	38	9,632	150	...	...	...	...	...	...	...	...	39,170	17	581
	Madras .	66,663	962	...	...	...	...	...	...	...	...	...	...	...	...	...	...	66,663	30	962
	Bombay..	16,892,920	351,783	662,607	13,252	21,840	370	952,196	20,155	...	...	...	...	...	...	...	...	18,529,563	8,272	385,560
	All India.	16,986,545	353,138	662,607	13,252	24,416	408	961,828	20,305	...	...	...	...	...	...	...	...	18,635,396	8,319	387,103

* The Indian Rupee is here converted at the exchange of Two Shillings.

† The Quantities of Wool Exported from the Bengal Presidency in the Year 1852-3, and the Madras Presidency in 1855–6, owing to their not having been officially recorded, are estimated from the given Values.

TABLE XIV., SHOWING THE QUANTITY OF **WOOL*** (SHEEP, LAMB, AND ALPACCA) IMPORTED INTO THE UNITED KINGDOM FROM EACH SOURCE SINCE 1820, THE COMPUTED REAL VALUE THEREOF, AND THE ANNUAL AVERAGE PRICE OF 1ST QUALITY AUSTRALIAN WOOL:—

Years.	Spain.	Germany.	Other Countries of Europe.	British Possessions, South Africa.	British Possessions, East Indies.	British Settlements in Australia.	South America.	Other Countries.	Grand Total Quantity.		Annual Average Price. 1st Quality Australian.	Computed Real Value.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	tons.	per lb.	£
1820	3,536,229	5,113,442	915,289	13,869	8,056	99,415	87,828	20,492	9,794,620	4,373		
1821	**6,968,927**	**8,615,526**	**808,803**	**12,153**	**18,175**	**175,433**	**11,273**	**21,738**	**16,632,028**	**7,425**		
1822	5,994,298	11,125,114	1,715,783	49,028	9,454	138,498	20,300	19,889	19,072,364	8,514		
1823	4,318,708	12,562,434	1,982,555	23,631	437	477,261	169	13,054	19,378,249	8,651		
1824	5,020,679	15,412,275	1,710,696	25,199	7,185	382,907	2,995	10,681	22,572,617	10,077		
1825	8,206,427	28,799,661	6,033,109	27,619	...	323,995	345,617	101,533	43,837,961	19,571		
1826	1,619,405	10,545,232	2,058,396	4,192	127,686	1,106,302	518,808	16,404	15,996,425	7,141		
1827	3,898,006	21,220,788	3,180,717	44,441	5,219	512,758	166,225	87,187	29,115,341	12,998		
1828	3,808,662	22,015,585	2,511,812	29,326	659	1,574,186	272,946	22,883	30,236,059	13,498		
1829	3,751,714	14,110,006	1,291,215	37,619	...	1,838,642	438,762	48,691	21,516,649	9,606		
1830	1,641,773	26,073,882	2,551,833	33,407	...	1,967,309	26,330	10,780	32,305,314	14,422		
1831	**3,474,823**	**22,437,022**	**3,166,839**	**47,868**	...	**2,493,337**	**14,310**	**17,830**	**31,652,029**	**14,130**		
1832	2,626,624	19,832,225	2,494,285	83,257	...	2,377,057	69,006	646,519	28,128,973	12,558		
1833	3,339,150	25,370,106	5,056,380	93,325	3,721	3,516,869	223,832	442,704	38,046,087	16,985		
1834	2,343,915	22,634,615	12,315,807	141,707	67,763	3,558,091	1,363,724	4,029,610	46,455,232	20,739		
1835	7,602,752	23,798,186	8,816,230	191,624	295,848	4,210,301	2,195,400	1,064,191	42,174,532	18,828		
1836	2,818,137	31,766,194	18,926,005	331,972	1,086,393	4,996,645	2,874,263	1,440,368	64,239,977	28,679		
1837	2,244,817	19,705,492	12,070,029	468,011	1,880,741	7,060,525	4,499,135	450,958	48,379,708	21,598		
1828	1,814,877	27,506,282	8,479,612	422,506	1,897,266	7,837,423	4,059,958	576,431	52,594,355	23,479		
1839	2,409,634	23,837,805	13,925,166	626,214	2,103,546	10,128,774	3,725,891	622,893	57,379,923	25,616		
1840	1,266,905	21,812,664	8,541,264	751,741	2,441,370	9,721,243	4,378,274	513,823	49,436,284	22,069	20d.	
1841	**1,088,200**	**20,959,375**	**8,305,994**	**1,079,910**	**3,008,664**	**12,399,362**	**9,174,249**	**155,220**	**56,170,974**	**25,076**	**19**	
1842	670,239	15,613,269	7,050,436	1,265,768	4,246,083	12,979,856	3,207,489	848,499	45,881,639	20,483	19½	
1843	597,091	16,805,448	5,877,538	1,728,453	1,916,129	17,433,780	4,588,987	295,667	49,243,093	21,984	21	
1844	918,853	21,847,684	15,313,087	2,197,143	2,765,853	17,602,247	3,760,063	1,308,831	65,713,761	29,337	24½	
1845	1,074,540	18,484,736	17,606,515	3,512,924	3,975,866	24,177,317	6,468,338	1,513,619	76,813,855	34,292	27	
1846	1,020,476	15,888,705	11,733,601	2,958,457	4,570,581	21,789,346	4,890,273	2,404,023	65,255,462	29,132	26	
1847	424,408	12,673,814	7,935,697	3,477,392	3,063,142	26,056,815	7,295,550	1,665,780	62,592,598	27,943	24	
1848	106,638	14,429,161	7,024,098	3,497,250	5,997,435	30,034,567	8,851,211	924,487	70,864,847	31,636	21¾	
1849	127,559	12,750,011	11,432,354	5,377,495	4,182,853	35,879,171	6,014,525	1,004,679	76,768,647	34,271	21	
1850	440,751	9,166,731	8,703,252	5,709,529	3,473,252	39,018,221	5,296,648	2,518,394	74,326,778	33,182	20	
1851	**383,150**	**8,219,236**	**14,263,156**	**5,816,591**	**4,549,520**	**41,810,117**	**4,850,048**	**3,420,157**	**83,311,975**	**37,193**	**19½**	
1852	233,413	12,765,253	13,382,140	6,388,796	7,880,784	43,197,301	6,252,689	3,661,082	93,761,458	41,858	22	
1853	154,146	11,584,800	26,861,166	7,221,448	12,400,869	47,076,010	9,740,032	4,357,978	119,396,449	53,302	24	
1854	424,300	11,448,518	14,481,483	8,223,598	14,965,191	47,489,650	6,134,334	2,954,921	106,121,995	47,376	23	6,499,004
1855	68,750	6,128,626	8,119,408	11,075,965	14,283,535	49,142,306	7,106,708	3,375,148	99,300,446	44,331	24¼	6,527,325
1856	55,090	8,687,781	14,480,869	14,305,188	15,386,578	52,052,139	8,076,317	3,167,430	116,211,392	51,880	26	8,664,420
1857	397,238	6,088,002	23,802,520	14,287,828	19,370,741	49,209,655	9,306,886	7,287,028	129,749,898	57,924	25	9,681,541
1858	110,510	10,595,186	17,926,859	16,597,504	17,333,507	51,104,560	10,046,381	3,024,216	126,738,723	56,580	24	8,972,218
1859	**153,874**	**12,036,125**	**27,145,518**	**14,269,343**	**14,363,403**	**53,700,542**	**9,759,779**	**1,856,050**	**133,284,634**	**59,502**	**23**	**9,831,007**

NOT OFFICIALLY RECORDED UNTIL 1854.

* IMPORTS WOOL.

Decennial Periods.	
1771 ...	1,829,772 lbs.
1781 ...	2,478,332
1791 ...	3,014 511
1801 ...	7,371,774
1811 ...	4,739,972
1821 ...	16,632 028
1831 ...	31,652,029
1841 ...	56,170,974
1851 ...	83,311,975
1859 ...	133,284,634

* PROPORTION OF ALPACCA WOOL IMPORTED.

	Sheep and Lamb. lbs.	Alpacca. lbs.	Total. lbs.
1853 ...	117,248,182	2,148,267	119,396,449
1854 ...	104,954,482	1,267,513	106,121,995
1855 ...	97,853,739	1,446,707	99,300,446
1856 ...	113,236,899	2,974,493	116,211,392
1857 ...	127,390,885	2,359,013	129,749,898
1858 ...	124,050 590	2,688,133	126,738,723
1859 ...	130,783 000	2,501,634	133,284,634

The Alpacca comes almost exclusively from Peru.

TABLE XV., SHOWING THE QUANTITY OF **FLAX** AND **TOW** IMPORTED INTO THE UNITED KINGDOM SINCE 1831, DISTINGUISHING THE PRINCIPAL COUNTRIES WHENCE IMPORTED; THE ANNUAL AVERAGE PRICE OF RIGA, ST. PETERSBURG, AND ARCHANGEL FLAX, AND THE COMPUTED REAL VALUE OF THE TOTAL IMPORTS OF ALL KINDS.

Years.	Russia.	Prussia.	Holland.	Belgium.	Italy.	Egypt.	East Indies.	Other Countries.	Total Quantity.		Annual Average Price of Different Qualities of Flax. "P.T.R.' Riga Flax until 1848. '12 Head," St. Petersburg from 1847.†			"9 Head," St. Petersburg ‡		4th Sort Archangel.' ‡		"DC," Riga. ‡		Computed Real Value.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	tons.	per lb. d.	per ton. £	s.	per lb. d.	per ton £	per lb d.	per ton £	per lb. d.	per ton £	
1831	69,804,672	11,393,648	14,361,872		165,200	...	...	9,152,640	104,878,032	46,821	$5\frac{1}{4}$	49	0							NOT OFFICIALLY RECORDED UNTIL 1854.
1832	74,801,216	16,143,456	12,789,392		78,064	4,928	112	6,224,624	110,041,792	49,126	$4\frac{5}{8}$	43	0							
1833	87,007,760	16,507,120	5,121,536	10,038,336	1,904	...	...	7,842,240	126,518,896	56,482	$4\frac{3}{4}$	45	0							
1834	63,035,280	11,641,280	9,089,584	4,415,712	66,640	...	...	2,664,368	90,912,864	40,586	$5\frac{7}{8}$	55	0							
1835	49,110,096	9,473,744	11,696,608	8,145,872	77,616	...	...	4,467,232	82,971,168	37,041	$5\frac{5}{8}$	53	0							
1836	116,146,352	20,192,592	17,361,792	13,357,008	2,912	...	...	4,200,336	171,260,992	76,456	$5\frac{1}{8}$	48	0							
1837	76,386,800	2,319,408	15,110,592	13,249,376	3,696	3,360	560	5,023,088	112,096,880	50,043	$4\frac{1}{2}$	42	0							
1838	122,030,608	14,755,440	21,459,424	17,183,376	5,152	...	336	6,708,576	182,142,912	81,314	$4\frac{5}{8}$	43	0							
1839	79,039,296	10,018,848	17,974,544	20,219,472	33,824	196,560	1,680	9,570,288	137,054,512	61,185	5	47	0							
1840	97,484,912	15,186,080	12,668,096	9,043,776	83,552	1,344	...	5,895,120	140,362,880	62,662	$4\frac{3}{4}$	44	0	$4\frac{1}{8}$	39	$4\frac{1}{8}$	38	4	37	
1841	108,578,960	12,394,480	13,449,520	10,888,192	48,832	303,072	13,776	5,169,584	150,846,416	67,342	$4\frac{1}{4}$	42	10	4	37	$3\frac{7}{8}$	36	$4\frac{1}{8}$	38	
1842	94,609,200	12,609,184	10,928,736	5,544,560	29,120	131,712	47,264	4,425,232	128,325,008	57,288	$4\frac{1}{4}$	40	0	$3\frac{3}{4}$	35	$3\frac{3}{4}$	35	$3\frac{5}{8}$	34	
1843	122,011,232	19,405,008	7,392,896	4,948,832	27,888	3,309,152	112,336	3,753,456	160,960,800	71,858	4	37	0	$3\frac{1}{4}$	30	$3\frac{1}{2}$	33	$3\frac{1}{4}$	30	
1844	124,546,576	27,933,248	11,945,696	5,036,304	286,384	3,389,792	11,872	4,201,456	177,351,328	79,175	4	37	0	$3\frac{3}{8}$	32	$3\frac{3}{8}$	32	$3\frac{3}{8}$	32	
1845	96,278,224	20,722,240	12,050,304	8,978,816	926,352	13,904,128	29,232	5,962,880	158,852,176	70,916	$4\frac{5}{8}$	43	0	$4\frac{1}{4}$	40	$4\frac{5}{8}$	43	$4\frac{1}{8}$	38	
1846	82,924,352	9,728,096	13,731,648	6,796,048	953,232	8,389,584	...	5,951,344	128,474,304	57,355	$4\frac{3}{4}$	44	0	$4\frac{1}{2}$	42	$4\frac{1}{2}$	42	$4\frac{1}{8}$	38	
1847	76,290,704	15,886,640	8,243,536	4,475,520	861,728	6,423,760	201,600	5,450,480	117,833,968	52,604	$4\frac{7}{8}$	46	0	$4\frac{3}{8}$	41	$4\frac{5}{8}$	43	$4\frac{1}{8}$	39	
1848	121,601,984	13,415,024	11,419,408	6,064,688	490,112	6,954,528	...	3,984,288	163,930,032	73,183	4	37	10	$3\frac{3}{8}$	31	$3\frac{1}{2}$	33	$3\frac{1}{4}$	30	
1849	151,454,800	20,243,664	12,744,032	8,486,128	151,760	5,654,880	...	3,612,112	202,347,376	90,334	$3\frac{1}{2}$	33	0	$3\frac{3}{8}$	31	$3\frac{5}{8}$	34	3	28	
1850	138,965,792	29,486,352	14,922,880	12,021,632	251,664	5,208,560	...	3,309,936	204,166,816	91,146	$3\frac{7}{8}$	36	0	$3\frac{5}{8}$	34	$3\frac{7}{8}$	36	$3\frac{3}{8}$	32	
1851	91,691,712	15,212,400	9,309,664	8,956,976	211,120	5,380,144	5,376	2,931,216	133,748,608	59,710	$4\frac{1}{4}$	40	0	$3\frac{5}{8}$	36	$4\frac{1}{4}$	40	$3\frac{1}{4}$	33	
1852	106,389,584	18,513,040	11,519,424	11,980,864	441,392	5,943,056	784	2,987,824	157,775,968	70,436	$4\frac{1}{8}$	39	5	$3\frac{1}{2}$	33	4	37	$3\frac{1}{2}$	33	
1853	144,255,104	27,146,896	13,350,400	11,149,712	417,424	9,531,872	6,272	5,080,208	210,937,888	94,169	$4\frac{3}{8}$	41	0	$4\frac{1}{8}$	39	$4\frac{7}{8}$	46	$4\frac{1}{4}$	40	
1854	*20,809,376	74,802,448	14,560,560	18,214,560	268,240	5,922,896	...	11,384,240	145,962,320	65,162	$5\frac{3}{8}$	50	0	5	47	$5\frac{5}{8}$	53	$4\frac{7}{8}$	46	3,417,126
1855	* 193,760	105,697,760	15,285,872	12,634,272	95,648	2,098,656	...	8,918,752	144,864,720	64,672	$4\frac{7}{8}$	46	0	$4\frac{1}{4}$	40	$5\frac{1}{4}$	49	$4\frac{1}{4}$	40	3,335,349
1856	120,977,248	32,316,032	17,064,096	12,550,944	121,520	1,494,528	784	4,423,440	188,948,592	84,352	$4\frac{1}{4}$	40	0	$3\frac{5}{8}$	34	$4\frac{1}{2}$	42	$3\frac{5}{8}$	34	3,633,194
1857	142,787,904	30,640,064	16,406,208	13,700,736	39,536	777,056	4,816	4,663,680	209,020,000	93,313	$4\frac{1}{2}$	42	0	$3\frac{5}{8}$	34	$4\frac{1}{2}$	42	$3\frac{5}{8}$	34	3,524,767
1858	104,259,008	10,827,152	12,345,872	10,862,320	6,496	1,153,376	...	4,343,136	143,797,360	64,195	$4\frac{1}{4}$	40	0	$4\frac{1}{4}$	40	$5\frac{1}{8}$	48	$5\frac{3}{8}$ } AVI	{ 50	3,020,879
1859	120,340,752	10,396,512	9,921,968	11,135,152	2,674,336	1,921,696	896	3,996,832	160,388,144	71,602	$6\frac{1}{4}$	[3]58	0	$4\frac{1}{2}$	[3]42	$5\frac{5}{8}$	[3]55	$5\frac{3}{8}$ } AVI	{ [3]50	3,769,058

* Note 1854-5 were the years of the Russian war, and the blockade of the Russian Ports; during this period prices were very irregular. In May, 1854, the prices were for 4th Sort Archangel, £61; 9-Head, St. Petersburg, £60—and for DC Riga, £57.

3, Short importations in 1858. In February, 1859, the prices were for "4th Sort," £64—"9 Head," £52—and "PW," £57.

† Prices received from Messrs. Noble.

‡ Ditto received from Secretary, Dundee Chamber of Commerce.

TABLE XVI., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **HEMP**† AND **HEMP ROPE**† EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850-1 TO 1857-8 INCLUSIVE:—

Years.	Whence Exported.	COUNTRIES WHITHER EXPORTED.] United Kingdom.		France.		Other Parts of Europe.		North America.		China.		Arabian and Persian Gulf.		Islands and Shores of the Indian Seas.		All other Places.		TOTAL EXPORTED. To all Parts.		
		Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Val.	Quantity.	Value	Quantity.	Value.	Quantity.	Value.	Quantity.		Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850–1.	Bengal.....	475,440	1,225	...	...	6,608	16	286,160	1,970	4,144	35	...	...	71,456	701	248,752	2,641	1,092,560	488	6,588
	Madras	32,928	132	...	...	...	...	...	...	...	...	8,400	38	...	...	...	...	41,328	18	170
	Bombay.....	879,312	3,740	...	...	...	...	...	...	...	...	341,824	1,430	...	...	3,584	16	1,224,720	547	5,186
	All India. ...	**1,387,680**	**5,097**	...	...	**6,608**	**16**	**286,160**	**1,970**	**4,144**	**35**	**350,224**	**1,468**	**71,456**	**701**	**252,336**	**2,657**	**2,358,608**	**1,053**	**11,944**
1851–2.	Bengal.....	117,376	285	...	...	...	...	996,016	6,592	5,824	50	...	...	103,264	1,024	262,304	2,273	1,484,784	663	10,224
	Madras	388,976	3,490	...	...	...	...	...	...	...	...	1,344	6	...	...	7,728	23	398,048	178	3,519
	Bombay.....	1,163,120	6,231	...	...	...	...	...	...	...	...	348,880	1,879	...	...	...	...	1,512,000	675	8,110
	All India. ...	**1,669,472**	**10,006**	...	...	...	...	**996,016**	**6,592**	**5,824**	**50**	**350,224**	**1,885**	**103,264**	**1,024**	**270,032**	**2,296**	**3,394,832**	**1,516**	**21,853**
1852–3.	Bengal.....	711,312	1,786	3,024	7	...	...	1,192,464	6,291	11,088	95	8,288	10	268,576	2,479	256,144	2,481	2,450,896	1,094	13,149
	Madras	394,240	1,810	...	...	...	...	672	9	...	...	2,016	9	...	..	448	7	397,376	177	1,835
	Bombay.....	2,614,640	14.007	...	...	...	...	...	...	...	...	310,128	1,661	...	...	5,600	29	2,930,368	1,308	15,697
	All India. ...	**3,720,192**	**17,603**	**3,024**	**7**	...	...	**1,193,136**	**6,300**	**11,088**	**95**	**320,432**	**1,680**	**268,576**	**2,479**	**262,192**	**2,517**	**5,778,640**	**2,579**	**30,681**
1853–4.	Bengal.....	2,695,840	6,864	...	...	...	...	3,076,192	12,202	...	...	2,912	36	681,744	5,582	1,111,488	9,124	7,568,176	3,379	33,808
	Madras	347,312	1,202	224	1	...	...	...	...	...	...	112	1	112	1	...	...	347,760	155	1,205
	Bombay.....	7,309,568	39,238	...	...	...	...	...	...	...	...	476,224	1,956	...	...	..	...	7,785,792	3,476	41,194
	All India. ...	**10,352,720**	**47,304**	**224**	**1**	...	...	**3,076,192**	**12,202**	...	...	**479,248**	**1,993**	**681,856**	**5,583**	**1,111,488**	**9,124**	**15,701,728**	**7,010**	**76,207**
1854–5.	Bengal.....	5,329,408	13,680	38,080	93	1,568	4	1,623,888	8,825	32,280	496	1,008	12	344,736	3,382	885,136	7,887	8,259,104	3,687	34,379
	Madras	877,184	3,058	...	...	...	...	...	...	...	...	112	1	...	...	1,344	9	878,640	392	3,068
	Bombay.....	6,230,000	37,767	...	...	94,080	840	...	...	...	...	300,608	2,536	...	...	...	...	6,624,688	2,957	41,143
	All India. ...	**12,436,592**	**54,505**	**38,080**	**93**	**95,648**	**844**	**1,623,888**	**8,825**	**35,280**	**496**	**301,728**	**2,549**	**344,736**	**3,382**	**886,480**	**7,896**	**15,762,432**	**7,036**	**78,590**
1855–6.	Bengal.....	1,697,696	6,350	116,816	576	13,104	48	1,476,944	8,363	31,696	420	5,040	55	175,056	1,717	215,936	2,431	3,732,288	1,666	19,960
	Madras	528,640	2,446	672	3	...	...	...	...	...	...	7,616	36	...	...	...	...	536,928	239	2,485
	Bombay.....	3,463,936	30,928	15,344	137	189,056	1,688	...	...	...	...	423,136	3,777	...	...	...	...	4,091,472	1,827	36,530
	All India. ...	**5,690,272**	**39,724**	**132,832**	**716**	**202,160**	**1,736**	**1,476,944**	**8,363**	**31,696**	**420**	**435,792**	**3,868**	**175,056**	**1,717**	**215,936**	**2,431**	**8,360,688**	**3,732**	**58,975**
1856–7.	Bengal.....	508,144	2,014	...	...	19,824	108	3,288,320	14,088	19,152	227	9,856	119	107,520	1,307	917,952	5,421	4,870,768	2,174	23,284
	Madras	271,152	1,047	33,824	138	2,464	11	...	...	...	...	336	1	...	...	224	1	308,000	138	1,198
	Bombay.....	2,676,576	23,851	...	...	...	...	...	...	...	...	363,552	3,246	...	...	59,136	528	3,099,264	1,384	27,625
	All India. ...	**3,455,872**	**26,912**	**33,824**	**138**	**22,288**	**119**	**3,288,320**	**14,088**	**19,152**	**227**	**373,744**	**3,366**	**107,520**	**1,307**	**977,312**	**5,950**	**8,278,032**	**3,696**	**52,107**
1857–8.	Bengal.....	2,054,080	13,662	14,896	118	...	...	1,002,288	7,779	...	...	2,464	30	248,304	2,555	669,088	6,216	3,991,120	1,782	30,360
	Madras	637,840	2,237	3,024	10	6,272	26	...	...	...	...	21,280	95	...	...	29,904	533	698,320	311	2,901
	Bombay.....	2,894,528	18,094	57,232	255	...	...	2,464	11	...	...	448,784	2,071	...	...	1,792	10	3,404,800	1,520	20,441
	All India. ..	**5,586,448**	**33,993**	**75,152**	**383**	**6,272**	**26**	**1,004,752**	**7 790**	...	...	**472,528**	**2,196**	**248,304**	**2,555**	**700,784**	**6,759**	**8,094,240**	**3,613**	**53,702**

* The Indian Rupee is here converted at the exchange of Two Shillings.

† This is the term used in the returns from India, but it is a misnomer. The "Hemp" here specified is almost entirely the produce of the leguminous plant called "Sunn" (*Crotalaria juncea*), not of the *Cannabis sativa*, or true Hemp.

TABLE XVII., SHOWING THE QUANTITIES (AS FAR AS CAN BE ASCERTAINED) AND VALUE* OF **SILK** EXPORTED FROM INDIA, AND EACH PRESIDENCY, TO ALL PARTS OF THE WORLD, FROM 1850–1 TO 1857–8 INCLUSIVE:—

Years.	Whence Exported.	Countries whither exported. United Kingdom. Quantity.	United Kingdom. Value.	France. Quantity.	France. Value.	Other Parts of Europe. Quantity.	Other Parts of Europe. Value.	North America. Quantity.	North America. Value.	China. Quantity.	China. Value.	Arabian and Persian Gulf. Quantity.	Arabian and Persian Gulf. Value.	Islands and Shores of the Indian Seas. Quantity.	Islands and Shores of the Indian Seas. Value.	All other Places. Quantity.	All other Places. Value.	Total exported. To all Places. Quantity.	Quantity.	Value.
		lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs.	tons.	£
1850–1.	Bengal...	1,256,533	605,387	247	66	...	...	...	...	...	...	905	412	...	...	...	...	1,257,685	561	605,865*
	Madras ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	14,716	4,063	...	...	...	...	...	...	...	...	45,985	7,704	...	...	7,552	1,686	68,253	31	13,453
	All India.	**1,271,249**	**609,450**	**247**	**66**	...	...	...	...	...	...	**46,890**	**8,116**	...	...	**7,552**	**1,686**	**1,325,938**	**592**	**619,318**
1851–2.	Bengal...	1,434,275	679,260	...	...	657	297	...	...	...	...	3,537	1,526	...	...	...	...	1,438,469	642	681,083
	Madras ..	210	116	...	...	...	...	...	...	...	...	...	...	...	...	...	...	210	...	116
	Bombay..	3,173	1,161	...	...	...	...	...	...	...	...	15,825	2,323	9,878	3,471	1,789	486	30,665	14	7,441
	All India.	**1,437,658**	**680,537**	...	...	**657**	**297**	...	...	...	...	**19,362**	**3,849**	**9,878**	**3,471**	**1,789**	**486**	**1,469,344**	**656**	**688,640**
1852–3.	Bengal...	1,361,155	658,673	987	497	576	296	...	...	...	...	82	27	...	...	...	...	1,362,800	608	659,493
	Madras ..	240	96	...	...	...	...	...	...	...	...	...	...	...	...	63	16	303	...	112
	Bombay..	19,813	5,685	...	...	...	...	...	...	...	...	17,546	1,850	...	...	978	406	38,337	17	7,941
	All India.	**1,381,208**	**664,454**	**987**	**497**	**576**	**296**	...	...	...	...	**17,628**	**1,877**	...	...	**1,041**	**422**	**1,401,440**	**625**	**667,546**
1853–4.	Bengal...	1,479,193	548,531	17,724	8,613	...	...	3,808	1,864	100	50	672	361	...	...	90,244	45,950	1,591,741	711	605,369
	Madras ..	200	88	...	...	...	...	...	...	...	...	254	82	...	...	2,731	1,147	3,185	1	1,317
	Bombay..	75,555	29,619	...	...	...	...	...	...	280	126	21,690	3,156	...	...	7,613	2,888	105,138	47	35,789
	All India.	**1,554,948**	**578,238**	**17,724**	**8,613**	...	...	**3,808**	**1,864**	**380**	**176**	**22,616**	**3,599**	...	...	**100,588**	**49,985**	**1,700,064**	**759**	**642,475**
1854–5.	Bengal...	1,019,648	446,720	56,468	4,332	...	...	...	...	...	...	2,800	1,385	...	...	7,280	7,873	1,086,196	485	460,310
	Madras ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	32,826	13,887	...	...	...	...	...	...	...	...	33,809	9,186	...	...	40,259	16,723	106,894	48	39,796
	All India.	**1,052,474**	**460,607**	**56,468**	**4,332**	...	...	...	...	...	...	**36,609**	**10,571**	...	...	**47,539**	**24,596**	**1,193,090**	**533**	**500,106**
1855–6.	Bengal...	1,322,608	641,118	47,040	23,407	...	...	...	...	...	...	1,344	699	...	...	13,216	6,363	1,384,208	618	671,587
	Madras ..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Bombay..	21,814	8,791	...	...	...	...	...	...	...	...	91,546	9,723	...	...	79,637	17,604	192,997	86	36,118
	All India.	**1,344,422**	**649,909**	**47,040**	**23,407**	...	...	...	...	...	...	**92,890**	**10,422**	...	...	**92,853**	**23,967**	**1,577,205**	**704**	**707,705**
1856–7.	Bengal...	1,155,056	562,093	171,248	78,255	...	...	32,144	1,583	...	...	...	...	...	...	94,024	45,734	1,452,472	648	687,665
	Madras ..	11,250	3,922	...	...	...	...	...	...	...	...	...	...	...	...	...	...	11,250	5	3,922
	Bombay..	141,044	55,043	9,520	3,332	...	...	...	...	...	...	3,704	371	...	...	138,788	31,806	293,056	131	90,552
	All India.	**1,307,350**	**621,058**	**180,768**	**81,587**	...	...	**32,144**	**1,583**	...	...	**3,704**	**371**	...	...	**232,812**	**77,540**	**1,756,778**	**784**	**782,139**
1857–8.	Bengal...	1,341,200	658,718	125,216	64,193	784	390	1,120	583	...	...	112	65	...	...	49,392	23,906	1,517,824	678	747,855
	Madras ..	1,038	413	870	553	24	13	...	...	...	...	...	...	...	...	...	...	1,932	1	979
	Bombay..	20,737	8,578	672	235	...	...	800	324	...	...	18,378	2,473	...	...	20,120	6,229	60,707	27	17,839
	All India.	**1,362,975**	**667,709**	**126,758**	**64,981**	**808**	**403**	**1,920**	**907**	...	...	**18,490**	**2,538**	...	...	**69,512**	**30,135**	**1,580,463**	**706**	**766,673**

* The Indian Rupee is here converted at the exchange of Two Shillings.

TABLE XVIII., SHOWING THE QUANTITY OF **SILK** (RAW, WASTE, KNUBS, HUSKS, AND THROWN) IMPORTED INTO THE UNITED KINGDOM FROM EACH SOURCE SINCE 1820 THE ANNUAL AVERAGE PRICE OF No. 3, TSATLEE; AND COMPUTED REAL VALUE OF ALL KINDS IMPORTED.

YEARS.	EAST INDIES.	CHINA.	ITALY, AND THE ITALIAN STATES.	TURKEY, SYRIA, AND PALESTINE.	EGYPT.	FRANCE.	HOLLAND.	BELGIUM.	OTHER COUNTRIES.	GRAND TOTAL.	QUANTITY.	ANNUAL AVERAGE PRICE. No. 3 TSATLEE.	COMPUTED REAL VALUE.	YEARS.
	lbs.	lbs.	lbs.	lbs.		lbs.	lbs.	lbs.	lbs.	lbs.	tons.	per lb.	£	
1820	1,206,722	221,520	513,908	217,147		397,193	NOT DISTINGUISHED.	NOT DISTINGUISHED.	85,376	2,641,866	1,180	...	NOT OFFICIALLY RECORDED UNTIL 1854.	1820
1821	**1,106,659**	**218,930**	**630,915**	**176,578**		**356,831**			**52,282**	**2,542,195**	**1,135**	...		**1821**
1822	924,223	172,679	790,108	318,344		384,507			90,707	2,680,568	1,197	...		1822
1823	1,331,750	287,607	609,153	203,844		403,093			45,187	2,880,634	1,286	...		1823
1824	1,105,170	202,130	720,294	319,063		1,088,534			42,457	3,477,648	1,553	...		1824
1825	906,240	123,107	1,336,551	341,107		1,053,575			134,190	3,894,770	1,739	...		1825
1826	1,620,269	169,591	166,226	240,840		430,814			37,485	2,665,225	1,190	...		1826
1827	1,122,393	128,431	295,873	358,757	...	1,576,414			128,859	3,610,727	1,612	...		1827
1828	1,213,740	212,895	585,629	671,226	166	1,843,762			237,823	4,765,241	2,127	...		1828
1829	2,116,596	120,977	231,664	281,421	...	976,059			79,216	3,805,933	1,699	...		1829
1830	1,736,232	19,199	475,779	463,398	896	1,477,832			144,845	4,318,181	1,928	...		1830
1831	**1,725,650**	**8,418**	**527,214**	**452,266**	...	**1,763,174**			**145,152**	**4,621,874**	**2,063**	...		**1831**
1832	1,814,826	28,110	566,702	457,866	1,113	1,151,718			204,562	4,224,897	1,886	..		1832
1833	989,619	22,186	380,925	368,669	...	1,531,151	232,769	2,752	135,608	3,663,679	1,636	...		1833
1834	1,825,374	582,856	404,687	419,368	288	1,415,563	82,691	3,671	114,114	4,848,612	2,165	...		1834
1835	1,109,758	737,802	522,440	677,561	2,551	2,004,989	241,690	11,709	66,827	5,375,327	2,400	...		1835
1836	1,453,510	1,281,839	479,333	695,355	...	2,363,927	124,737	9,861	49,468	6,458,030	2,883	...		1836
1837	1,303,351	1,807,690	291,673	386,097	...	1,421,204	53,961	1,610	55,379	5,320,965	2,375	...		1837
1838	1,151,416	721,517	381,855	478,775	...	1,851,367	64,554	2,342	17,658	4,669,484	2,085	...		1838
1839	1,388,070	360,882	619,317	731,906	...	1,801,646	87,877	320	23,988	5,014,006	2,238	...		1839
1840	1,104,675	247,763	501,333	725,189	...	1,838,835	232,708	7,568	90,765	4,748,836	2,120	...		1840
1841	**1,175,314**	**277,097**	**755,131**	**732,626**	**158**	**1,763,714**	**175,964**	**10,393**	**75,701**	**4,966,098**	**2,217**	...		**1841**
1842	1,367,207	180,148	771,842	733,122	1	2,241,830	409,964	18,787	62,606	5,785,507	2,583	...		1842
1843	1,197,610	275,309	1,074,823	606,399	894	1,562,530	487,030	6,839	136,342	5,347,776	2,387	...		1843
1844	1,669,585	353,016	1,273,010	745,346	84,856	1,465,315	505,716	28,774	174,555	6,300,173	2,813	...		1844
1845	1,723,326	1,175,865	1,223,089	446,012	22,638	1,027,664	525,361	37,737	146,467	6,328,159	2,825	17s. 7d.		1845
1846	1,415,353	1,836,872	705,726	424,939	10,729	792,409	457,788	11,945	79,577	5,735,338	2,560	16 6		1846
1847	1,083,204	2,021,765	656,613	270,717	66,893	795,314	610,125	23,515	70,601	5,598,747	2,499	15 3		1847
1848	772,189	2,241,011	1,037,398	379,037	15,980	1,347,339	620,575	56,178	119,048	6,588,755	2,941	13 5		1848
1849	1,804,328	1,861,537	1,240,076	285,803	42,780	1,000,749	539,118	146,724	113,862	7,034,977	3,141	15 9		1849
1850	1,569,997	1,812,370	1,486,328	795,237	217,328	754,626	380,635	39,686	102,969	7,159,176	3,196	18 10		1850
1851	**1,198,948**	**2,099,134**	**1,262,392**	**464,438**	**248,529**	**560,710**	**578,304**	**28,333**	**156,390**	**6,597,178**	**2,945**	**18 10**		**1851**
1852	1,339,003	2,470,029	946,042	609,534	925,398	626,858	819,513	66,135	212,699	8,015,211	3,578	17 11		1852
1853	586,662	2,996,396	667,178	722,959	1,866,036	1,098,142	1,224,174	42,246	232,640	9,436,433	4,213	18 3		1853
1854	944,148	4,952,926	419,113	242,623	1,550,948	1,185,311	1,061,461	178,050	204,419	† 10,738,999	4,794	16 11	6,536,175	1854
1855	903,108	5,049,022	293,139	188,905	781,818	821,087	652,719	71,833	142,999	† 8,904,630	3,975	16 6	5,561,098	1755
1856	660,038	4,195,814	260,534	262,571	* 2,515,108	1,198,463	876,427	34,183	248,765	† 10,251,903	4,577	21 4	8,798,431	1856
1857	497,804	7,187,090	244,388	259,777	* 4,488,947	1,423,273	612,858	29,820	291,070	15,035,027	6,712	24 6	14,612,181	1857
1858	1,007,944	2,521,080	183,399	149,416	* 3,075,187	964,621	466,918	28,430	116,530	8,513,525	3,801	18 9	6,329,691	1858
1859	**529,631**	**3 707,524**	**186,618**	**196,113**	*** 5,463,161**	**1,910,012**	**341,648**	**5,559**	**238,583**	**12,578,849**	**5,616**	**21 6**	**10,596,676**	**1859**

* The quantity entered as imported from Egypt after 1855, is for the most Part thence in transit from India—the entries not specifying whether so or not.

† The Totals, 1853 to 1856, differ slightly from those given in Table , arising from the Board of Trade giving the detail only in cwts., which when reduced does not coincide with the exact weight in lbs.

TABLE XIX., SHOWING THE DECLARED REAL VALUE OF **BRITISH TEXTILE** AND OTHER MANUFACTURES EXPORTED FROM THE UNITED KINGDOM SINCE 1820.

Years.	Cotton Manufactures.	Woollen and Worsted Manufactures.	Linen Manufactures.	Silk Manufactures.	All Textile Manufactures.	Other Articles.	Total Value, British Manufactures, of all kinds Exported.	Years.
	£	£	£	£	£	£	£	
1820	16,516,748	5,586,948	1,654,579	371,775	24,130,050	12,294,603	36,424,653	1820
1821	**16,093,787**	**6,464,783**	**1,981,628**	**374,473**	**24,914,671**	**11,744,960**	**36,659,631**	**1821**
1822	17,218,724	6,490,559	1,774,213	381,703	25,865,199	11,103,765	36,968,964	1822
1823	16,326,604	5,637,713	2,095,642	351,409	24,411,368	11,046,681	35,458,049	1823
1824	18,452,987	6,045,239	2,442,587	442,596	27,383,409	11,012,892	38,396,301	1824
1825	18,359,526	6,200,115	2,130,697	296,736	26,987,074	11,890,314	38,877,388	1825
1826	14,093,369	4,989,673	1,487,662	168,801	20,739,505	10,797,218	31,536,723	1826
1827	17,637,165	5,283,041	1,895,187	236,113	25,051,506	12,131,351	37,182,857	1827
1828	17,244,417	5,125,984	2,001,005	255,871	24,627,277	12,186,899	36,814,176	1828
1829	17,535,006	4,661,251	1,885,841	267,930	24,350,028	11,480,622	35,830,650	1829
1830	19,428,664	4,851,096	2,066,424	521,010	26,867,194	11,384,309	38,251,503	1830
1831	**17,257,204**	**5,389,124**	**2,460,704**	**578,874**	**25,685,906**	**11,477,742**	**37,163,648**	**1831**
1832	17,398,392	5,479,786	1,783,432	529,691	25,191,301	11,253,224	36,444,525	1832
1833	18,486,401	6,540,726	2,239,030	737,404	28,003,561	11,663,786	39,667,347	1833
1834	20,513,586	5,975,415	2,579,658	637,198	29,705,857	11,943,334	41,649,191	1834
1835	22,128,304	7,149,602	3,208,778	973,786	33,460,470	13,911,800	47,372,270	1835
1836	24,632,058	7,998,044	3,645,097	917,822	37,193,021	16,100,958	53,293,979	1836
1837	20,596,123	4,989,075	2,606,752	503,673	28,695,623	13,375,121	42,070,744	1837
1838	24,147,726	6,179,604	3,566,435	777,280	34,671,045	15,389,925	50,060,970	1838
1839	24,550,375	6,694,965	4,233,452	868,118	36,346,910	16,886,670	53,233,580	1839
1840	24,668,618	5,780,810	4,128,964	792,648	35,371,040	15,937,700	51,308,740	1840
1841	**23,499,478**	**6,300,821**	**4,320,021**	**788,894**	**34,909,214**	**16,635,902**	**51,545,116**	**1841**
1842	21,679,348	5,822,350	3,372,300	590,189	31,464,187	15,820,801	47,284,988	1842
1843	23,447,971	7,533,120	3,702,052	667,952	35,351,095	16,855,352	52,206,447	1843
1844	25,805,344	9,163,053	4,075,476	736,455	39,780,328	18,754,377	58,534,705	1844
1845	26,119,331	8,760,042	4,096,936	766,405	39,742,714	20,368,368	60,111,082	1845
1846	25,599,826	7,243,373	3,706,213	837,577	37,386,989	20,399,887	57,786,876	1846
1847	23,333,225	7,897,402	3,608,744	985,626	35,824,997	23,017,380	58,842,377	1847
1848	22,681,200	6,510,803	3,296,238	588,117	33,076,358	19,773,087	52,849,445	1848
1849	26,775,135	8,432,946	4,225,894	998,334	40,432,309	23,163,716	63,596,025	1849
1850	28,257,401	10,040,332	4,828,994	1,255,641	44,382,368	26,985,517	71,367,885	1850
1851	**30,088,836**	**9,861,727**	**5,058,822**	**1,326,778**	**46,336,163**	**28,112,559**	**74,448,722**	**1851**
1852	29,878,087	10,161,074	5,372,351	1,551,866	46,963,378	31,113,476	78,076,854	1852
1853	32,712,902	11,628,968	5,913,409	2,044,361	52,299,640	46,634,141	98,933,781	1853
1854	31,745,857	10,678,371	5,052,959	1,692,380	49,169,567	48,015,159	97,184,726	1854
1855	34,779,141	9,744,469	5,050,994	1,524,343	51,098,947	44,589,138	95,688,085	1855
1856	38,232,741	12,390,070	6,253,760	2,962,056	59,838,627	55,988,321	115,826,948	1856
1857	39,073,420	13,645,176	6,164,833	2,889,829	61,773,258	60,292,849	122,066,107	1857
1858	43,001,322	12,743,867	5,870,696	2,096,300	63,712,185	52,896,571	116,608,756	1858
1859	**48,208,444**	**15,113,137**	**6,291,734**	**2,351,839**	**71,965,154**	**58,475,273**	**130,440,427**	**1859**

TABLE XX.

INDIAN RAILWAYS.

Name of Company.	Direction of the Line.	Length of Line Sanctioned	Length of Line Open.	Length in course of Execution.	Date when it is expected a further portion of the Line may be opened.	CAPITAL. Estimated Amount.	Amount Sanctioned.	Amount Paid up. ¶
		Miles.	Miles.	Miles.		£	£	£
East Indian	Calcutta to Delhi*	1,138	Calcutta to the river Cynthea, and branch to Raneegunge 169 Allahabad to Cawnpore 126	About 900. The works on the Jubbulpore Branch are just about to be commenced.	To Rajmahal and from Cawnpore to Agra in 1860. To Allahabad end of 1861. To Delhi and to Jubbulpore end of 1862. (*This is exclusive of the large Bridges*)	19,000,000	14,000,000	13,673,967
	Allahabad to Jubbulpore	200						
		Total 1,338	Total 295					
Madras	Madras to the Western Coast at Beypore	405	Madras to Gorreatum... 96	334 Operations on the Main Line to Bellary and on the Branch to Bengalore will commence shortly.	To Beypore in 1860. (*Other Lines not estimated.*)	10,000,000	5,000,000	4,314,887
	Branch to Neilgherries.	30						
	Bangalore Branch	80						
	Madras to Bellary.....	330						
		Total 845						
Great Indian Peninsula	Bombay to Callian, with Branch to Mahim	35	Bombay to Wassind on the N.E. line, and S.E. to Campoolie—also from Lanowlie to Moholl (in the Deccan). Total 274	About 900.	To Sholapore, March, 1860. To Jubbulpore and Nagpore, 1862. Excepting Works on Bhore & Thul Ghauts, which will not be finished before 1862.	12,000,000	8,333,300†	5,777,232
	Callian to Jubbulpore.	573						
	Callian, *via* Poonah, to the river Kristna.	388						
	Branch from Bhosawal to Nagpore.....	263						
	Campoolie Branch	7						
		Total 1,266						
Sind: Sind Railway.	Kurrachee to Kotree on the Indus.....	114	...	114	By the end of 1860.	1,400,000	1,250,000	994,332
Punjab Railway...	Moultan to Lahore and Umritser	250	...	250	Lahore to Umritser 1860, and to Moultan 1862.	4,000,000‡	1,500,000	551,675
	Delhi to Lahore.....	240						
		Total 490						
Indus Flotilla.....	For the Navigation of the Indus, &c., between Kotree and Moultan, in connection with the Railways	...	...	Most of the boats have been shipped.	Expected to be in complete working order in 1860.	250,000	250,000	249,140
Bombay, Baroda, & Central India....	Bombay, by Surat and Baroda, to Ahmedabad	310	...	310	Surat to Ahmedabad 1860. Bombay to Surat 1861.	2,300,000	2,300,000	1,785,578
Eastern Bengal	Calcutta to Dacca, ‖ with a Branch to Jessore.....	130	..	80	End of 1861.	1,250,000	1,000,000	440,133
Calcutta and South Eastern	Calcutta to the Mutlah.	26	...	26	March, 1861.	250,000	250,000	149,378
Great Southern of India.....	Negapatam to Trichinopoly, ‖ with Branches to Salem and to Tuticorin....	300	...	80 Operations commenced.	Negapatam to Trichinopoly, early in 1861.	2,000,000	For the line from Negapatam to Trichinopoly, 500,000	216,221
		Total 4,819						

SUMMARY.

	Miles.		Miles.
Length of Railway sanctioned	4,819	Length of Railway expected to be opened in 1861.....	2,162
Length of Railway open.....	665		
Length of Railway in course of execution.....	2,994	Estimated amount of capital.....	£52,450,000
Length of Railway expected to be opened in 1860.....	890	Amount paid up (March 1860).....	28,151,483

RAILWAY DEPARTMENT INDIA OFFICE, March, 1860.

* Including Raneegunge and Benares Branches.
† Including £333,300 Debentures.
‡ For the Line from Moultan to Umritser, £2,000,000. It is probable that the Line from Delhi to Lahore will require a like amount.
‖ The Line is only sanctioned to the Ganges at present, but it is intended eventually to be carried to Dacca, surveys for which purpose have been ordered.
‖ The Line from Negapatam to Trichinopoly is all that has been sanctioned for immediate construction.
¶ In England to the 31st December, 1859, and in India to the latest advices.

DISCUSSION.

The Chairman, in inviting discussion upon the excellent paper they had heard, said he was sure the meeting at large must be as gratified as he was personally at hearing the statements made by Dr. Forbes Watson, and he congratulated that gentleman, as well as the meeting, upon the rich stores of natural products of India, which were as yet comparatively unknown in this country. He congratulated the manufacturing world upon sources of industry comparatively undeveloped, and the energetic and enterprising world upon the stores of wealth there which only required to be gathered. He was glad to see present two Members of Parliament,—Mr. Hadfield, member for Sheffield, and Colonel Sykes, member for Aberdeen,—both of whom had interested themselves very much in the question of obtaining an adequate supply of raw materials to meet the wants of our national industry. He was glad also to see Mr. Warren present, with one of his wonderful pieces of machinery, applicable to the manufactures now under consideration. He had known that gentleman for many years as the servant of the public, and the servant of progress, and the nation at large owed much of invention and much of usefulness to his labours. He was happy to find that Mr. Warren had turned his attention to the treatment of fibres, and he welcomed his presence with pleasure. He had likewise the satisfaction of seeing near him a distinguished gentleman, who, some time ago, attended one of the meetings of the Manchester Cotton Supply Association —Dr. Riddell—who then laid upon the table of the meeting some very interesting and excellent specimens of cotton grown in India; and if Manchester and the other great manufacturing districts could obtain an adequate supply of cotton of the quality then produced, we should not only be independent of the United States for the great bulk of that commodity, but for the sake of humanity we should cease to be exclusively dependent upon slave labour for the raw material which was necessary to our existence. It was gratifying to him to state that the specimens of cotton brought by Dr. Riddell from India possessed all the characteristics which were required by the manufacturer. He also saw present another friend, Mr. Bourne, who had interested himself in the development of the products of our West Indian territories, and that gentleman would be able to tell them that an ample supply of cotton might be obtained from those regions. They had wonders before them as yet almost unexplored, and he hoped the paper they had heard would lead to an interesting discussion.

Mr. P. L. Simmonds said that, often as the subject of Indian fibres had been discussed before the Society, it had lost none of its telling interest in a manufacturing point of view, and it had certainly never been more competently handled than on the present occasion. Dr. Forbes Watson had dealt with its varied details in a thorough investigation which left nothing to desire, and had evinced an amount of research, experiment, and study which were most remarkable. The extensive statistical tables, maps, and diagrams, with the numerous illustrative specimens of fibres and their manufactured products exhibited that evening, could not be duly appreciated or understood by a mere superficial glance, but would give, when published in the columns of the *Journal*, a wide field for investigation and inquiry. Even in the brief abstract of the paper read, the meeting had heard much that was new and important, but there was much yet in store for careful and thoughtful perusal. As there were doubtless many gentlemen desirous of addressing the meeting, he should content himself with a few brief observations. He believed the more discussion was provoked on the subject of the supply of textile and fibrous materials, the more probability there was of increased attention being given to their production, and of our increased supplies coming in to make up the deficiency now complained of. The cotton interest was now so large and independent an interest of the country, that it was well able to take care of itself, and fully competent, as it was now doing, to make its wants known far and near. A Flax Supply Association, he believed, had also been formed to promote its cultivation in India and elsewhere, and to stimulate inland supplies. That this was absolutely necessary, was quite evident from the fact of the decreased acreage under culture with flax in Ireland, which had now dropped to something like 96,000, or less than half what it was a few years ago. Whether this was to be attributed to the want of labour owing to emigration, to the cost of culture, or some other cause, he could not state. An emigration of 68,000 souls in 1858, and probably fully as many last year from Ireland, would no doubt have its effect, especially as the great bulk of these, or about one-half were from the Province of Ulster. When they glanced at the map of India before them, and saw the extent of country included in its range, stretching from Singapore in the east, to Kurrachee in the west, from the Himalayas in the north, to Cape Cormorin in the south, who could doubt that in such a magnificent extent of country there must be ample fibrous materials to supply the pressing wants of commerce now or hereafter. There was necessarily a limit to this extended cultivation of flax in this country, owing to the exhausting nature of the crop and the stipulations in leases, but there was no reason why India and our colonies, where there was abundance of cheap land available, should not grow it in quantities. Instead of getting increased foreign supplies of flax, our supplies were declining, for while, in 1857 and previous years, we received upwards of 1,800,000 cwt., in the last two years we had only received about 1,350,000 cwt. Hence our flax spinners were obliged to seek for other fibres, and jute from India now came in to as large an extent as foreign hemp. Not that it was available for the same purposes, possessing less tenacity and strength, and not taking colour well, but from its silky lustre and softness it was largely worked up at Dundee and elsewhere with flax, and in rugs, carpets, &c. The extent of the present production in India might be estimated by the fact stated by Dr. Watson, that 269,000 tons of this fibre were shipped last year, including the gunny bags, which were in such large demand for baling in the United States and elsewhere, besides the extensive local consumption for twine, ropes, curtains, sails, &c. What would our manufacturers not give for ample supplies of the valuable rheea and nettle fibres, spoken of by Dr. Watson, the excellent qualities of which were appreciated by all who had tested them. Then there were the long, white, and strong fibres of the two species of *Sansievera*, well adapted for both cordage and clothing. Less had been done with coir fibre in India than in Ceylon, and the enormous extension of trade in that article was an evidence that there was a wide field open yet for the utilization of many other formerly waste products. The Ejoo, or Gamute fibre, might, as had been observed, come into use for upholstery purposes, instead of horse-hair. It was plentiful in the islands of the Eastern Archipelago, where it was much used and valued for forming rough cables, which were not so much affected by salt water and friction as other ropes. The fetid *Pederia*, the fibre of which was spoken so favourably of by Dr. Watson, as being worth £150 to £200 per ton, was certainly worth further investigation in order to ascertain whether it could be obtained in any quantity. There was another plant touched upon, the wild plantain (*Musa textilis*), the fibre of which entered so largely into commerce for the Manilla white rope and other purposes. Although not now grown in India, it might be well worth while to introduce it there, seeing the estimation in which the product was held, for the shipments from Manilla of this fibre misnamed "hemp," had now increased to 30,000 tons, and 1,500 tons of the white rope were made from it. In addition to these a considerable trade was carried on in the Phillippines in coarse fibres, made of the leaf of the sago palm and of other fibres. These fabrics, known in the Manilla markets as Sagaran, Gumaras, and Midrinaque, were shipped to the

United States, Spain, and England. The last named, Midrinaque, had been for some years imported in increasing quantity to the States and to Europe, being chiefly used in lieu of buckram and crinoline for stiffening dresses, linings, &c. The other two fabrics were largely used at the government factories for parting the leaf tobacco sent to Spain. The strong and silky pine-apple fibre was also there in extensive use for making the light and delicate fur or cloth, and it was worth fully the price of £50 per ton, which Dr. Watson had put upon it. Time would fail to go into detail on many other of the Indian fibres which were yet little known and appreciated in the home markets. In conclusion, he must differ with Dr. Watson in the opinion that "half-stuff" for paper could not be prepared in India for shipment to this country. He had had some of excellent quality sent him from Ceylon, which could be laid down very cheap in this country. It mainly turned upon the question of freight, and freights very often, as of late years, had ruled exceedingly low from India. The maceration and compression of the fibre was not a very difficult process, and water was not scarce in many localities. The specimens round the room of Indian papers, all made from native fibres, showed what had already been done there, and the wide field open for skill and enterprise. It wanted but European supervision, European capital, and European intelligence, to obtain from India stores of undeveloped products, which would enrich our merchants and manufacturers, and greatly extend our foreign commerce.

Mr. Thomas Routledge said he would confine the few remarks he was about to make to the application of raw fibre to the manufacture of paper, being a subject with which he was more especially conversant. The last time he had an opportunity of addressing a meeting in that room was in November, 1856, when a paper on the same subject was read by Dr. Forbes Royle, the able predecessor of Dr. Forbes Watson. Then anticipating the speedy repeal of the paper duty, he stated his conviction that, consequent thereupon, an immense increase of production would result; and that, looking to the improbability of any very considerable or permanent addition to the supply of material through the ordinary channels—as the high value of land and labour in England would act practically as a prohibition to any production here—it was obvious that we must look to foreign countries, and our colonies especially, to meet the necessities of the case. The duty had now happily been abolished, and it was generally admitted that the supply of rags alone was quite inadequate to meet the requirements of the trade; even assuming that if in the late commercial treaty with France it had been provided that there should be free-trade in rags, the beneficial effect to our manufacturers would have been but temporary, as the cost of rags in the two countries would rapidly have assimilated. It would, indeed, almost appear that England was periodically subject to a rag as well as to a monetary panic; although, happily for the trade, the former took place at somewhat longer intervals than the latter. There was a book in the British Museum, of which he possessed a copy, published in the year 1801, by one Matthias Koops, the introducer and inventor of both straw and wood for paper making, from which he would briefly quote. Mr. Koops there said, referring to rags:—

"All Europe has of late years experienced an extraordinary scarcity of this article, but no country has been so much injured by it as England; the greatly advanced price and the absolute scarcity equally operating to obstruct many printing presses in this kingdom; and various works remain, for these reasons, unpublished, which might have proved very serviceable to the community."

He could almost imagine that Mr. Koops had been present with himself at the deputations which waited last session on Lord Derby, when Mr. Chambers, of Edinburgh, and Mr. Cassell stated that they had been compelled to abandon the sale of some of their cheap periodicals for the people. Mr. Koops went on to say:—

"The great demands for paper in this country have rendered it necessary to be supplied from the Continent with rags; this supply is extremely precarious, and is likely to be more wanted as the consumption increases, because this material, which is the basis of paper, is not to be obtained in England in sufficient quantity."

If Mr. Koops had written his book yesterday, it could not have more pertinently applied to the present state of the paper trade; a partial remedy, however, then existed, as an Act of Parliament was passed, prohibiting, under a heavy penalty, the burial of the dead in any other dress but wool. He did not know whether this act was still in existence; but if not, he hardly imagined the paper manufacturers would agitate for such an enactment. With regard to the application of raw fibres to paper-making in ancient times, they had from the earliest ages been employed for the manufacture of paper. The Egyptians were the first who practised this art extensively, and they for many hundred years held this even then highly lucrative trade entirely in their own hands, supplying the world. In India, China, Japan, indeed all eastern countries, he believed without exception, paper was made from their indigenous raw fibres. Recent accounts had shown to what a variety of purposes it was applied in China, and more particularly Japan. He had lately seen, at the Kensington museum, some hangings for a room, which, at a short distance it would be difficult to distinguish from the richest brocade. These were made chiefly from strips of gilt paper, excessively strong, interwoven with silk dyed with brilliant colours; and our upholsterers and decorators would do well to take a leaf out of the Japanese book. In China and Japan rags were not used at all, their paper being made from rice straw, shoots of the bamboo, inner barks of various trees, raw hemp, &c. It would appear that the manufacture of paper from cotton wool, in other words raw cotton, dates from a very early period, as it was known to the Chinese and Persians before the year of our Lord 700. The Greeks also at Constantinople and the Moors in Spain seemed to have practised the art very extensively; but it was not introduced into Europe until the eleventh century, and not till the twelfth century was paper made from rags, when it was called "parchment cloth." The first notice taken of any document written on this paper was at the latter end of the eleventh or commencement of the twelfth century, when the Empress Irene, wife of the Emperor Alexius Comnenus, made three copies of rules for her nuns at Constantinople, two of which were on parchment and one on cotton paper. The period at which cotton paper was first introduced into England could be ascertained with accuracy; the most ancient MSS. which could be produced dating 1049, but its use continued until the end of the fourteenth century, when it was gradually supplanted by linen paper, which, however, was not introduced before the year 1367. In Italy and in Spain paper of that date was preserved, in France 1314, and in Germany 1308; it was likely, therefore, that Germany had the honour of its invention, more particularly as at Augsburgh the first linen manufactories were established. In England many documents, dating from the years 1282 to 1347, were preserved, but it was almost impossible to ascertain whether the MSS. were written on paper made from linen alone or with an admixture of cotton. The art of manufacturing paper from linen and linen rags was only established in England in the latter part of the 16th century, all paper previous to that date being imported from Holland and France. The first paper mill was erected in England, in the reign of Queen Elizabeth, A. D. 1588, at Dartford in Kent, by a German, of the name of Spielman, for which he received the honour of knighthood. The revenue arising from the excise duty on paper, in the year 1799, was £140,000, and it must be admitted that since then the trade had made considerable progress. Within a comparatively recent period a complete revolution had taken place in the manufacture of paper, dating from the extension of the cotton trade in

this country. Cotton cloth had to a very great extent superseded flax for clothing and domestic purposes, and consequently the rags now collected in this country were nearly three-fourths cotton fibre, and the same remark, although in a less degree might be applied to France, Belgium, and Holland. The paper-maker, however, refused no fibrous refuse except wool and silk, and even the former was used to a trifling extent for filtering paper. Large quantities of what might strictly be termed raw fibres were, even at the present time, extensively employed; cotton waste, the sweepings of the Lancashire mills, as also flax and hemp tow, and waste, but many causes had operated to reduce the supply even of these materials. The extension of railways and machinery had induced a large consumption of cotton waste for wipings, and the high price of cotton had compelled the spinners to introduce new processes for economising their waste. The scarcity of flax, again, had sadly inconvenienced the paper-maker, who now found that the tow, which formerly came to him, was, if possessing any length of staple, and tolerably clean, retained by the spinners; indeed lately, so great had been the scarcity of every description of fibre, that even gunny bagging, if clean and of good quality, was being purchased to be re-spun, and made into hop-bags and sacking, after undergoing a process of re-manufacture. Dr. Watson and other authorities had said that any quantity of flax fibre, not perhaps high enough in quality for the spinner, but admirably adapted for the paper-maker, could be sent from India at a very low price. The rheea, the *Hibiscus*, various hemps, and similar exogenous plants yielded splendid fibre for paper-making. Dr. Royle, in his valuable work on the Fibrous Plants of India, said, in his report to the Lords of the Treasury:—"Among cultivated plants, there is probably nothing so well calculated to yield a large supply of material fit for making paper of almost every quality, as the plantain (*Musa paradisiaca*), so extensively cultivated in all tropical countries on account of its fruit, and of which the fibre-bearing stems are applied to no useful purpose. Indeed, their removal, after the plant had fruited, in many instances proved a considerable item of cost. The problem of economically obtaining these fibres was now in a fair way of being speedily determined, as the Tropical Fibre Company, with which he was connected, had sent out machinery to one of the largest plantain estates in Demerara; and Mr. Watson, the proprietor, in co-operation with several influential gentlemen in the colony, was determined to give the question its full extension. He had also introduced these machines into Java and other countries, and the samples of fibre received were of fair quality, worth £20 to £25 per ton for spinning purposes. These machines, the invention of the Hon. Francis Burke, of Montserrat, a model of which Mr. Warren, the engineer who manufactured them, would produce for the inspection of the meeting, were, with trifling modifications, adapted for the treatment of Endogenous fibrous plants, such as the agave, aloe, sanseviera, and the bromelia, the tow of which, the long fibres being sold to spinners, would furnish first-class paper-making material. Samples of paper made from the plantain fibre alone, and mixed with cotton rags, were on the table. The other samples of paper, as also of half-stuff, which he then exhibited, were of his own manufacture, and at least proved the fact that a fair quality of paper could be produced from a most unpromising-looking raw material. He was now turning out upwards of six tons weekly of this paper, which was strong and tough, and appeared to meet the main requirement of the day, which was a cheap common printing paper. They had seen the first attempts, by Koops, upon wood and straw, in the year 1800, and most of those present knew the straw paper now generally in use, and its superiority over these early efforts, and he hoped the paper manufacturers of the present day, seeing from the scarcity and high price of rags, the urgent necessity of the case, would earnestly direct their attention to the field of promise now opened to them. He thought the community at large, as well as the paper-manufacturers, were much indebted to the Society of Arts for so judiciously affording the opportunity of ventilating this important question, as also to Dr. Watson, for the very able and instructive paper he had read that evening, which must have convinced the most sceptical that, however widely the requirements of the trade might be extended, the field laid open to them for paper-making material, by the exercise of ordinary enterprise and judgment, in the East Indies particularly, was practically inexhaustible.

Mr. Warren would say a word or two upon the invention to which the last speaker had alluded (Burke's machine). The success of the apparatus might be attributed to the adoption of a new principle by Mr. Burke in the clearing of fibres. It was for some time a prevailing opinion that the operation of the machinery should be parallel to the fibres; but Mr. Burke, in this machine, adopted a transverse action, by which the fibres were beautifully cleaned, and the pulpy substance of the plantain stem effectually removed. He wished to say a word or two upon the closing observations of Dr. Forbes Watson, with reference to the production of these raw materials in India. He (Mr. Warren) had had something to do with that matter for a long time past. For the last fifteen or twenty years he had heard the same sort of challenge as had been throw out to the manufacturers that night. It had been said that the cotton manufacturers, as the users of these textile materials, should help themselves, if they wanted to be helped at all. That was precisely his own creed, wherever it could be carried out; but it was impossible that the users of the flax, hemp, and cotton could superintend the production of those materials at a distance of several thousand miles. They had given ample evidence of their desire to do what they could, which was to buy the fibres in immense quantities, if brought into the market in the required quantity. The laws of India with regard to cultivation were such as to be injurious to increased production, and he was sorry to see that the Chancellor of the Exchequer for India had proposed taxes upon trade as a means of raising revenue. He would suggest that if India was to develop her great resources, the legislature must do in that country what they had done here, viz., remove all restrictions from the producers of raw materials, as well as of manufactured articles. There was a tax imposed upon tools used by the cutters of canes, and by barbers and smiths, and he had in his possession government receipts for the taxes which had been paid by the owners of these articles. Such taxes as these affected materially commercial development in India. The land tax and the laws relating to the tenure of land, had influenced for evil the agricultural products of that country. Those who were acquainted with India would bear him out as to the importance of liberating the trade of India in the same way that we had liberated the trade of this country. The cotton manufacturers were told that if they wanted cotton from India they must cultivate it themselves, or take it in such quantities as would make it worth growing. In three days after that statement was made, a person had been empowered to purchase £12,000,000 worth of cotton of the quality corresponding with the samples sent to the manufacturer, at the price which was put upon then. Mr. Warren then proceeded to describe a working model of a machine used for expressing the fibrous matter from the plantain stalk, and operated upon a portion of that material. He added that his experience of the per centage of fibre yielded by the plantain, was that it was greater than was mentioned by Dr. Forbes Watson. He (Mr. Warren) had found it to amount to between 7 and 9 per cent. and he had never found less than 7 per cent. of clean fibre.

Colonel Sykes, M.P., thought that in the remarks that had been made they were not doing full justice to the author of this paper, who had bestowed such an enormous

amount of labour upon the subject. One only of the numerous tables upon the wall must have occupied month in preparation. He referred to the one that gave the comparison of the different soils in which these fibres grew. That was alone a study not for the hour during which they were there, but if they wished to turn it to practical account they might study that table of analysis for days and even weeks, to ascertain what soils were best suited for the production of the article they required. It was remarkable that in the Punjab they found a very large quantity of potash and soda. Comparing that with the soil of Belgium, they would find scarcely an appreciable quantity of potash and soda in the latter: yet Belgium produced some of the finest flax; and the Punjab was capable of producing the same valuable quality of flax, notwithstanding the difference in the soils. He apprehended that the great object of their meeting was to see whether any practical results could be worked out from the specimens of Indian produce now exhibited. There were before them thirty or forty specimens of fibres, all of which could be turned to good account if a sufficient quantity of them could be secured, and a constant supply depended upon. Gentlemen might say, "Here are the fibres, how can we obtain them in sufficient quantity and sufficiently readily?" That was a question for the consideration of the practical man, and required to be practically worked out. How should this be done? In the year 1821 they would find the quantity of cotton sent from India was 8,000,000 lbs., whilst in 1859 it had risen to 192,000,000 lbs. The exports of wool, silk, and flax had gone on increasing in the same ratio. If they asked how this great increase had taken place, he would refer them, as an illustration, to the other articles of indigo and sugar. Sixty years ago no indigo came into this country from India. How was it we had so much now, for India supplied not only England, but the world with indigo? Those results had been produced by European capital and enterprise. A party of adventurers, sons of public servants, and half-castes went out and hired land from the Zemindars, as a farmer in this country hired a farm of a landlord. They advanced the money to the farmers to grow the indigo plant, and from a few pounds of indigo sent to this country from India in the year 1800, they now received millions of pounds of that article annually. The employment of similar means had produced enormous imports of sugar from India, and the same might be done with regard to flax and other fibres. Manufacturers in this country wanted the Rheea fibre, which was one of the most valuable plants in India. It was a small shrub, but would grow all over the country. If they wanted it in any large quantity it was for capitalists to employ agents to go out to Bengal or Assam, in both of which provinces there was land enough to be got for half a crown an acre. There was nothing to prevent a company sending out agents to the farmers in India, and saying, "We will give you half a crown an acre for your land; here is the seed of the Rheea plant, grow it, and we will take the fibre and send it home." There was a practical result. But Mr. Warren had asked how was that to be done at a distance of several thousand miles from home. He could tell them to imitate those who had produced the results he had just mentioned. If they wanted to work this out with advantage, they would do as others had done before, and he recommended them to make such bargains with the tenants as that they might get a living as well as themselves. In conclusion he would express his admiration at the devotion with which Dr. Forbes Watson had followed up this subject for the last two or three years.

Mr. Bourne would offer a word of encouragement to the paper-makers. Now that the repeal of the paper-duty was settled by the passing of the bill, he thought they might inspire each other with confidence for the future. There were three articles which grew in the West Indies well suited for paper-making, which could be imported to his country at ten per cent less than the price of rags. He had seen excellent paper made from materials which grew in the Island of Jamaica.

Col. Sykes added, that for 2,000 years paper had been made in India—never from rags, but always from fibres.

Mr. Sangster remarked that there was one point which had scarcely been touched upon, and which was most essential in the consideration of this subject. It was the question as to the quantity of the material to be produced; and there was likewise the question of cost in this country. He believed he was the first person who introduced the Rheea fibre into England, and during the last ten years he had spent some hundreds of pounds in experimenting upon it. He thought they could not get Indians to cultivate the Rheea, owing to the great trouble which was involved in the preparation of it. He believed the cost of it in this country would be quite £50 per ton. It was a question of labour and cost, and the way to value it was for a dozen gentlemen to put down £1,000 each to cultivate the rheea and see what it cost, and what it was really worth.

Mr. E. W. Trent mentioned that he had been connected with the rope and twine manufacture for the last thirty years, and had carried out extensive contracts, both for the home government and for the East India Company. His establishment was the first to spin the Company's ropes by machinery. With regard to Indian fibres, he believed that a great quantity which had been imported had reached this country in a very damaged state. In some quarters he was aware that prejudice existed against the use of Indian fibres for the manufacture of rope; and the late Mr. Tucker, who was for fifty years inspector of cordage for the government, if he saw a bale of Bombay hemp upon the works would probably have condemned the whole of it, from a prejudice against Indian fibres for such purposes. He believed that by the employment of proper machinery many of these fibres would be made available. Mr. Henley, who had paid a great deal of attention to the cultivation of the Rheea, assured him that it was only a question of machinery to bring this fibre into the market at as low a price as jute. A native workman would prepare 2 cwt. of jute in a day, whilst it took two men ten days to clean 1 cwt. of Rheea. His opinion with regard to the Rheea was that it would ultimately supersede the rest, and he believed the quantity that could be produced was so great that it would even take the place of flax. He was convinced, if the Italian hemp were introduced into India, together with the Rheea, we should be independent of all other parts of the world for those articles. Mr. Trent remarked upon the depressed state of the rope-making trade in Belfast, owing to the want of an adequate supply of the raw material, and then proceeded to refer to the first Colonial Fibre Company, which had not been successful.

Mr. David Chadwick had during this discussion heard no statement made as the views of the cotton interest at Manchester. They were all much indebted to Dr. Forbes Watson for his able paper; but reverting to the question of the cotton supply, and the remarks of Col. Sykes that he did not see why this plant should not be cultivated largely, as land was to be had for half a crown per acre, although he (Mr. Chadwick) was not connected with the Cotton Supply Association, he should be sorry that the meeting should separate without any statement being made as to the prevailing opinion of the manufacturers of Lancashire, why they had not a greater supply of cotton from India, and what they desired to do to promote that object. There was no question, that whether right or wrong, the feeling in Lancashire was that the impediments caused by the regulations of the East India Company had been the reason of the supply of cotton from India not being larger. The supply from the United States had very much increased, and a similar progress ought to have been made in our own territories. Our American friends had effected this, having only fair competition and free trade with all the world to encourage them. He had conversed with the late Dr. Royle upon this subject, and had pointed out that the land-tax and the system of land tenure in India, the

want of roads and water communication, were the main causes of this state of things, and for this the rulers of that country were greatly to blame. Dr. Watson had shown, and they must all concede, that India was capable of producing any quantity of cotton. What was the reason this was not done? Mr. Warren had stated that when a sample of cotton from India was shown to the Lancashire manufacturers they said, "Produce this quality of cotton and we will give you an order for £12,000,000 worth of it." But it was not produced. He did not lay blame upon any particular person for this; but he thought it right to state what was the prevalent opinion in Lancashire upon this subject. They were much indebted to Dr. Watson for this paper, and he hoped this meeting would tend to induce the Indian Council and Secretary of State for India to give greater facilities for the production of cotton in that country.

Mr. TEMPLE (Chief Justice of British Honduras) said when he entered the room he was not aware of the subject which was to occupy their attention, and he regretted that he had not heard the whole of Dr. Watson's very excellent paper. What he had heard, however, had greatly instructed and delighted him. He thought the question which had been before them had special relation to fibres, and not to the particular country whence they were procured. As long as they got the materials for textile purposes, and for the manufacture of paper, it mattered not from what country they came. It appeared to him that they had that evening been looking entirely to India for the supply of these materials, and they had omitted all reference to those colonies where there had been no disturbances, and where there were no impediments to cultivation. In those colonies these fibres could be cultivated as well as sugar and cotton, and other important products. There was no doubt that India was capable of producing all these fibres which Dr. Watson had described; but he undertook to say that our West Indian possessions; Jamaica, British Guiana, and British Honduras, were capable of producing fibres as useful as these. For cotton cultivation there was not a finer country than British Guiana. There were hundreds of square miles of land now lying waste, capable of producing cotton as good as any they imported from America. Then again there was British Honduras, with hundreds of square miles, which would produce as good cotton as that of India or the Southern States of America. Those were our own undisputed possessions, and yet they were neglected. There was one observation which fell from the chairman, from which he differed. He had understood the chairman to express a wish that they might be rendered independent of the United States for their supply of cotton. He should regret to be independent of the United States. Our dependence upon them and their dependence upon us was the greatest surety for amicable relations between the two countries. Let us cultivate cotton in our colonies, to cheapen the price and increase the supply; but let us not seek to place ourselves in a position to be entirely independent of the United States; if we were to become so there would be an end of those amicable relations which at present existed.

Colonel SYKES, with reference to what had fallen from Mr. David Chadwick, begged to put a brief question to that gentleman. The manufacturers of Spitalfields and Coventry depended upon China, France, and Italy, for the raw produce of silk. There was often a great deficiency in that article; they could not get enough of it. Did they attribute to the French or the Italian Governments the cause of the non-production of the quantity of silk they required? Why should not this be done in the one case as in the other?

The CHAIRMAN said a most agreeable duty now devolved upon him in having to ask the meeting to accord their thanks to Dr. Forbes Watson for the very interesting, enlightened, and excellent paper with which he had favoured them. He did not know when he had passed so instructive an evening as he had enjoyed on the present occasion. The industrious world was greatly indebted to Dr. Watson for his labours. He congratulated him upon the result, and he hoped it would be attended with honour to himself and with benefit to the capitalists and labouring classes of the country. The honourable and learned gentleman on his right (Mr. Chief-Justice Temple) had either misunderstood what he said, or he (the Chairman) had imperfectly expressed himself with respect to America. What he had intended to say was that it was not desirable for them to be exclusively dependent on the United States for cotton, and whilst he had no desire to see a less quantity of cotton from the United States, still he thought common prudence told them that they ought to have their supplies of raw material from as many channels as possible, so as to prevent them from suffering from any sudden failure of crops in any one locality.

A vote of thanks having been passed to Dr. Forbes Watson,

COL. SYKES begged to be allowed to express his thanks to the Society that, through the medium of the *Journal*, these elaborate investigations would be carried throughout the country, and would tend to render this meeting so beneficial to our industrial interests.

Dr. WATSON, in acknowledging the compliment paid to him, said that, while bearing testimony to the remarkable liberality of the Society of Arts in promoting these important public objects, he looked upon the illustrations of his paper, which had been prepared by order of the Indian Government, as manifesting their desire to spread broadcast information referring to the products of India. He had been the humble agent of carrying out the wishes of the government in this respect. It was their desire that every product grown in India should be as well known in this country as flax itself. He believed the day was not very far distant when this would be accomplished, and that these products, which were of so much interest, would be placed in different museums throughout the country, with the fullest opportunities for their inspection by those interested in the subject.

On the table and round the room were displayed a large collection of fibres and textile fabrics, the produce of India, and lent by the Indian Government.

The Secretary announced that on Wednesday evening next, the 16th inst., a paper by Mr. E. Rimmel, "On the Art of Perfumery, its History, and Commercial Development," would be read

Home Correspondence.

PAPER MATERIAL.

SIR,—I must again claim your indulgence in replying to the forced objections started by your anonymous correspondent "Inquirer."

Had this individual called on me,—witnessed my process, and received my explanation,—as I invited him, in common with the rest of my audience, he never could have committed such blunders, or be under such a misapprehension regarding my whole system as he now evidently is.

To reply in the order of his objections:—

I have made paper from straw and other similar materials, free from silica, and would have presented specimens on the evening of the 18th ult., but for the limited time allowed me for preparation.

"Inquirer" says, that "arrangements of the most perfect kind have for years been in operation effectually to prevent" the evil of packing. This I deny in toto. It is somewhat singular that he should have forgotten to state when, where, and by whom. Nothing is more easy than for an anonymous correspondent to make wide general

assertions. I am acquainted with all the modes in use—not one of which is, in any way, similar to the means I employ. It was incumbent on your correspondent to give some detailed particulars.

I am now called on to account for not having referred to other patents. I was prompted not to do so, from the absence of the very feeling which instigates "Inquirer." I would not make invidious comparisons, or enhance my process at the expense of others. No one has used superheated steam in the mode I have been doing for the last three months, with the most marked success. It would be a work of supererogation to attempt speculating against facts. The use of superheated steam has heretofore been nullified by allowing it to come in contact with liquid. This I particularly avoid, and herein consists one of the great points of my invention.

As my patents are only in the provisional stage, dated February 29th and March 28th last respectively, it would not have been advisable to have gone into unnecessary details, as these would have been published, thereby vitiating the foreign patents.

I have, moreover, in the letter published in the *Journal* of the 27th ult., answered the objections with regard to superheated steam, which letter "Inquirer" evidently did not see.

The inventive genius of your correspondent must have been sorely taxed when he used the following as an argument against my process. To wit, he says that at present the straw paper-makers cut it into chaff, so that in a space of twelve feet by six, one ton, by great condensation, can be packed.

I have yet to learn that cutting straw, or any other cylindrical substance, into short lengths, will cause it to occupy much less space; it is the hollow portion which occupies the space. Now, as my process enjoins the flattening out of the straw, it follows that, if one ton of cylindrical straw will require the space designated, surely one ton and a half of flat straw can be got into the same space.

The use of the trays facilitates the introduction of a much larger quantity than if they did not exist. For instance, each tray is piled up with straw, so that the next presses it down, and so on until the apparatus is charged. The actual space occupied by each tray is not more than two inches; and as the straw diminishes in bulk nearly two-thirds when under alkaline treatment, this objection, like the others, has no valid existence.

My friend in America is about securing letters patent in England for his process. I will, therefore, not enter into details, but from what I can understand from the confused mode of putting the question by your correspondent, he desires to know how a boiler can sustain 200lbs. pressure to the square inch? The one employed is spherical, 14 feet in diameter, made of best $\frac{5}{8}$ plate, lapped 6 inches, and treble riveted; this contains from 7,500 to 8,000lbs. of straw. It has been in operation for more than eight months.

In my apparatus no pressure is required; it is only by the constant supply of superheated steam that I am enabled to sustain the requisite heat to dissolve the silica, in the space of one hour, from the straw, which has heretofore taken from 12 to 20 hours to accomplish but imperfectly. My materials are not in an alkaline solution or liquid—they are merely saturated. My patents will be published next September and October, when "Inquirer" will discover how egregiously he has been mistaken with regard to my whole mode of treatment.

In conclusion I would state that it is, indeed, most strange, if "Inquirer" is correct in any of his positions, that I should have been applied to by most of the principal makers for terms of license to work my patents.

I am, &c.,
ROBERT H. COLLYER, M.D.

Beta House, 8, Alpha road, N.W., May 8.

The accompanying letter, from my friend Baron Liebig, will be interesting in this connection:—

Munich, October 13th, 1859.

The communication regarding your important discovery of converting the fibre of straw into a pulp, capable of being made into all kinds of paper, has received my attention. It gave me true pleasure, because the substitution of a suitable material for rags in the manufacture of paper, cannot be regarded as otherwise than highly desirable.

I am moreover of opinion, that the simplicity of your process, as well as its cheapness of application, renders your beautiful discovery highly valuable, and I can only wish that it may be duly appreciated, as it deserves to be, and that you may reap rich fruits from your labours and experiments.

With my sincere regards,
I am, dear sir, entirely yours,
JUSTUS v. LIEBIG.

To Dr. Robert H. Collyer, 8, Alpha-road,
St. John's-wood, London.

BREAD-MAKING.

Sir,—The bread-making machine of Dr. Dauglish is undoubtedly a specimen of ingenuity and perfect action, well adapted to produce very good bread; and as it dispenses with the use of brewer's yeast, or other artificial ferment, it is so far a great improvement. Brewer's yeast, when drunk as it flows from the fermenting vat, will destroy life almost as certainly as laudanum or nox vomica. Yeast also contains a large portion of the impurities and adulterations of the beer from which it is produced. Why should we be compelled to swallow such foul and filthy stuff all the days of our life, even in the smallest quantities?

Good flour, made from sound wheat, possesses the fermenting power in itself, and biscuits can be made with care, that will be porous and light, to a small extent, without the introduction of any extraneous matter whatever. But bread is required to be porous and light in an extreme degree, and some assistance becomes necessary to enable the dough to ferment and rise without being liable to run into acidity. The common baker's process with yeast, and the bread-making machine of Dr. Dauglish, both equally effect this desirable object, but both, especially the latter, set at nought the inherent fermenting power of a mixture of flour and water, and are so far unnatural processes for making bread.

The most simple and natural process is to set aside a portion of the dough from a former batch, usually called leaven, a very small quantity of which, when properly managed, will cause a very large mass of fresh dough to ferment and rise to a puffy lightness, fully equal to that produced either by brewer's yeast or the Dauglish machine. It is quite a vulgar error to imagine that leavened bread must necessarily be sour, because a portion of the first made batch of dough will be ready, the instant it is cut off, to raise the sponge of the second batch, and of course can have had no time to run into acidity.

The great advantage of leaven bread over that made with yeast, is the fact that yeast dough is squeezed down flat by the whole strength of the kneader, the instant before it goes into the oven, so that the whole rising takes place within the oven itself, a circumstance that partly causes the very offensive effluvia in bakers' shops. On the contrary leaven bread must rise nearly to its full height before it goes into the oven, and hence arises the bakers' objection to make this kind of bread. English bakers are apparently so pinched for profit that they have adopted the plan, unknown out of England, of slapping one mass of dough upon the other, in order to make the high quartern loaf, for, in order to economise fuel, they must fill their ovens from side to side and from floor to vault, a practice that very much injures the wholesomeness of the loaves so crammed into the oven. On the contrary, a very large space is required between the top of the loaf and the vault to make really wholesome bread; and I will venture to assert that no alcohol could be drawn from a foreign baker's oven.

Another objection to leaven bread is, that it is only adapted to the warmer climates, as a blast of cold air checks

the process of rising, and the result would be heavy bread. Surely the bakers could contrive to have a kneading room of uniform temperature without much trouble; but the mischief is that in London the ovens are all built in the cellars, under the street, from which a most offensive stench arises, from some cause unknown to me, but which is always perceived on passing a baker's shop. If the ovens were placed under the kneading room, there would be no difficulty in obtaining a temperature regulated by a thermometer.

In the discussion which followed the reading of the paper a vast variety of hostile opinions were advanced; as was to be be expected, philosophers and chemists have each their favourite theory to support, and of course are not practical bread-makers. Witness the delusion put upon four or five of them, when some years ago two Frenchmen pretended to be able to make twice as many loaves out of one sack of flour as could be produced by the English bakers. The experiment was made at the Marylebone workhouse. Dr. Letheby's assertion that machine-made bread was non-nutritious and unwholesome is simply absurd; but Mr. Bonthron combines practical knowledge with chemical science, and his observations deserve more serious attention. That gentleman denies the use of alum by the millers, who it is well-known never make their flour from one sort of wheat only. They purchase perhaps a large quantity of first-rate, high-priced wheat, but it would never do to supply the bakers with such prime flour—they would never take inferior qualities. So the millers also purchase large quantities of cheap, inferior corn, often in a damaged state, to grind down with the first named, and thus be enabled to make an average kind of marketable flour, and increase their profits to the damage of the consumer at the same time. It is unfortunately the case that alum in fine powder improves the commercial appearance of flour as well as baker's bread, an adulteration that meets with no objection from the bakers, because alum powder increases the water-holding power of flour so adulterated, and enables them to make into fair-looking bread such damaged stuff as would run into mud instead of rising, without the addition of alum.

The ostensible object of introducing alum into the mills, is for the purpose of filling up the large vacancies always occurring in the millstones, with a cement composed of a strong solution of alum and stone dust, resulting from the dressing of the stones, the whole of which is gradually ground down into the flour of which our bread is made. In a former communication, inserted in the first volume of the *Journal*, at page 589, I have already accounted for the enormous quantity of inferior and damaged corn sold by the farmers to the millers, who eagerly buy it up for the purpose of lowering flour from fine wheat to the proper standard for the bakers.

Mr. Bonthron asserts that all persons may avoid the sue of alum bread by dealing only with the high-priced bakers, but that gentleman must be well aware that it is only the rich that can deal with the high-priced bakers, to whom the article of bread is a very minor object, while, on the contrary, to the poor it is the most important portion of their diet. Why should they be most cruelly compelled to eat alumed bread?

Perhaps Mr. Bonthron purchases pure white salt, as he admits that adulteration; but bakers generally buy what is called baker's mixture,—a combination of salt, alum, and a variety of other chemicals, often including the ferment, of the composition of which the baker is wholly ignorant, and can, therefore, safely assert that he does not purchase alum, and keeps none upon his premises.

The taste for salt in bread has been superinduced upon the public by the bakers; first, because it has a tendency to disguise the flavour of bad materials; and secondly, because it adds to the weight, and is much cheaper than flour. To those accustomed to eat pure bread the addition of salt is very distasteful; and I am only surprised that the tea-dealers, upon the same principle, have not introduced the taste for salt in their teas.

It appears that Mr. Bonthron admits the admixture of potatoes in his high-priced bread, which, unless sold openly as potato-bread, is a fraud upon his customers, as that vegetable contains less than 25 per cent. of nutritive matter; and that gentleman also lays much stress upon what is called water-holding power, showing that he values the power to absorb water in the flour he purchases.

Mr. Bonthron is quite justified in stating the bread made by the machine of Dr. Dauglish is tasteless, especially when compared with that made with baker's yeast, which, besides a confusion of ill-flavours, is sometimes so bitter as to be almost uneatable. Machine-made bread, according to Dr. Dauglish, being a simple mechanical mixture of flour, carbonic acid, and water, with salt for flavour, without fermentation, is not bread, but an artificial substance that resembles it.—I am, &c.,

HENRY W. REVELEY.

Poole, May 1st.

MR. WM. NEWTON'S PAPER ON PEAT.

SIR,—I have to acknowledge the receipt of your letter of the 4th inst., and regret to find that the communication respecting what appears to be my *lapsus linguæ*, as to the calorific power of properly prepared peat fuel, did not reach you in time to have the corrections made in the report of the proceedings.

It is universally admitted that "an Irishman is allowed to speak twice." I therefore claim my country's privilege, and, in justice to the subject and myself, I request the insertion of this letter in your next *Journal*. What I intended to say was, that the peat fuel alluded to would produce, from the same boiler, "one-third more steam" than the best coal coke, not "three times as much," which would be monstrous.

I now repeat that such fuel can be made to produce one-third more steam. I must not, however, be understood to speak of English peat; all of that which I have seen is of much inferior quality, and intermixed with silica and other substances of clayey natures.

Permit me now to prognosticate that the time will come when the peat fields of Ireland will be deemed more valuable than the coal fields of England for the production of fuel for metallurgical purposes, independently of the many other uses for that little-understood vegetable matter. I am, &c.,

JASPER W. ROGERS.

Robertstown, Co. Kildare.

MEETINGS FOR THE ENSUING WEEK.

MON. .....London Inst., 7. Rev. Henry Christmas, "On Eminen Personages of English History living between the year 1640 and 1660."
Geographical, 8½. 1. Mr. Alderman Hopkins, "On a Poss ble Passage to the North Pole." 2. Col. Schaffner, U.S., "Proposed Telegraphic Communication with America, *via* the Faroes, Iceland, and Greenland."
Medical, 8½. Mr. H. Haynes Walton, "On the Ophthalmo cope and its Application, with Practical Illustrations."

TUES. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbivorous Mammalia—Cameline Ruminants."
Civil Engineers, 8. Discussion on "Indian Railways," and, if time permits, Mr. M. Scott, "On Breakwaters, Part II."
Statistical, 8. Mr. Fred. Purdy, "On the Statistics of the Poor Rate, before and since the Poor Law Amendment Act."
Pathological, 8.
Zoological, 9.

WED. .....Pharmaceutical, 11 a.m. Anniversary.
Literary Fund, 3.
London Inst., 7. Dr. Spencer Cobbold, "On the Structure and Habits of the Mammalia."
Society of Arts, 8. Mr. E. Rimmel, "On the Art of Perfumery; its History and Commercial Development."

Geological (Burlington House), 8. 1. Mr. G. P. Walls, "An Outline of the Geology of Venezuela and Trinidad." 2. Mr. M. E. Lartet, "On the Co-existence of Man with certain Extinct Quadrupeds, proved by Fossil Bones from various Pleistocene deposits bearing incisions made by sharp instruments."
Ethnological, 8½.
Archæological Assoc., 8½.
THURS. ...Royal Inst., 3. Professor Ansted, "On Physical Geography and Geology—The Origin of Volcanoes."
Antiquaries, 8.
Chemical, 8. Mr. Wanklyn, "On Zinc-methyl." Dr. Guthrie, "On some Compounds of the Olefines."
FRI.....United Service Inst., 3. Hon. John Wethered, "Superheated Steam."
London Inst., 7. Prof. Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Royal Inst., 8. Prof. W. Thomson, "On Atmospheric Electricity."
SAT.....Asiatic, 2. Anniversary.
Royal Inst., 3. Mr. F. A. Abel, "On Heat and Chemical Force."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 4th*, 1860.]

Dated 20th January, 1860.

146. J. Shaw, Manchester—Imp. in the construction of ventilators for hothouses, conservatories, and other such buildings.

Dated 10th March, 1860.

658. J. C. Haddan, 14, Bessborough-gardens, Pimlico—Imp. in the manufacture of projectiles and of cannon for discharging the same.

Dated 26th March, 1860.

775. C. Martin, Isleworth, Middlesex, and W. Pidding, Borough-road, Southwark—Imp. in the manufacture of paper, applicable also to the manufacture of hats, bonnets, caps, and various articles of ladies' and gentlemen's wearing apparel, furniture, boxes, ornaments, bottles, casks, and various articles of utility, vehicles, houses, sailing and steam vessels, and boats, in the mixture of liquids, fibrous and other substances or materials for such purposes, and in the machinery connected therewith.

Dated 29th March, 1860.

815. N. Smith and R. Smith, Thrapston, Northampton—Imp. in the construction of haymaking machines.

Dated 3rd April, 1860.

851. P. Woodruff, Machen, Monmouthshire—An imp. in the manufacture of iron from the puddling furnace for the purpose of rolling same into sheets intended to be coated with tin, lead, or any other metal, applicable also to the manufacture of all other sorts of sheet or bar iron, where toughness, strength, and ductility are essential.

Dated 5th April, 1860.

866. E. T. Delafield, Brussels, Belgium—Improved apparatus and processes for decomposing neutral fatty bodies or matters into fatty acids and glycerine, and for the distillation thereof. (A com.)

Dated 9th April, 1860.

884. C. Sprye, 120, New Bond-street—An improved disengaging hook.

Dated 12th April, 1860.

917. J. Bushell, W. Bushell, S. Bushell, J. Bushell, and D. Bushell, Great Snoring, near Fakenham, Norfolk—An improved agricultural machine.

Dated 16th April, 1860.

950. W. H. Muntz, Millbrook, Hants—Imp. in the construction of floating piers.
952. W. Smith, Kennington-row, Kennington-park, Surrey—Imp. in paving or covering roads and other ways.
954. D. G. FitzGerald, Cambridge-street, Middlesex, and G. Rate, Great George-street, Westminster—An improved method of igniting the charge in ordnance and other fire-arms.
956. A. Accarain, Limbourg, Belgium—Imp. in treating ores of zinc, and in the apparatus employed therein.
958. T. Turner, Fisher-street, Birmingham—Certain imp. in rifling, applicable to either breech or muzzle loading fire-arms or ordnance.

Dated 17th April, 1860.

960. C. Vaughan, W. J. Vaughan, and R. Vaughan, Birmingham—Imp. in the manufacture of hoes.
964. H. Adcock, City-road, Middlesex—Imp. in puddling, balling, and mill furnaces.
966. S. Cheetham, Manchester—Certain imp. in cop tubes.
968. C. De Jongh, Lautenbach, near Guebwiller, France—An improved mode of mounting the needles, points, and guides, used in knitting and lace machinery.

Dated 19th April, 1860.

981. S. Wheatley and A. Milnes, Manchester—An improved grinding strickle, for grinding the cards on the cylinders of carding engines.
983. T. F. Edgeworth, 147, Park-road, Toxteth-park, Liverpool—Imp. in apparatus for heating fluids.
985. J. Dale and H. Caro, Manchester—Imp. in dyeing cotton yarns or threads and fabrics. (A com.)

Dated 20th April, 1860.

987. W. H. Kingston, A.B., Trinity College, Dublin—A coke furnace for the distillation of coals. (A com.)
989. J. Dyer, jun., Islington—A new or improved process for the ornamentation of certain articles of bed-room furniture.
991. T. G. Dawes, Wolverhampton—Imp. in working hammers by compressed air.
993. T. Boyle, 4, Woburn-buildings, Euston-square—Producing multiplied and many-coloured reflections of light from one focus of incidence.
995. W. Lukyn, senr., Broad-street, Nottingham—A method of attaching artificial or natural teeth on expanded or contracted frames.
997. J. Walker, Walsall, Staffordshire—Imp. in railway sleepers.

Dated 21st April 1860.

999. A. Hedley, Banbury, and G. H. C. Hedley, St. Neot's, Huntingdonshire—Imp. in valves and apparatus for regulating the flow of fluids.
1001. W. Macnab, Greenock—Imp. in and connected with marine and other steam engines.
1005. W. Buckwell, Phœnix Stone Works, East Greenwich, Kent—An improved mode of operating, recording, or printing telegraphic apparatus.
1007. J. Harvey, Circus-street, Marylebone-road—Imp. in safety valves.

Dated 23rd April, 1860.

1009. F. Datichy, Paris—Imp. in apparatus for utilising the waste steam of steam engines.
1011. J. Dangerfield, Tipton, Staffordshire—Imp. in apparatus or machinery for the manufacture of chains.
1013. R. A. Brooman, 166, Fleet-street—Imp. in buoys. (A com.)

PATENTS SEALED.

[*From Gazette, May 4th*, 1860.]

May 4th.
2296. H. Monument & G. Berry.
2528. A. L. Dowie.
2530. G. Pacey.
2531. H. Charlton.
2547. G. White.
2578. J. Walworth and R. Harrowby.
2608. T. Robinson.
2618. J. Knight.
2790. J. Macintosh.
2821. W. Clay.
2902. A. V. Newton.
258. T. Hill.
278. J. Gedge.
420. E. Caplen.
528. W. Birks, sen., and W. Birks, jun.

[*From Gazette, May 8th*, 1860.]

May 8th.
2553. E. T. Hughes.
2554. J. Edwards and J. S. Wright.
2555. R. A. Brooman.
2556. J. Tenwick.
2557. A. J. Melhuish.
2564. R. A. Brooman.
2566. A. Jacquelain.
2567. R. Lansdale.
2627. G. Laidlaw.
2628. H. Naylor & W. Crossley.
2645. C. G. Hill.
2646. R. Mushet.
2668. T. Carr.
2746. C. L. Smith.
2778. W. Spence.
2893. M. Jones.
2911. A. V. Newton.
190. F. G. Grice.
392. W. Gossage.
574. J. McCulloch.
589. W. G. Ramsden.
669. M. Miller and J. Kemp.
689. J. Shields and A. Shields.
719. J. H. Heal.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, May 4th*, 1860.]

April 30th.
1233. R. Leake and M. Sykes
May 1st.
1246. W. E. Wiley
1256. J. Leslie
1303. C. E. Darby
1404. E. A. Cowper
May 2nd.
1421. J. Davy and W. Bentley.

[*From Gazette May 8th*, 1860.]

May 3rd.
1255. W. E. Wiley.
1258. J. T. Way.
1541. J. A. Salmon.
May 4th.
1279. A. Kinder.
1944. F. J. Evans.
May 5th.
1275. G. K. Geyelin.
1277. W. Hood.
1345. S. Yeldham.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, May 4th*, 1860.]

May 1st.
1057. H. C. Jennings.
1075. R. Quin.
1094. J. S. Russell.
May 2nd.
1131. C. W. Finzel.

[*From Gazette, May 8th*, 1860.]

May 3rd.
1121. C. Nickels.
May 4th.
1944. F. J. Evans.

Journal of the Society of Arts.

FRIDAY, MAY 18, 1860.

INTERNATIONAL EXHIBITION of 1862.

The Secretary reported to the Council that the amount of the Guarantee Fund promised up to the 16th May, was £239,950.

CONVERSAZIONE.

The Second Conversazione of this Session will take place on Saturday evening, the 26th May, at the South Kensington Museum. The doors will be opened at 8 o'clock.

The band of the Coldstream Guards will be in attendance.

NINTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS.

The Ninth Annual Conference between the Representatives of the Institutions in Union and the Council will be held on Friday, the 22nd June, at 10 o'clock in the morning. Sir Thomas Phillips, Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference, stating at the same time (if possible) whether those gentlemen will also be present at the Society's Annual Dinner, which will take place on the same day, and of which particulars are given below.

The Chairmen of, or Representatives from, the several Local Boards of Examiners are invited to attend.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Friday, the 22nd June, at six o'clock punctually. The Right Honourable Benjamin Disraeli, M.P., will preside.

Members and their friends are invited to be present, and tickets (price 10s. 6d. each) may be obtained at the Society's House on and after Wednesday next, the 23rd May.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William C. Ross, R.A., is now open at the Society's House, and will remain open during the month of May only.

The public are admitted on payment of one shilling each person.

Members of the Society of Arts have free admission, and may *personally* introduce one friend.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th April, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 16, 1860.

The Twenty-third Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 16th instant, R. Temple, Esq., Chief Justice of British Honduras, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Brown, John William	Ross, Thomas
Hawes, Thomas Edward	Thomson, Rev. Wm., D.D.

The Paper read was—

ON THE ART OF PERFUMERY, ITS HISTORY, AND COMMERCIAL DEVELOPMENT.

By Eugene Rimmel.

The subject I am about to treat this evening is one which may not appear of great importance at first sight, yet I am in hopes of showing you that it is sufficiently interesting as an art, and extensive enough as a trade, to deserve a small share of your attention.

Perfumery* may be defined as the art of collecting and presenting in a convenient and fixed form, for the gratification of the sense of smell, the numerous volatile and evanescent fragrant principles diffused throughout nature. Perfumes are invisible and imponderable emanations from all odoriferous bodies carried through the atmospheric air, and rendered perceptible to our senses by means of our olfactory organs. They can become fixed in other bodies with which they come in contact, and on the degree of affinity which exists between them may be said to rest the principles of the art of perfumery. Animal substances are found to absorb odours more readily than any others; vegetable substances possess that property to a less extent, whilst metallic bodies entirely repel them. The odoriferous particles are of such tenuity that no perceptible difference in weight can be observed in bodies which emit them unceasingly. A single pod of musk was found to have discharged in one day 57 million particles in a radius of 30 yards, without having become in any way diminished. Other very abstruse calculations have been made to determine the exact size of an odoriferous particle, but the results obtained by the various learned men who have made these experiments so

* From two Latin words, *per fumus*, smoke through, because perfumes were first used in the shape of fumigators.

totally differ from each other, that it is permitted to doubt their accuracy.

Pleasant perfumes exercise a cheering and exhilarating influence on the system, and revive the nerves when fatigued or depressed. "Ointment and perfume rejoice the heart," say the Scriptures,* and, in fact, owing to the close connection which exists between the olfactory organs and the brain, perfumes produce an agreeable and beneficial effect on the mind, and procure the most pleasurable sensations. They especially refresh memory, and a spot that we have visited, or some circumstance in our life, will be often recalled to us by some particular odour. Even when sleep has bereft us of most of our faculties, perfumes preserve their action on our confused ideas, and are capable of influencing our dreams.†

Criton, Hippocrates, and other ancient doctors, classed perfumes among medicines, and prescribed them for many diseases, especially those of a nervous kind. Pliny also attributes therapeutic properties to various aromatic substances, and some perfumes are still used in modern medicine. A certain class, however, of our medical men entirely prohibit the use of scents, pretending that they are injurious to health. In this, I think they are mistaken. It is true that flowers, if left in a sleeping apartment all night, will sometimes cause head-ache and sickness, but this proceeds not from the diffusion of their aroma, but from the carbonic acid they evolve during the night. If a perfume extracted from those flowers were left open in the same circumstances, no evil effect would arise from it. All that can be said is that some delicate people may be affected by certain odours, but the same person to whom a musky scent would give a head-ache, might derive much relief from a perfume with a citrine basis. Imagination has, besides, a great deal to do with the supposed noxious effects of perfumes, and Dr. Capellini relates the story of a lady, who fancied she could not bear the smell of a rose, and who once fainted at the sight of one of those flowers, which turned out after all to be artificial.‡ Numerous examples might be adduced, on the contrary, tending to show that perfumes are beneficial and prophylactic in the highest degree. After the Dutch had destroyed, by speculation, the clove trees in the Island of Ternate, that colony was visited by a series of epidemics, which had been kept off until then by the fragrant smell of the cloves; and in more modern times, when London and Paris were ravaged by cholera, there was not, to my knowledge, a single victim among the numerous persons employed in the perfumery factories of either city. In fine, we are prompted by a natural instinct to seek and enjoy pleasant odours, and to avoid and reject unpleasant ones; and it is unreasonable and unjust to suppose that Providence has endowed us with this discerning power to mislead us into a pleasure fraught with danger.

Odours have been classified in various ways by scientific men. Linnæus divided them into seven classes, three of which only were pleasant odours, viz.,: the aromatic, the fragrant, and the ambrosial; but however good his general divisions may have been, the above were far from correct, for he classed carnation with laurel leaves, and saffron with jasmine, than which nothing can be more dissimilar. Fourcroy divided them into five series, and De Haller into three. All these were, however, more theoretical than practical, and none classified odours by their resemblance to each other. I have attempted to make a classification comprising only the various odours used in perfumery, by adopting the principle that as there are primary colours from which all secondary shades are composed, there are also primary odours with perfect types, and that all other aromas are connected more or less with them, and can be obtained by the combinations of those primary odours. You will find in the Appendix a table of that classification, which I have divided into 18 series, with the perfect type of each and the perfumes belonging to it. They are as follows:—The rose, jasmine, orange-flower, tuberose, violet, balsamic, spice, clove, camphor, sandal, citrine, lavender, mint, aniseed, almond, musk, amber, and fruit flavour. This is the smallest number of types I could reduce it to, and even then there are some particular odours, such as that of winter-green, which it would be difficult to introduce into either class; nor does this list comprise the scents which are produced by the combination of several classes together.

I shall now give you a short sketch of the history of perfumery. From the earliest ages perfumes have been in use among civilised nations, both for sacred and private purposes. Some writers state that perfumes originally came from Elam, or ancient Persia, but it is more natural to suppose that they were discovered and used in the various countries which produced them, such as spices in India, balm in Judæa, frankincense in Arabia, &c., and thence carried to other places in the course of trade. The first mention we find of them in the Scriptures is when Joseph was sold by his brothers to some Ishmaelites who came from Gilead with their camels, bearing spicery, and balm, and myrrh, and carrying it down to Egypt.* This would confirm my preceding supposition. In the book of Exodus full directions are given to Moses how to make the holy anointing oil and the incense of sweet spices.† The anointing oil was a mixture of myrrh, cinnamon, calamus or sweet rush, cassia, and olive oil; and the incense consisted of stacte, onycha, galbanum, and frankincense. The former was used to anoint the tabernacle, the holy vessels, and the altar of burnt offerings. It was also poured on the head of the high priest, in sufficient profusion to run down his beard and the skirts of his garments,‡ and was intended as a symbol of everlasting priesthood among Aaron and his generation.§ The incense was burned in a censer, and also on the altar. Those two preparations were to be strictly confined to sacred purposes, and persons employing the same for private uses were cut off from the people. It was also strictly forbidden to any but the descendants of Aaron to offer incense before the Lord, and Korah, Dathan, and Abiran, with 250 others, were burnt for having violated that law.‖ Uzziah, the king, was likewise reprimanded by Azariah, the priest, for attempting to burn incense in the temple, and having persisted in his design was struck with leprosy on the spot.¶

Perfumes were largely used by the Jews for private purposes, and were esteemed as of great value. When Hezekiah received the envoys of the King of Babylon he showed them all his treasures, the gold and the silver, and the spices, and the precious ointment; ** and sweet spices also formed part of the costly presents brought to Solomon by the Queen of Sheba.†† The principal ingredients employed at that time are thus summed up in the Canticles:—"Spikenard and saffron, calamus and cinnamon, with the trees of frankincense, myrrh and aloes, with all the chief spices." ‡‡ They were principally made up in the shape of ointments, which were lavishly used by the rich, not only in their toilet, but also as a mark of distinction bestowed on their guests. Thus we find Mary Magdalene, when Jesus was sitting at table in the house of Simon the leper, pouring a costly ointment of spikenard on his head and on his feet.§§ They also used perfumes in a dry form, to impart a sweet odour to their garments, ‖‖ and their beds, ¶¶ and for the purifications of the women as ordained by law.*** Aromatics were likewise burned during their entertainments,††† and used for preserving the bodies of the dead. The body of Jesus was embalmed with a mixture of myrrh and aloes, brought by Nicodemus.‡‡‡ Cosmetics were besides in use among the women, and we are told that Jezebel painted her face when she was expecting Jehu.§§§

* Prov. xxvii.
† Dr. Cloquet's Traité d'Osphrésiologie.
‡ T. Capellini, Memoire sur l'influence des odeurs.

* Gen. xxxvii. † Exodus. xxx. ‡ Ps. cxxxiii. § Exodus, xl. ‖ Numb. xvi. ¶ 2 Chron. xxvi. ** Is. xxxix. †† 2 Chron. ix. ‡‡ Cant. IV. §§ St. Mark, xiv. ‖‖ Ps. xlv. ¶¶ Prov. vii. *** Est. ii. ††† Cant. I. ‡‡‡ St. John, xix. §§§ 2 Kings. ix.

It is, however, the opinion of most commentators, that it was not her face, but her eyes, which she painted, in the Egyptian fashion. Ezekel explains that mode of painting more clearly, and says, "Thou didst wash thyself, paintedst thine eyes, and deckedst thyself with ornaments.* Soap does not appear to have been known by the Jews. It is true that the word soap occurs once in the Bible, but in this instance the Hebrew word "borith," according to Beckmann's opinion, ought to have been translated lees or alkali, and is supposed to mean a natural alkaline production of Judea, somewhat similar to the Egyptian natron or nitrum. In the Talmud (Book Cheritoth) we find in the description of the composition of the holy incense, the words "borith Carshina," which are usually translated "soap of Carshina," but soap would form a very bad ingredient for incense, and it is more likely to mean a sort of natural alkali or saltpetre, found at Carshina, which would serve to promote combustion.

In Egypt, perfumes were likewise applied to three distinct purposes; offerings to the gods, uses in private life, and embalming the dead. Besides the information we gather respecting them from the Greek and Roman authors, the numerous allusions to this subject in their sculptures and paintings, and the relics found in their tombs, prove to us that perfumes were in general use among the Egyptians. Incense was offered to all the gods, and introduced on every grand occasion when a complete oblation was made. It was usually accompanied with a libation of wine, but was sometimes presented alone. The ingredients differed according to circumstances. Plutarch tells us that for offerings to the sun they consisted of myrrh, resin, and a mixture of 16 ingredients called *kuphi*. The High Priest usually presented the incense, but in grand ceremonies the king himself held the censer in one hand, and with the other threw balls or pastilles of incense into the flames. The censer was a sort of cup fixed at the end of a stick, and not attached to a chain like the modern ones. Sometimes also they introduced the fragrant substances into the body of an ox, or other victim after it was slain, and burned it on the fire, pouring over it a quantity of oil. The aromatics in that case had the effect of counteracting the unpleasant smell of burning flesh.

The perfumery they used for private purposes consisted principally of ointments, of which there was a great variety. Some were composed of grease, and some of oil. Among the latter the *Moringa pterygosperma*, called by the Arabs *ben* and the *ricinus communis*, or castorberry oil, were chiefly used as bases, and flavoured with origanum, bitter almonds, spices, and other odoriferous substances. The castor-oil, from its abundance and cheapness, was chiefly used by the poorer classes, who anointed their whole body with it, a custom still prevalent in some parts of India. At all the feasts of rich people it was the fashion to anoint the heads of the guests when they arrived, and it was the first duty of the servants to pour some sweet-scented oil on their hair, or rather on their wigs, for they were all shaved, and wore that artificial head covering.† Ointments were also used as offerings to the gods, and one of their most curious applications was to anoint the statue of a god, which was done on particular occasions. The bottles in which they kept their ointments, of which a great many specimens have been found in the tombs, were usually made of alabaster, onyx, or other stone, glass, ivory, bones, or shells. One of those, preserved in Alnwick Castle, contains an ointment which has retained its scent to this day, after having been made perhaps 3,000 or 4,000 years. A celebrated preparation for the toilet was the Kohl or Kheul, a black powder, used by the ladies for darkening the inside of the eyelids. It was supposed to increase the beauty and brilliancy of the eye, and to make it appear larger; they even thought it beneficial to the sight. It was made, according to some, from antimony, and according to others, from burnt almonds. The vases used for the Kohl were generally of a fantastical form, and the bodkins for applying it were made of stone, wood, or pottery, specimens of which are to be found in the British Museum. This preparation, strange to say, is still in great use among Eastern nations, and even in some parts of Europe. I have a receipt of that used by the modern Arabs, which will be mentioned in its proper place.

*Ez. xxiii. †Sir Gardner Wilkinson's "Ancient Egyptians."

The process of embalming caused also a great consumption of aromatics, and is thus described by Herodotus:—After extracting the brain from the nostrils, and filling the head with drugs, they cut a hole through the side of the body, removed the intestines, washed the cavity with palm wine, and filled it with powder of pure myrrh, cassia, and other fragrant substances, frankincense excepted, after which the body was sewn up. This was the first-class or most expensive mode of embalming. For the second class, they injected oil of cedar into the abdomen, and kept the body in salt for several days. The third kind, which was only adopted for the poor, consisted simply in cleansing the body with an injection of syrmœa and salt. Diodorus gives a somewhat similar account, stating that they use myrrh and other drugs, which have the power, not only of preserving the body for a length of time, but also of imparting to it a fragrant odour.

The ingredients used by the Egyptians for their perfumery were about the same as those employed by the Jews. A few of them, such as bitter almonds, origanum, &c., were indigenous to the soil of Egypt, but they also imported a great quantity of foreign aromatics, principally from Arabia and India. In the time of the Ptolemies frankincense trees were first planted in Egypt, and Cleopatra introduced likewise the balm trees from Judæa.

The Persians, the Assyrians, the Phœnicians, and other great ancient nations, were greatly addicted to the use of perfumes. Five times a-day the priests of Zoroaster burnt fragrant woods and spices on his altar, and the sculptures of Nineveh bear witness to the use of perfumes by the Assyrians in their sacred rites. There is no doubt that they were also largely used for private purposes by those nations, for among the treasures left by Darius in his tent were several chests of perfumes. In those times Tyre and Babylon were the two great marts for perfumes, the former for the shipping trade, the latter for internal consumption.*

The Greeks, being a most refined nation, were naturally great admirers of perfumes. Not only did they offer them in their religious ceremonies as a homage due to their gods, but they also looked upon them as a sign of their presence. Homer, Euripides, and other poets never mention an apparition of their deities without adding that they shed an ambrosial fragrance around them. Besides the sacred uses, perfumes were lavishly employed in private life, and their consumption increased at one time to such an extent, that Solon thought it necessary to forbid the Athenian people from using them. We may suppose, however, that this law was not long observed, for in the time of the Roman Empire, the Athenians were still celebrated for their talent in making up perfumery. Their principal perfumes were unguents, and the most famous was the *panathenaicon*, of which Athenæus gives us the recipe. They also used various aromatics for burning at their festivals or private entertainments, and dry perfumes for scenting their clothes,† a custom which is still prevalent among the modern Greeks. Odoriferous herbs and spices were likewise burned with the bodies of the dead, and perfumes poured on their ashes. Another purpose to which perfumes were applied by them was to flavour wines, which was supposed to render them beneficial, as well as more agreeable. Pamphilius, Columella, and others give us the receipts for obtaining those perfumed wines, which were generally made with spices and aromatics from India or Arabia. The most esteemed, however, were prepared by infusing flowers in them, which gave them a very delicate flavour. Athenæus mentions one of those wines called *sapria*, which was made by infusing in it roses, violets, and hyacinths. Although applied

* Ez. xxvii. † Iliad, 21.

to a different purpose, this may be looked upon as the first tep to alcoholic perfumes.

The Romans carried the art of perfumery to great perfection, and their productions were as numerous, if not as excellent, as those of modern perfumers. Pliny, Dioscorides, Galen, and other authors, give us the fullest particulars on this subject. In the early times of the Roman monarchy, the use of perfumes seems to have been confined to sacred purposes and funeral rites, but during the Consulate, and still more so under the Roman Empire, the gradual increase of luxury gave a great impulse to the perfumery trade. In the year of Rome 565, during the censorship of P. Licinius Crassus, and Julius Cæsar, an edict was issued to prohibit the sale of exotic perfumes. They were already used at that time in such profusion, that Lucius Plautius, after being proscribed by the Triumvirs, was betrayed, in his place of concealment at Salernum, by the smell of his unguents. At a later period Nero consumed, at the funeral of Poppœa, more aromatics than could be produced by Arabia in a twelvemonth; and in a feast given to him by Otho, gold and silver pipes shed costly perfumes around the hall during all the time of the entertainment.

There were three kinds of perfumes principally used—the *hedysmata*, or solid unguents, the *stymmata*, or liquid unguents, having an oily basis, and the *diapasmata*, or powdered perfumes. The unguents formed a numerous class, and their names were borrowed, some from the ingredients which entered into their composition, some from the original place of their production, and others, again, from the peculiar circumstances under which they were first made. Like our present preparations they succeeded each other in public favour, and novelty was as great an attraction to the Roman belles as it is to our modern ladies. There were the simple unguents, flavoured with one aroma, such as the *rhodium*, made from roses, the *crocinum*, from saffron, a favourite perfume of the Romans, the *melinum*, from quince blossoms, the *metopium*, from bitter almonds, the *narcissinum*, from narcissus flowers, the *malabathrum*, prepared from a tree called so by Pliny, and supposed by some to be the *Laurus cassia*, and many others too numerous to mention. The compound unguents were prepared by combining several ingredients. The most celebrated were the *susinum*, a fluid unguent, made of lilies, oil of ben, calamus, honey, cinnamon, saffron, and myrrh, the *nardinum*, made of oil of ben, sweet rush, costus, spikenard, amomum, myrrh, and balm, and, above all, Pliny praises the regal unguent, which was originally prepared for the King of the Parthians, and which consisted of no less than 27 ingredients.* Some of those preparations were very costly, and sold for as much as 400 denarii per pound, or about £15. The Romans not only applied them to the hair, but to the whole of the body, even to the soles of the feet. The most refined, indeed, adopted a different perfume for each part of the person. Besides this their baths, their clothes, their beds, the walls of their houses, and even their military flags, were impregnated with sweet odours. Some carried that taste so far as to rub their horses and dogs with perfumes. In addition to the unguents I have named, the Roman ladies made use of numerous cosmetics to increase their beauty, and they attached so much importance to that branch of their toilet, that they had some slaves, called *cosmetæ*, whose special duty was to apply those preparations. Some of those cosmetics consisted of pea-flour, barley-meal, eggs, wine-lees, hartshorn, bulbs of narcissus, and honey; others simply of corn flour, or crumb of bread soaked in milk. They made with those pastes a sort of poultice, which they kept on the face all night and part of the day. Some, indeed, only removed them for the purpose of going out, and Juvenal tells us, in one of his satires, that the Roman husbands of his time seldom saw their wives' faces at home. Asses' milk was also much esteemed for the complexion, and Poppœa, who used to bathe in it every day, obtained permission, when she was exiled from Rome, to take with her 50 asses, to be able to continue her favourite ablutions. Besides these, they used bean flour to remove wrinkles, *psilotrum*, a sort of depilatory, white lead or chalk for the face, vermillion for the cheeks, Egyptian kohl for the eyes, barley-flower, kneaded with fresh butter, to cure pimples, calcined pumice-stone to whiten the teeth, and various sorts of hair dyes. Of the latter some were intended to turn the hair black, and the most curious preparation consisted of a liquor prepared from leeches which had been left to putrefy during 60 days in an earthern vessel with wine and vinegar. As, however, blondes were very scarce among the Roman ladies; the most fashionable dye was one which turned their naturally dark hair into a sandy or fair colour. This was principally accomplished by means of a soap from Gaul or Germany, called sapo (from the old German *sepe*), and composed of goat's fat and ashes. It is rather remarkable that this was the first introduction of soap we find mentioned, and that it was then solely applied to the purpose of dyeing the hair. It has not been clearly ascertained at what precise period the detergent properties of soap were discovered and made use of; but it is evident that in Pliny's time they only used struthion (*gypsophila struthion*) and saponaria (*saponaria officinalis*), besides the Egyptian nitrum for washing. In this instance, therefore, a most useful discovery was due to a very frivolous cause.

The perfumers of Rome (called *unguentarii*) were very numerous, and occupied a quarter of the town named *vicus thuraricus*, in the *Velabrum*. They were principally Greeks, and their shops were the common resort and meeting-place of the fashionable loungers. It would far exceed the limits of this paper to give a complete history of Roman perfumery, but those who may feel some interest in the subject will find in "Pliny's Natural History" the list and description of the ingredients used for this purpose which were imported from all parts of the known world.

At the fall of the Roman empire, when a horde of barbarians drove away civilisation and luxury from the imperial city, perfumery took refuge for a time in the new eastern metropolis. The Greek emperors and their court made a lavish use of perfumes, and at all public festivals fountains of fragrant waters perfumed and refreshed the air. The Oriental church consumed also at that time such a quantity of aromatics for religious ceremonies that they purchased in Syria a piece of ground ten square miles in extent, planted with incense trees for their own special use.

The Arabs, originating as they did from a country producing perfumes, were naturally very fond of them, and have preserved that taste to the present day. They introduced perfumery into Spain, and at the brilliant fêtes given by their caliphs at Granada, Cordova, or Seville the atmosphere was always impregnated with the sweetest odours. I have in my possession (owing to the kindness of M. Chapelié, of Tunis) the recipes of the principal perfumes and cosmetics which are in use among the modern Arabs, and of which you will find specimens on this table. I look upon them as very interesting in this point of view, that they are undoubtedly the same preparations that were used centuries ago, their composition and appearance being of the most primitive description. Indeed, I am inclined to think that some of them were borrowed by the Arabs from the Egyptians. This is evidently the case with the celebrated Kohl or Kheul, which I have mentioned before. I shall not take up your time with the details of all those recipes, but will merely give you that of the Kohl, which is very curious. They prepare it as follows:—They remove the inside of a lemon, fill it up with plumbago and burnt copper, and place it on the fire until the whole becomes carbonised; then they pound it in a mortar with coral, sandalwood, pearls, ambergris, the wing of a bat, and part of the body of a chameleon, the whole having been previously carbonised and moistened with rosewater whilst hot. They apply it inside the eye-

* Pliny's Nat. Hist., Book XIII., chap. 2.

lids with a small ebony stick, and believe, as did the Egyptians, that it strengthens the eyes and cures inflammation. You will remark, besides, among the specimens the henné or henna, made with the powdered leaves of the *Lawsonia inermis*, which is used throughout the east by the women for dyeing of a red colour their hands and nails, their feet, and even their hair; also a turpentine paste used as a depilatory, and a white composition called schnouda, which they apply instead of rouge for raising a natural bloom on the cheek.

Among modern nations, France and Italy were the first to resume the use of perfumes. In the Catholic churches they not only burnt incense as they do now, but they used fragrant tapers to perfume the air at all grand ceremonies; and we find that such was the case at the baptism of Clovis, the first Christian King of France, in the year 496. Perfumes were also introduced into private life at an early period, and Charlemagne is said to have made great use of them. In the year 1190 Philip Augustus granted a charter to the master perfumers, which was confirmed by John in 1357, and later by Henry III. in 1582. That charter was for the last time renewed and enlarged by Louis XIV. in 1658. It was then requisite to serve four years as apprentice and three years as companion to be elected master, which shows it was already considered as a handicraft of some importance. Their preparations were at first very simple, such as aromatics to burn in apartments, various unguents, and rose-water, which was always offered by noblemen to their guests at table. Alcoholic perfumes were not made till about the fourteenth century, and the first we find mentioned is Hungary water, distilled from rosemary, which, according to some authors, was prepared in the year 1370, by a Queen of Hungary, named Elizabeth, who had the receipt from a hermit, and became so beautiful through the use of it that she was asked in marriage at the age of 72, by the King of Poland. The truth of this story is, however, doubted by Beckmann, who devotes a whole chapter to the subject, and I am inclined to be of the same opinion.

When Catherine de Medicis came to France to marry Henry II., she brought with her a Florentine, named René, who was very expert in preparing perfumes, for the Italians were then more advanced than the French in that art, and from that time perfumery came into general use among wealthy people. This René also possessed the art of preparing subtle poisons, and his royal mistress is said to have had frequent recourse to his talents to get rid of her enemies. Among her victims, the historians mention Jeanne d'Albret, mother of Henry IV., and state that she was poisoned by having worn some perfumed gloves presented to her by Catherine, but some modern chemists doubt that it was possible to poison anyone by such means.

Perfumery was still at that time in a semi-barbarous state and I have met with a French recipe book bearing date 1599, which bears evidence of having been written by some ignorant and superstitious alchemist. I shall merely quote, as a specimen of the state of the art of that period, a recipe for making a marvellous water for the complexion, which is as follows:—"Take a young raven in the nest, feed it on hard eggs for 40 days, kill it, and distil it with myrtle leaves, talc, and almond oil." It also gives a recipe for making pomatum with apples, which was the custom then, and was the origin of the name. From that time, however, perfumery went on progressing, and at the court of Louis XV., etiquette prescribed the use of a particular perfume for each reception day, which caused it to be named the "perfumed court." Since then, the advance of civilisation and public welfare has rendered the use of perfumery general in all ranks of society, and France has now became the chief mart of that article for all parts of the world.

In England perfumes were at first imported from Italy and France, and came into great vogue during the reign of Queen Elizabeth. Shakspeare often mentions musk, civet, perfumed gloves, and pomanders, or pommes d'ambre, which were balls of perfume, to be held in the hand and smelt occasionally: the latter were supposed to preserve from the plague.

It is difficult to ascertain the precise date when manufactories of perfumery were first established in England, as perfumers did not form here a separate corporate body as they did in France, but in an old English recipe book, in my possession, printed in 1663, I find a dentifrice prepared by M. Ferene, of the New Exchange, Perfumer to the Queen, so that they had already at that time begun to manufacture. Those recipes are about in the same style as those of the French book, but time will not allow me to quote extracts from them, although they are very curious. In Dean Swift's time perfumers' shops seem to have been the resorts of loungers, as they were in ancient Rome, for he says,—

> "First issued from perfumers' shops
> A crowd of fashionable fops."

And since that period the perfumery trade of England has followed about the same progress as that of France, until it has reached its present state of prosperity.

To conclude the history of perfumery, I shall briefly state that, besides the nations I have mentioned, others have been in the habit of manufacturing and using perfumery for ages past. The inhabitants of India were among the first to make perfumes, possessing as they did most of the elements at home. Their perfumery, however, has not advanced with the times, and is consequently far behind our modern productions. The Chinese are also very partial to odours. You will find on the table specimens of the joss sticks they burn in temples and private houses, and of some of their perfumes. The latter, however, are only essential oils, some of which I suspect to be of Indian origin. The Japanese use, likewise, many cosmetics for their toilet, and the Tagals of the Philippine Islands are passionately fond of scents. The use of perfumes was even known to the ancient Mexicans, and Montezuma used to mix ambergris with his tobacco. In fine, it is to be supposed that in all countries which produce perfumes, men find means to appropriate them to their use and pleasure, and even in a half-savage island like Otaheite, the natives anoint their hair with a pomatum called Monoï, prepared from cocoa-nut oil flavoured with the flowers of the Tiaré, a sort of Jasmine, with large petals, which exhales a beautiful odour, a specimen of which you will find on the table.

I shall now give you the statistics of the present state of the perfumery trade in England and France, confining myself to those two countries, not only because they are the most important, but also because they are the only recognised centres of manufacture of that article with which they supply the whole world. There are, it is true, other manufactories in Germany, Russia, Spain, and the United States, but their principal trade consists in counterfeiting the productions of the London and Paris manufacturers, which cannot be considered as a legitimate business.

There are about 40 manufacturing perfumers in London, employing from 20 to 100 hands each, according to the importance of their business. I exhibit here a table of the exports from 1853 to 1858, such as are found in the Blue Books, but I must tell you I consider those returns as quite incorrect. Thus, in 1858, it would appear that the total exports of perfumery from the United Kingdom was only £80,791, whilst I am certain that they were at least three or four times that amount. It is true that fancy soaps are not included in this table, but the amount reported (4,928 lbs. for 1858) is so ridiculously small, that it is also evidently wrong. Our exports of scented soaps to the United States alone would far exceed that quantity. From the table of imports of essential oil and perfumery materials during the same years, it will be seen that in 1858, the quantity of essential oils imported amounted to 290,204 lbs. in weight, of a value of £168,330; and if we add to that the other perfumery materials not included in essential oils, such as musk, of which 10,957 ozs., worth at least

£15,000 were imported, we shall find that the total amount of those imports exceeded £200,000. If we consider that those do not include spirits of wine, which are very costly in this country, fancy soaps, of which immense quantities are made, and many other materials, we may fairly assume that the total production of perfumery in the United Kingdom does not fall short of £1,000,000 per annum.

In Paris there are about 80 perfumers, employing together from 2,000 to 3,000 hands. The annual amount of the export trade of perfumery averages from 12 to 13 millions of francs, or about £500,000, divided as will be seen in the table appended. The yearly average export trade for ten years, from 1827 to 1836, was six millions of francs; from 1837 to 1846, eight millions; from 1847 to 1856, ten millions, and that for 1858 above twelve millions, so that the trade has doubled since 25 years. It is difficult to estimate the amount of home consumption, but it is at least equal to that of the exports, which gives a probable total product of £1,000,000, or about the same as that of England.

The principal branches of the perfumery trade are making scented soaps, compounding perfumes, and preparing various articles used for the toilet. The process of soapmaking is so well known to you that I need not describe it here; I shall only mention that there are four kinds of soaps generally manufactured by perfumers, hard soap by the hot process, which is made by boiling grease, and sometimes a small portion of resin, with an excess of soda-lees, until they become saponified; hard soap by the cold process, which is prepared by introducing a fixed dose of concentrated soda-lees into grease in a liquefied state; soft soap by the cold process, which is obtained in the same way as the last, only substituting potash for soda-lees; and transparent soap, which is a combination of soap and alcohol. The cold process is principally resorted to when a delicate colour or fine odour is to be procured. By substituting a pomade for the grease, you obtain the true scent of the flower. I have here specimens of a violet and a jasmine soap, prepared in that way, which no essential oil could give. The removal of the excise restrictions has caused great improvements in the manufacture of English toilet soaps, by giving the perfumers free scope to make experiments, and to prepare scented soaps with all the care they require, instead of being compelled to resort, as before, to the common soapmakers.

The next important branch of the trade is the preparation of perfumes, of which large quantities are consumed both at home and abroad. The basis of all fine perfumes is obtained by treating with alcohol the pomade or oil extracted from the flowers, as I shall explain hereafter. This may be called the truly artistic part of perfumery, for with a very limited number of flowers the perfumer has to imitate all the others. This is done by studying resemblances and affinities, and blending the shades of scent as a painter does the colours on his palette. Thus for instance no perfume is extracted from the heliotrope, but as it has a strong vanilla flavour, by using the latter as a basis with other ingredients to give it a freshness, a very perfect imitation of that flower is obtained, and so on with the others. You will find on the table specimens of those natural and artificial perfumes. There is also a large quantity of toilet waters manufactured chiefly with an alcoholic basis. The most widely known is the Cologne water, which was invented in the last century by an apothecary in Cologne. It can, however, be made just as well anywhere else, as all the materials for it come from the south of France. Its perfume consists principally of the flowers, leaves, and rind of the fruit of the bitter orange-tree, which blend well together, and form an harmonious compound. The toilet vinegar is a sort of improvement on Eau-de-Cologne, with the addition of balsams and vinegar. Lavender water was formerly distilled with alcohol from fresh flowers, but is now prepared by digesting the essential oil in alcohol, which produces the same result at much less cost. The other articles manufactured by perfumers are too unimportant to be interesting to you.

The ingredients used for making up perfumery are very numerous, and come from all parts of the world. You will find in the appendix a table of the principal ones, arranged alphabetically for convenience in referring, giving the commercial name, the botanical description, the form in which they are used, the average price, and the place of production. Time will not allow me to read this list through, but I shall give you a brief summary of those materials, grouping them together according to their nature, in the following twelve series:—

1. The animal series, comprising musk, civet, and ambergris. It is very useful in perfumery, on account of its durable aroma, which resists evaporation longer than any other. Musk is a secretion found in a pocket under the belly of the musk deer, a ruminating quadruped, inhabiting principally the mountains of Thibet, Tonquin, and China. The best is called Tonquin musk, the next in quality is is the Assam musk, and the most inferior is the Caberdeen musk, which comes from Siberia. Civet is the secretion of the civet cat, an animal found in the Indian Archipelago and in some parts of Africa. It has a most repulsive odour by itself, but combined in small quantities with other perfumes, it produces a pleasing effect. Ambergris is a curious substance, which for a long time puzzled the savans, but is now acknowledged beyond a doubt to be a morbid secretion of the sperm whale. When the animal is thus diseased it ejects the ambergris, which is found floating on the sea, or more frequently deposited on the coast. I have here a very curious specimen, which was found inside a whale, before the disease had come to its maturity, which accounts for its black colour. Ambergris, although apparently possessed of little scent, imparts a most ethereal and delicate odour to other perfumes.

2. The floral series includes the following, which have hitherto been the only flowers available for perfumery purposes:—Jasmine, rose, orange-flower, cassie, tuberose, violet, jonquil, and narcissus. Out of those eight, four only yield an essential oil by distillation, viz., the rose, orange-flower, jasmine, and cassie. The essence or otto of roses comes principally to this market from Turkey, where the flower is largely cultivated in the neighbourhood of Adrianople. The competition in price, however causes it to be very seldom pure, being more or less adulterated with an oil called Turkish geranium, which is in reality nothing but Indian ginger grass oil. The usual market price of Turkish otto varies from 15s. to 30s. per oz., according to its degree of purity. The otto made in the South of France is very fine, but not so rich in flavour as the Tunisian otto, which is worth £4 per oz. If, however, we are to judge quality by price, the palm must be awarded to the East India otto, made at Ghazepore, which costs there £12 per oz. The essence of orange-flower, called neroli, is of two sorts. The best is made from the flowers of the bigarrade, or bitter orange tree. The flower of the edible orange-tree, commonly called Portugal, yields a very inferior essence. The two other essential oils, jasmine and cassie, are only distilled in Algeria and Tunis, and their high price precludes their being used to any extent. The most ordinary way of extracting the aroma of flowers is by means of fatty bodies through a process which I shall describe hereafter.

3. The herbal series, distilled from the flowers, leaves, or stalks of plants or shrubs, and comprising principally geranium, lavender, peppermint, fennel, thyme, marjoram, serpolet, spike, rosemary, verbena, petit grain, made from the leaves of the orange tree, patchouly, and wintergreen.

4. The andropogon series, which comes all from the island of Ceylon, and consists of the *Andropogon schœnanthus*, or lemon-grass, which is used to imitate verbena, which it closely resembles. The *Andropogon citratum*, or citronella, used principally for scenting honey soap, and an undefined species, which yields the ginger grass oil of commerce. This is a very useful series, and the two former

especially are grown to a considerable extent in the island of Ceylon.

5. The citrine series, comprising the bergamot, orange, lemon, cedrat, and limette, all belonging to the citrus family. The rind of the fruit only is used, and yields an essential oil by expression or distillation—the former is by far the best. On the coast of Genoa it is prepared by rubbing the fruit against a grated funnel; in Calabria, by squeezing out the oil on a glass surface; and in Sicily, by pressing gently the pared rind in cloth bags.

6. The spice series, including cassia, cinnamon, cinnamon-leaf, cloves, mace, nutmeg, and pimento.

7. The wood series, consisting of sandal-wood, rose-wood, rhodium, cedar-wood, and sassafras.

8. The root series, comprising orris-root and vetivert. The vetivert, or *Anatherum muricatum*, called by the Hindoos Kus-kus, is extensively used in India for making mats and blinds, which, being frequently watered in the sun, shed a most pleasant fragrance. It gives a very lasting perfume.

9. The seed series, composed of aniseed, dill, and carraway.

10. The balm and gum series, including balsam of Peru, balsam of Tolu, benzoin, styrax, myrrh, and camphor. With the exception of the last, they are all exudations of various trees. Camphor is obtained by boiling the wood of the *Laurus camphora*.

11. The fruit-series, including bitter almonds, tonquin-beans, and vanilla. The essential oil of bitter almonds contains from eight to ten per cent. of prussic acid, which can be removed by distilling it over potash. Vanilla is the fruit or bean of a creeper found principally in Mexico.

12. The artificial series, comprising all the artificial flavours produced by chemical combinations. Of these the most extensively used in perfumery is the nitro-benzine, usually called mirbane, or artificial essence of almonds. This is obtained by treating rectified naphtha with nitric acid and sulphuric acid, or by some with nitric acid alone. The naphtha is poured slowly through a tube into the acids, decomposition follows, and the essence is found floating on the surface. Artificial essences of lemon and cinnamon have also been produced, but have not been brought to sufficient perfection to be available for practical use. Besides these, artificial essences, imitating fruit flavours, are manufactured, but principally for making confectionery. The pear essence is an amylic ether, the apple essence a valerianic ether, containing amyl, and the pine apple essence a butyric ether. The whole of those require diluting with five or six times their weight of alcohol to develop their flavour.

In the above I have not comprised the inodorous materials used for perfumery as bases, such as spirits of wine, oil, &c., as they are also applied to other purposes. I shall only allude to four oils which might perhaps be employed for perfumery, and of which I exhibit specimens. The oil of ben, produced on a large scale in Jamaica, by Mr. Kemble, which has the advantage of not becoming rancid; crab-oil or carapa-oil, from Demerara, which can be obtained also from the west coast of Africa; gingelly or sesamum oil, from India, used by the Hindoos for toilet purposes; and oil of tamanu, from Otaheite, which is yielded by a sort of wild almond.

I have arranged the specimens of perfumery materials on the table according to the place of their production, by which you will see that we obtain about 21 from the East Indies and China, 2 from Africa, 6 from North America, 6 from South America, 2 from Turkey, 4 from this country, and 28, or the greater number, from the South of France and Italy, which may be called the great centre of manufacture for perfumery materials. I shall not describe to you their different modes of distillation, which are more or less on the old principle well-known to you; but a very interesting process is that of extracting the aroma of flowers by means of fatty bodies, which is the principal system adopted, especially for the flowers too delicate to bear distillation. The first attempt that was made in this way, some 200 years ago, was to place some almonds in alternate beds with fresh gathered flowers, renewing the flowers several days, and afterwards pounding the almonds in a mortar, and pressing the oil which had absorbed the flavour of the flowers. Curiously enough, a similar process is now used in India by the natives for obtaining scented oil from the flowers of Jasmine, Bayla, or Chambul, but substituting Tel or Sesamum seeds for almonds. The next improvement was to use a flat earthen pan, with a thin layer of grease inside, strewing the flowers on the grease, and covering it with another jar similarly prepared. After renewing the flowers for a few days, the grease was found to have taken their scent and was removed. This process was abandoned in France about 50 years ago, but the Arabs still employ it to prepare their pomades, the only difference being that they use white wax mixed with grease instead of pure grease.

There are now two processes in use for making those scented pomades and oils, one is by maceration, and the other by absorption. The former is used for the less delicate flowers, such as the rose, cassia, orange flower, jonquil, and violet, which can bear a tolerable degree of heat without losing their scent. A certain quantity of grease is placed in a pan fitted with a water bath and brought to an oily consistency. Flowers are then thrown in and left to digest for some hours, after which they are removed and others are put in, and so on for two or three days, until the grease is quite saturated. It is then taken out and pressed in cloth bags. The process of absorption, called by the French enfleurage, is chiefly confined to the jasmin and tuberose flowers, but is sometimes applied to the cassie. It consists of a series of square glass frames, covered with a thin layer of purified grease, in which ridges are made to facilitate absorption. Fresh gathered flowers are strewed on that layer, and renewed every morning as long as the flower is in bloom, and by that time the grease has acquired a very strong flavour. The same process is used for oil, but the frames instead of a glass have a wire bottom, over which is spread a thick cotton cloth soaked in olive oil. Flowers are laid on in the same way, and the cloths submitted to a strong pressure to extract the oil when sufficiently impregnated. The frames, of which you have specimens on the table, are piled up on each other to keep them air-tight.

The three principal towns where this manufacture is carried on are Grasse, Cannes, and Nice. From the details furnished by M. Pilar, one of the first manufacturers of Grasse, it appears that there are about 100 houses engaged in that occupation, and in that of distilling essential oil, materials for which abound in the neighbourhood. Out of that number 70 are in Grasse, which may be called the head-quarters of the trade. The following are approximate numbers and values of the flowers consumed in that locality for manufacturing purposes:—

800,000	kilos. or	1,760,000	lbs. of	Orange Flowers,	worth about	£32,000
250,000	,,	550,000	,,	Rose Flowers	,,	10,000
50,000	,,	110,000	,,	Jasmine Flowers	,,	6,000
30,000	,,	66,000	,,	Violets	,,	7,000
30,000	,,	66,000	,,	Cassia	,,	10,000
15,000	,,	33,000	,,	Tuberose	,,	3,000

The average quantities of the principal articles manufactured are:—

300,000	kilos. or	660,000	lbs.	of scented pomades and oil, worth about		£250,000
80,000	,,	176,000	,,	Rose Water	,, ,,	5,000
500,000	,,	1,100,000	,,	Orange Flower water,	1st qty.	30,000
1,000,000	,,	2,200,000	,,	,, ,,	2nd ,,	50,000

This does not include the essential oils, of which the list would be too long, but some of them are very valuable, such as the Neroli, for instance, which is distilled from orange flowers, and is worth about £10 per lb.

The processes I have described are those in actual and practical use; but there is a new process, lately patented by M. Piver, the eminent Paris perfumer, to extract the aroma of flowers by the pneumatic principle, which is extremely ingenious. I shall describe it to you, M. Piver having kindly allowed me to inspect it. A strong current

of air is forced, by means of an air-pump, into a receiver filled with fresh flowers, and passes into a cylinder containing grease in a liquefied state, which is kept in constant motion, by a series of discs revolving on an axis in the centre. The fragrant particles come thus in contact with a surface of grease, constantly renewed, which readily absorbs the greater part of them, and passing through a second cylinder fitted in the same way, those that have escaped the first become fixed in the second, and let the air issue nearly scentless. In order to avoid all chance of waste, the same current of air is driven several times again through the flowers in the same way until it has exhausted all their scent. The force of this current of air is such that although the flowers are put in perfectly dry, it drives out of them part of the water, which they naturally contain, and which is collected in a receiver at the side of the apparatus. This water, which is quite a new product, possesses the scent of the flower in the highest and most refined degree. I have here specimens of the scented oil and of the water produced by this process. This apparatus not having come into practical use yet, it would be somewhat premature to discuss its merits in a commercial point of view, but as it performs in twenty-four hours a work which usually takes as many days, and as, moreover, it absorbs all the aroma of the flowers without wasting a particle, it appears to me to be likely to become generally adopted, if the cost of working is not too great. There is, however, a disadvantage connected with it; the pomades and oil produced by that means become rancid in a very short time, owing, no doubt, to the quantity of oxygen which they absorb in the rapid motion which they undergo in the cylinder; if this cannot be remedied, these pomades will only serve for infusing in alcohol, and will have to be employed as soon as they are made.

Another new and interesting process is that patented by M. Millon, a French chemist, for extracting the aroma of flowers by means of ether, or sulphuret of carbon, which are both powerful solvents. M. Millon operates in this way:—The flowers are placed it a percolating apparatus, and the ether or sulphuret of carbon poured over them; after leaving them in contact for ten or fifteen minutes the liquid is drawn off, and a fresh quantity added, and drawn off in the same way. This completely dissolves all the odour of the flowers, and leaves them quite scentless. The liquid is then distilled, and the ether or sulphuret of carbon becoming volatilised at a much lower temperature than the fragrant principle is drawn over alone, and leaves a residue containing all the perfume of the flower. This residue is sometimes quite solid, and sometimes semi-liquid, but it always becomes solid in a short time. It is spread in thin layers, and exposed to the heat of the sun, or some equivalent temperature, until it loses the unpleasant smell of the solvent used. It can be left open for any length of time without evaporating, nor is any degree of natural heat capable of altering the perfume or turning it rancid. It has a much finer flavour than any sort of essential oil, as you can see by the specimen on the table, which M. Millon explains by stating that the perfume of a flower always became altered by being subjected to a higher temperature than that of the atmosphere. If this residue is treated with alcohol it takes up the odour and colouring matter, and a small portion only of the resinous and waxy matters forming the residue. This alcoholate again treated with distilled water gives up the greatest part of the aroma. Plain water, however, has no effect on it. The residue is also soluble in grease or oil. This process is very curious in a scientific point of view, as it is the nearest approach that has been made yet to the insulation of perfume from the substances into which it is usually embodied. It is far from being, however, the actual fragrant principle in a solid and palpable shape, nor has Mr. Millon been able to ascertain exactly what proportion it bears to the flowers used. The residue he obtains averages from one to three grammes per kilogramme (or one to three per 1,000) and when it has been treated with alcohol, and given up all its perfume and colouring matter, the inodorous waxy substance left seems to have lost scarcely a few hundred parts of its weight. M. Millon tried to insulate the aroma from alcohol by distillation, but it became lost in the operation, and on his trying to evaporate it with distilled water the water became perfumed, but without leaving the fragrant principle floating on the surface, as is generally the case. He found it therefore, theoretically and practically impossible to solve that interesting question. This process has not not yet received any application on a large scale. I think it, however, very important, if it can be worked at a moderate price, not for great centres of manufacture, where other and cheaper means can be adopted, but to collect the perfumes of flowers in places where sufficient quantities do not exist to warrant the expense of a regular manufactory, and where it may be convenient to use a light and portable apparatus such as this is.

It now remains for me to call prominent attention to what may be done to improve and increase the production of perfumery materials, which does not at present keep pace with the growing trade. We are now wholly dependent for our finest perfumes on the south of France and Italy, and when the crop of a flower fails as did that of Jasmine last year, it puts the manufacturers to serious inconvenience. It would therefore be the interest of perfumers to promote the production of those materials in other countries; and the high price they fetch in the market would make it a very profitable speculation for any person undertaking their manufacture with proper knowledge and spirit.

It has been proposed to cultivate flowers in England on a large scale for perfumery purposes, but the climate renders this scheme totally impracticable—English flowers, however beautiful in form and colour they may be, do not possess the intensity of odour required for extraction, and the greater part of those used in the south of France for perfumery would only grow here in hot-houses; the only flower which might be had in abundance would be the rose, but the smell of it is very faint compared with that of the southern rose, as you may judge by the specimen of English rose-water exhibited. The English oils of lavender and peppermint are superior, it is true, to those made in France and Italy, but I think that is owing to the very cause which would militate against the success of other flowers in this country. If we add to this the shortness of the flowering season and the high price of land and labour, we may arrive at the conclusion that it would prove as bad a speculation as that of attempting to make wine from English grapes.

There are, however, other countries, where this scheme could be carried out with much better success, and where the materials abound, growing spontaneously in wild profusion. Spain and Portugal both teem with an endless variety of fragrant flowers and aromatic plants. M. Robillard, manager of the Botanical Gardens at Valencia, has commenced distilling essential oils of geranium, verbena, artemisia, petit-grain, spikenard, and bitter almonds, of which you will find specimens on the table, as well as of sundry fragrant herbs found in the fertile Huerta de Valencia. They also manufacture very good essence of lemon in the neighbourhood of Malaga. In the plains of Spanish Estramadura, I have passed through miles and miles of waste land covered with lavender, rosemary and iris growing wild in the greatest abundance. The only use made of them hitherto is to burn them, a few of the lavender flowers (such as specimen exhibited) find their way to Madrid, where they are used to strew on the floor; they sell there for 16 reals per fanega, which is about equal to 3s. 6d. per cwt. In Andalusia all the flowers cultivated in the south of France abound, and could be profitably worked. In Portugal, and especially in the provinces of Alentejo and Algarves, aromatic plants grow wild in great quantities. You will find on the table specimens of several—one which they call rosmarinho, but

which is in reality a sort of wild lavender (*Lavandula stacha.*) It gives, when bruised, a delicious scent—the alcrim do sul, or common rosemary (*Rosmarinus officinalis*) and the alcrim do norte (*Diosma ericoides*), a variety with a very fine scent. Besides that, there are immense quantities of orange trees, the flowers of which appeared to me superior in intensity of fragrance to those of France or Italy. There are also some trees which bear beautifully-scented flowers, such as the *Pawlonia imperialis*, the Nessri, or African musk rose, and the *Doricus caracolla*, a beautiful creeper. In short, Portugal, from its richness of produce and facility of communication with England, seems to me a very eligible spot for manufacturing perfumery materials for this market; and I can assure those who would feel inclined to undertake this speculation, that they would meet with every encouragement from the young and intelligent King of Portugal, to whom I had the honor of being presented during my stay in Lisbon, and who seemed very anxious to assist in developing the natural resources of his country.

In Algeria the colonists have for some time turned their attention to utilizing the flowers and plants of their country, and principally the jasmine, orange flowers, cassie, violets, narcissus and geraniums. I exhibit here some pomades, oils, and essences produced by M. Richard, of El-Biar, near Algiers.

In Tunis they manufacture some essential oils of the finest descriptions, of which you will find specimens on the table. They comprise rose, jasmine, cassie, aloes, nessri or white musk rose, zensfour, the flowers of a species of willow, nisk-snadak, made from a sort of thistle, apple, quince, violier and narcissus. The price of those essences is, however, very high, ranging from £4 to £8 per liquid ounce.

But it is not in foreign countries alone that we must look for fresh sources of production; our own tropical colonies offer an ample field to those who will turn their attention to the subject.

From the East Indies we procure already many perfumery materials, but none of them are extracted from flowers, yet highly fragrant flowers are there in abundance, and could be rendered available if colonists would take the trouble of gathering and distilling them. Those that could not be easily distilled might no doubt be treated by the absorption process, and yield a fine pomade or oil. I sent out some time since some oil frames to Madras to make experiments in that way, but have not received the results in time for this paper. I exhibit here a small collection of East India oils, comprising sohag, jasmine bayla, sumbar, musk root, and khurakhah, but they are all, more or less, impregnated with the flavour of sandalwood, which, it appears, is occasioned by their distilling the flowers with sandalwood, in order to obtain a larger quantity of essential oil. I expected another collection from Ghazepore, containing otto of roses, khoss, keorah, jasmin bayla, johee, chomalee, sohag, musk, and amber, but unfortunately it will not arrive until the end of this week. I shall be happy, however, to show it to any person who may feel interested in the matter. Those essential oils are all very costly, varying from £1 to £12 per ounce, but they would no doubt be obtained much cheaper if there was a regular market for them, which would warrant the extension of the cultivation of flowers for that purpose. In China fragrant flowers likewise abound, and could be easily rendered available when we get a firmer footing in the country. Among the most odorous are the chulan, jasmin and kohé-wha, which the Chinese use to flavour their fine teas. An exquisite essence is also obtained from the alfangilan, a Manilla flower, which is probably also found in India and China.

Australia and Tasmania abound in fragrant flowers and aromatic plants. I have appended to this paper a very interesting report on the subject, with which I was favoured by Dr. Müller, of the Botanical Gardens at Melbourne. It appears from it that plants of the myrtle, rue, and mint tribe grow wild in Australia in great abundance, and that there are also many varieties of the acacia, and other flowering trees and shrubs which could be turned to some account. I have a specimen here of the flowers of the *Acacia dealbata*, or silver wattle, (a Tasmanian tree), which have the same flavour as the French cassie, but are somewhat smaller. Another curious specimen is that of the myall wood, obtained from an undefined species of acacia, which has an intense smell of violets, a very scarce odour in nature. This would prove valuable if it could be obtained in sufficient quantities. There is also a great quantity of sandalwood, of fine flavour, in West Australia.

The botanic riches of the Cape colony are well known, and could be turned to good account for perfumery with little cost and labour; the same may be said of British Guiana. I have here a specimen of indigenous vanilla from Demerara, the cultivation of which would give a good return. Our West India Islands produce the frangipane and other highly-scented flowers, besides many aromatic herbs, such as lemon grass,

I have also a specimen of a very fragrant wood from Cayenne, which they call in French "bois de rose femelle," and which is no doubt found likewise in British Guiana.

British Honduras, with its luxuriant vegetation, would also probably yield a rich crop of fragrant treasures to those who would take the trouble to seek them. In fine, all our colonies, favoured by sun and climate, can in course of time be made to supply their share of aromatics, affording thus greater variety to the perfumer, and increasing their own resources.

I trust that this sketch, imperfect as it is, will suffice to convince you that perfumery is not of such trifling importance as you might have imagined. A trade which in two countries alone amounts to nearly £2,000,000, and which gives employment to thousands and pleasure to millions, deserves a little notice.

Allow me, in conclusion, to express a hope that the few hints I have thrown out will draw from the gentlemen present some remarks which may lead to practical and useful results.

APPENDIX.

The following is Dr. Müller's report above referred to:—

"Melbourne Botanical and Zoological Gardens,
1st Dec., 1859.

"SIR,—In reply to your request to be furnished with information on such plants peculiar to Australia as may be regarded as practically valuable for their perfume, I have the honour to inform you that I cannot point to any plant which would supersede in odour or in yield of essential oil, any of those already in use elsewhere, but I beg to add, that many of our native plants are as yet imperfectly examined in this respect, and it is therefore very possible that, in future experiments, plants may be pointed out possessing a sufficient quantity of scented oil to render them available for distillation.

"I would, however, direct your attention to the great prevalence of the Myrtaceous plants in Australia, which all, without exception, are characterised by the presence of a greater or less quantity of essential oil pervading leaves and flowers. This applies not only to the huge masses of *Eucalypti*, constituting our principal forests, all of which yield an aromatic volatile, often, however, somewhat camphoric oil, but also to the so-called tea-trees, species of *Melaleuca* and *Leptospermum*, so called because the oil by which they are pervaded, render any infusion of their leaves of an aromatic, more or less pleasant taste, and they were, therefore, used by early navigators as an antiscorbutic tea. More important as perfume plants are many of the species of *Baeckeæ* and *Chamelauricæ*, embracing numerous handsome and common shrubs of the myrtle family, of which some are impregnated with large quantities of truly well-scented oil. Of the actual yield of the respective species I can, however, at present afford no accurate information.

"Very many of the Acaciæ indigenous to this country, produce flowers of most agreeable scent, and a distillate may possibly be obtained from them, which would be useful for cosmetics; and if so, they will require much more attention, as these trees are very gregarious, and produce flowers generally in the utmost profusion. How far the plants of the rue tribe, which all are strongly odorous from essential oils, are of value for perfume distillation future experiments must prove; my impression is, however, that in themselves they furnish an oil rather useful for medicinal than cosmetic purposes, unless a small admixture of oil of a peculiar flavour is needed to the ordinary composition now in use. The rue plants, I may add, are not only plentiful, but also extremely varied in species.

"The plants of the mint tribe deserve particular attention in my opinion, for their essential oil; thus three kinds of Australian mints are possessed of an exceedingly pleasant odour, very different to that of the crisp and the peppermint. There are also plants allied to the basilicon (*Plutranthus, Anisamelia, Ocymum*), which have a very agreeable scent, and undoubtedly could be advantageously distilled; but they are not, or rarely, available in Victoria, but are still largely to be found in the warmer parts of New South Wales. In the latter colony there are also several trees and shrubs of the orange tribe full of exquisite oil.

"The species of Prostanthera are nearly all strongly and agreeably scented; they occur in South Australia, Tasmania, Victoria, and New South Wales; their oils, I do not doubt, could be cheaply obtained, but would be only useful for admixture with others.

Well-scented flowers are produced by many native shrubs, for instance, Logania, Tetrathrea, Stockhausia, Jasmine, Alyxia, Heliotrope, &c., but whether it will be profitable to subject them to distillation remains to be ascertained.

Amongst the strongly odoriferous flowers, I may mention also the *Xerotis fragrans*, and I may avail myself of this opportunity to contradict a rather current belief that the generality of our flowers are devoid of scent. For although we have no plant wild in Australia equal to the Rose, and several other favourite flowers in regard to scents, very many still exhale a lovely odour. The *Humea elegans* is recommended for distillation by some naturalists of New South Wales.

The Myall wood is found rather commonly in the desert of the interior of Eastern and South-Eastern Australia, and is obtained from several species of Australian trees. Should this prove useful for the desired purpose, it could now, with steam communication, easily be obtained in large quantity from the country along the River Murray, and its tributaries.

I have the honour to be, Sir,
Your obedient servant,
FRED. MULLER.

Declared Value of the Exports of Perfumery from the United Kingdom.

	1853.	1854.	1855.	1856.	1857.	1858.
	£	£	£	£	£	£
To Russia	2,173	1,363	843	2,119	5,312	3,039
Hanse Towns	2,781	3,222	3,858	3,867	3,529	2,886
Holland	1,000	975	924	1,068	1,123	1,116
Egypt	1,920	2,205	1,884	2,201	2,161	2,140
South Africa	1,821	1,686	1,275	1,967	2,692	2,913
Mauritius	1,156	1,379	1,081	1,651	1,569	1,279
Australia	23,016	18,679	7,759	18,843	18,548	16,706
British India	13,870	18,067	18,374	24,579	20,465	21,480
British N. America ...	12,156	3,0[illegible]	1,645	3,800	3,073	2,384
British West Indies...	6,[illegible]9[illegible]	5,671	5,472	6,457	8,294	6,382
United States... ..	5,956	4,707	3,431	6,255	5,239	3,258
Other Countries ...	8,698	10,472	13,385	19,514	22,525	17,208
Total	70,643	71,434	59,93[illegible]	92,321	90,630	80,791

IMPORTS

Of Perfumery Materials into the United Kingdom.

Quantities.

		1855.	1856.	1857.	1858.
Ambergris...	oz.	16	91	545	120
Castor	cwts	37	31	33	33
Civet	oz.	...	...	1,476	300
Elder Flower Water ...	lbs.	190	2,113	4,856	5,184
Rose Leaves	,,	4,386	9,577	5,838	13,627
Lavender Flowers ...	,,	15,028	4,878	348	388
Musk	oz.	9,489	17,580	10,728	10,957
Oil of Almonds	lbs.	1,060	372	13	614
,, of Bays	,,	2,813	...	1,254	7,605
,, unenumerated ...	value	£25,686	60,844	7,757	43,633
Orange Flower Water ...	lbs.	12,770	25,892	32,415	31,999
Orris Root	cwts.	530	416	437	280
Perfumery unenumerated	lbs.	24,541	27,209	29,034	30,029
Rose Water	,,	17,050	21,785	29,939	30,633
Quince Seed	cwt.	1	13	3	6
Vanilla	lbs.	973	4,579	7,573	3,034
Powders prepared ...	,,	189	569	169	210
Soap, scented or fancy ...	,,	29,741	27,429	17,390	23,258

EXPORTS

Of Perfumery from France in 1858.

To what Countries Exported.	Value in francs.	Weight in kilos.
Russia	254,635	50,927
Zollverein	302,080	60,416
Holland	90,275	18,005
Belgium	1,062,060	212,412
United Kingdom	1,273,030	254,606
Portugal	192,630	38,526
Two Sicilies	56,145	11,229
Spain	583,855	116,771
Sardinian States	256,475	51,295
Tuscany	56,195	11,239
Switzerland	279,605	55,921
Greece	64,445	12,889
Turkey	599,470	119,894
Egypt	82,060	16,412
Mauritius	260,410	52,082
East Indies	195,085	39,017
United States	751,095	150,219
Mexico	122,380	24,476
New Grenada	127,475	25,495
Venezuela	156,040	31,248
Brazil	908,615	181,723
Uruguay	163,900	32,780
River Plate	498,945	99,789
Chili	286,080	57,216
Peru	460,865	92,173
Bolivia	88,250	17,650
Hayti	99,535	19,907
Cuba and Porto Rico	1,291,825	258,365
St. Thomas	392,770	78,534
Algeria	317,220	63,444
Guadaloupe	136,405	27,281
Martinique	136,805	27,361
Reunion	260,135	52,027
Other Countries	352,905	70,581
Total	12,159,700	2,431,960

Progress of the French Perfumery Trade.

AVERAGE TOTAL OF EXPORTS.

For 10 years from 1827 to 1836	...	6	million francs.
,, ,, 1837 to 1846	...	8	,, ,,
,, ,, 1847 to 1856	...	10	,, ,,
Exports of 1857	...	13	,, ,,
Ditto 1858	...	12	,, ,,

PRINCIPAL MATERIALS USED IN PERFUMERY.

NAMES.	DESCRIPTION.	IN WHAT FORM USED.	AVERAGE PRICE PER lb. £	s.	d.	PLACE OF PRODUCTION.
Almond (bitter) ...	Fruit of the Amygdalus amara	Emulsion or meal ...	0	0	6	Northern Africa.
Ditto	Ditto	Essential oil	1	12	0	Distilled in England from foreign almonds
Ambergris ...	Secretion of the Physeter macrocephalus...	Powder and alcoholate.	32	0	0	Found floating on the sea, or on the coasts of India, China, Japan, Greenland, and other places.
Aniseed	Seed of the Pimpinella anisum	Essential oil	0	9	0	North of Europe.
Ditto (Star) ...	Capsules & seeds of the Illicium anisatum	Ditto	0	16	0	China and Japan.
Balsam of Peru ...	Exudation of the Myroxylon peruiferum ..	Natural form	0	6	0	Western Coast of South America.
Balsam of Tolu ...	Exudation of the Toluifera balsamum ...	Ditto	0	5	0	Ditto.
Benzoin Gum ...	Exudation of the Styrax benzoin	Powder and alcoholate.	0	6	0	Siam.
Ditto	Ditto	Ditto	0	3	0	Sumatra and Singapore.
Bergamot	Expressed or distilled from the rind of the fruit of the Citrus Bergamia.	Essential oil	0	14	0	Calabria and Sicily.
Bigarrade	Expressed or distilled from the rind of the Citrus bigaradia	Ditto	0	16	0	South of France and Italy.
Camphor... ...	From the wood of the Laurus camphora...	Powder and alcoholate.	0	2	6	China and Japan.
Carraway ...	Seed of the Carum carui	Essential oil	0	8	0	England, Germany, and France.
Cascarilla ...	Bark of the Croton cascarilla and eleuteria	Powder	0	0	6	Bahama Islands.
Cassia	Distilled from the bark of the Laurus Cassia	Essential oil	0	16	0	East Indies and China.
Cassie	Flower of the Acacia farnesiana	Dried flowers	0	6	0	South of France, Italy, and Algeria.
Ditto	Obtained by maceration from the above ...	Pomade or oil ...	0	10	0	Ditto.
Ditto	Distilled from the above	Essential oil	64	0	0	Tunis.
Cedar ...	Distilled from the wood of the Pinus Cedra and Juniperus Virginiana	Ditto	0	16	0	Syria, United States, and Honduras.
Cedrat ...	Distilled or expressed from the rind of the Citrus cedrata	Ditto	1	4	0	South of France and Italy.
Cinnamon	Distilled from the bark of the Laurus Cinnamomum	Ditto	3	4	0	Ceylon.
Cinnamon leaf ...	Distilled from the leaves of the same plant	Ditto	0	4	0	Ditto.
Citronella	Distilled from the leaves of the Andropogon Citratum	Essential oil	0	12	0	Ceylon
Civet	Secretion of the Viverra Civetta	Alcoholate	16	0	0	Indian Archipelago and Africa.
Cloves	Flower bud of the Caryophyllus aromaticus	Powder and alcoholate.	0	1	6	Indian Archipelago, and Zanzibar.
Ditto	Distilled or expressed from the above ...	Essential oil	0	6	0	Distilled in England and France from foreign cloves.
Dill	Seed of the Anethum graveolens	Ditto	0	6	0	England.
Fennel	Distilled from the Anethum fœniculum ...	Ditto	0	8	0	South of France.
Geranium	Distilled from the leaves of the Pelargonium odoratissimum	Ditto	4	0	0	South of France, Italy, Algeria, and Spain.
Ginger grass ...	Distilled from leaves of Andropogon sp....	Ditto	0	12	0	Ceylon.
Iris or Orris ...	Root of the Iris florentina	Powder and alcoholate.	0	0	9	Italy.
Jasmine ...	Obtained by absorption from the flowers of the Jasminum odoratissimum.	Pomade and oil ...	0	10	0	South of France and Italy.
Ditto	Distilled from the above	Essential oil	96	0	0	Tunis and Algeria.
Jonquil ...	Obtained by maceration from the flowers of the Narcissus Jonquila ...	Pomade and oil ...	0	10	0	South of France and Italy.
Laurel ...	Distilled from the leaves of the Cerasus lauro-cerasus	Distilled water ...	0	1	0	Ditto.
Lavender...	Distilled from the flowers of the Lavandula vera...	Essential oil	2	8	0	England.
Ditto	... ...	Ditto	0	6	0	South of France and Italy.
Lemon ...	Distilled or expressed from the rind of the fruit of the Citrus medica ...	Ditto	0	16	0	Coast of Genoa, Calabria, Sicily & Spain.
Lemon grass ...	Distilled from the Andropogon Schænanthus	Ditto	1	0	0	Ceylon.
Limette	Expr. from the fruit of the Citrus limetta.	Ditto	1	4	0	South of France.
Mace	Expressed from the refuse nutmegs ...	Concrete oil	0	8	0	Indian Archipelago.
Marjoram ...	Distilled from the Origana majorana ...	Essential oil	0	8	0	South of France.
Mirbane	Nitrobenzine or artificial Ess. oil of Almonds	Ditto	0	8	0	England and France.

PRINCIPAL MATERIALS USED IN PERFUMERY—(*Continued*).

NAMES.	DESCRIPTION.	IN WHAT FORM USED.	AVERAGE PRICE PER lb. £	s.	d.	PLACE OF PRODUCTION.
Musk	Secretion of the Moschus moschatus ...	Powder and alcoholate.	24	0	0	Thibet, China, and Siberia.
Musk seed .	Seed of the Hibiscus abelmoschus ...	Ditto	0	4	0	West Indies.
Myrtle	Distilled from the leaves of the Myrtus communis	Essential oil	0	16	0	South of France.
Myrrh ...	Exudation of the Balsamodendron Myrrha	Powder and alcoholate.	0	6	0	East Indies.
Narcissus...	Obtained by maceration from the flowers of the Narcissus odorata	Pomade and oil ...	0	10	0	Algeria.
Neroli (bigarrade) ...	Distilled from the flowers of the Citrus Bigaradia	Essential oil	10	0	0	South of France, Italy, and Algeria.
Neroli (Portugal) ...	Distilled from the flowers of the Citrus aurantium	Ditto	6	0	0	Ditto.
Nutmeg ...	Distilled from the fruit of the Myristica moschata...	Ditto	0	6	0	Indian Archipelago.
Orange ...	Distilled or expressed from the fruit of the Citrus aurantium	Ditto	0	12	0	Calabria and Sicily.
Orange flower	Obtained by maceration of the flowers of the Citrus Bigaradia ...	Pomade and oil ...	0	10	0	South of France and Italy.
Orangeflower water	Distilled from the above	Distilled water ...	0	1	0	Ditto.
Patchouly ...	Leaves of the Pogostemon Patchouli ..	Powder and alcoholate.	0	2	0	India and China.
Ditto	Distilled from the above	Essential oil	4	0	0	Distilled in England and France from dried leaves.
Peppermint	Distilled from the leaves of the Mentha piperita	Ditto	2	10	0	England.
Ditto	Ditto	Ditto	0	12	0	United States.
Petit grain (bigarrade)	Distilled from the leaves of the Citrus bigaradia	Ditto	3	0	0	South of France.
Petit grain (Portugal) ...	Distilled from the leaves of the Citrus aurantium	Ditto	2	0	0	Ditto.
Rose	Flower of the Rosa centifolia	Powder	0	5	0	Ditto.
Ditto	Obtained by maceration of the above ...	Pomade and oil ...	0	10	0	South of France and Italy.
Ditto	Distilled from the above	Essential oil or otto ...	24	0	0	Turkey.
Ditto	Ditto	Ditto	40	0	0	South of France.
Ditto	Ditto	Ditto	64	0	0	Tunis.
Ditto	Ditto	Ditto	192	0	0	East Indies.
Rose water ...	Distilled from the above	Distilled water ...	0	1	0	South of France and Italy.
Rosemary ...	Distilled from the Rosmarinus officinalis ..	Essential oil	0	4	0	South of France.
Rosewood ...	Distilled from the wood of the Lignum aspalathum	Ditto	3	0	0	Distilled in France and Germany from foreign wood.
Sandalwood ...	Wood of the Santalum citrinum ...	Powder	0	1	0	India, China, Indian Archipelago, and West Australia.
Ditto	Distilled from the above wood	Essential oil	3	0	0	Distilled in England and France from foreign wood.
Sassafras	Distilled from the Laurus sassafras ...	Ditto	0	6	0	United States.
Serpolet	Distilled from Thymus Serpyllum ..	Ditto	0	8	0	South of France.
Spike	Distilled from Lavandula Spica	Ditto	0	4	0	Ditto.
Styrax	Exudation of the liquidambar styraciflua	Alcoholate	0	6	0	Turkey.
Thyme	Distilled from the Thymus vulgaris ...	Essential oil	0	6	0	South of France.
Tonquin	Beans of the Dipterix odorata ...	Powder, expressed oil, and alcoholate	0	5	0	South America and West Indies.
Tuberose...	Obtained by absorption from the flowers of the Polianthes tuberosa ...	Pomade and oil ...	0	10	0	South of France and Italy.
Vanilla	Pod of the Vanilla planifolia	Powder and alcoholate.	8	0	0	Mexico.
Verbena	Distilled from the Aloysia citriodora ..	Essential oil	5	0	0	Spain.
Violet ...	Obtained by maceration from the flowers of the Viola odorata	Pomade and oil ...	0	16	0	South of France, Italy, and Algeria.
Vitivert	Rhizoma of the Anatherum muricatum ...	Powder and alcoholate.	0	2	6	India.
Ditto	Distilled from the above	Essential oil	2	0	0	
Wintergreen ...	Distilled from the Gaultheria procumbens.	Ditto	1	4	0	United States.

CHEMICAL, ESSENTIAL, AND PERFUMED OILS OF ALL KINDS, IMPORTED INTO THE UNITED KINGDOM.

	1853.	1854.		1855.		1856.		1857.		1858.	
	Quantity.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	lbs.	lbs.	£	lbs.	£	lbs.	£	lbs.	£	lbs	£
Hamburgh	10,598	10,725	2,632	11,798	7,207	5,536	4,825	10,159	4,286	9,630	3,139
Holland	6,067	4,130	1,253	7,133	6,017	4,134	2,136	4,073	1,577	1,562	382
France	39,307	31,928	5,823	38,973	17,996	46,713	20,398	41,861	23,379	53,761	33,913
Sardinia	6,811	3,573	841	2,071	1,257	15,315	6,503	8,901	4,337	2,785	2,248
Two Sicilies	159,682	96,429	25,486	107,165	34,699	119,928	39,574	128,992	48,701	10,055	35,325
Austrian Italy	3,205	2,738	696	257	180	962	971	2,354	1,819	1,241	1,691
Turkey Proper	1,362	2,125	19,651	974	9,828	1,422	14,268	1,875	14,188	1,271	14,916
Java	...	...	...	...	...	...	...	2,741	411	3,958	594
China	9,350	2,639	1,154	9,069	6,253	16,075	9,849	10,145	7,214	25,347	16,005
United States	13,257	22,581	13,574	28,958	21,046	33,493	20,649	23,318	14,816	24,609	12,560
British East Indies	38,953	19,904	4,363	11,606	8,119	29,997	32,606	46,160	36,976	62,696	45,714
Other parts	4,676	6,597	1,395	1,863	1,628	4,885	1,874	900	456	3,289	1,843
	293,268	203,369	76,873	219,865	117,230	288,460	153,653	281,479	158,156	290,204	158,339

The computed value in 1854 and 1855, was from 1s. 10d. to £10 8 0 per lb.
" " in 1856 " 2 0 to 11 8 0 "
" " in 1857 " 2 0 to 11 5 4 "
" " in 1858 " 2 0 to 12 4 8 "

CLASSIFICATION OF ODOURS.

CLASSES.	TYPES.	ODOURS BELONGING TO THE SAME CLASS.
Rose	Rose	Geranium, Sweetbriar, Rhodium, Rosewood.
Jasmine	Jasmine	Lily of the Valley.
Orange Flower	Orange Flower.	Acacia, Syringa, Orange leaves.
Tuberose	Tuberose	Lily, Jonquil, Narcissus, Hyacinth.
Violet	Violet	Cassie, Orris-root, Mignonette.
Balsamic	Vanilla	Balsam of Peru and Tolu, Benzoin, Styrax, Tonquin Beans, Frankincense, Heliotrope.
Spice	Cinnamon	Cassia, Nutmeg, Mace, Pimento.
Clove	Clove	Carnation, Clove Pink.
Camphor	Camphor	Rosemary, Patchouly.
Sandal	Sandalwood	Vetivert, Cedarwood.
Citrine	Lemon	Bergamot, Orange, Cedrat, Limette.
Lavender	Lavender	Spike, Thyme, Serpolet, Marjoram.
Mint	Peppermint	Spearmint, Balm, Rue, Sage.
Aniseed	Aniseed	Badiane, Carraway, Dill, Coriander.
Almond	Bitter Almonds	Laurel, Peach Kernels, Mirbane.
Musk	Musk	Civet, Musk-seed, Musk-plant.
Amber	Ambergris	Oak-moss.
Fruit	Pear	Apple, Pine-apple, Quince.

DISCUSSION.

Mr. P. L. SIMMONDS said, that Mr. Rimmel had fully justified the preliminary remarks he had made, and clearly shown that perfumery was not only most interesting as an art, but of much greater importance than was generally supposed in a commercial and industrial point of view. Without following Mr. Rimmel in his historical *resumé* of perfumery, he would pass on to notice a few of the products alluded to, taking them somewhat in his order of enumeration. He would, however, first allude to one point touched upon by Mr. Rimmel—the insufficiencies and inaccuracies of the official statistical details which rendered it exceedingly difficult to analyze or bring out results correctly on many subjects. This was a matter which was discussed only the previous evening, at the Statistical Society. It was, however, difficult to know where to draw the line of detail, so as to particularise instead of aggregating small articles of import and export. The French and American returns were, however, far superior to ours in minuteness of detail and classified arrangement. No notice, however, was taken in the Blue books of fancy or scented soaps exported; they were all thrown together. The small quantity alluded to as exported was only foreign-made soap re-shipped; still, looking at the value, the exports of perfumery must be largely understated. Thus much for statistics, and now he would glance at the animal series of perfumes. Looking at the high price and popular estimation of musk, something might be done to obtain it from other sources than simply the musk deer. The musky odour was very widely diffused in nature, not only in the leaves, roots, and seeds of plants, but in animals, fishes, birds, reptiles, and insects—as, for instance, the musk ox, the musk rat, the alligator, the musk duck, &c. About three years ago, the Chairman, in a valuable paper he had read to the Society on the natural resources of British Honduras, had referred to the alligator as a source of musk, and all who had been in the haunts of this reptile knew that there was a strong exhalation of musk given out. He (Mr. Simmonds) at that time, had furnished Mr. Temple with several corroborative instances of musk being obtained from this animal.* Mr. Chief Justice Temple had presented him with one of the musk glands there alluded to, which he had himself extracted from an alligator. Now, as this animal was one not usually spared when met with, although somewhat difficult to kill, from its scaly armour, yet a commercial onslaught on it would be beneficial to the safety and comfort of man. Passing to the floral series, he could only add that there were rich stores of wild flowers in heaths, plains, forests, and savannahs in most of our colonies, waiting but the gathering of the richly-perfumed blossoms to be utilised in some way; and as there were Government botanic gardens at the Cape, Mauritius, Calcutta, Ceylon, and several of the West India Islands, the managers of them would no doubt, upon application, be as ready to furnish valuable suggestions and information on application as Dr. Müller, of Victoria, had done. The distillation of otto of roses was an interesting field of investigation, and some information relating thereto had been recently published in the *Pharmaceutical Journal* by Mr. D. Hanbury. The use of aromatic flowers for flavouring tea in China was very general. Among those used were the curious green flowers of Chu-lan (*Chloranthus inconspicuus*), Pacsheen, the sweet scented pale yellow flower of the *Gardenia florida*, Quy-fa, or Kuey-hoa, the yellow flower of *Olia fragrans*, Moo-Sy-Hoa (*Jasminum Sambac* and *Paniculatum*) orange flowers. The cowslip-flavoured tea was scented with the pink flowers of the *Primula prœnitens*. Many others were believed to be used, and they should always be in full bloom. The consideration of flowers bordered upon another subject, the character of the honey and the wax obtained from different countries. The flowers of the white-leaved European lime, which is very fragrant and expanded in June, were much sought after by bees, and the honey produced from them was whiter, more delicately flavoured, and on the Continent sold at a higher price, than that produced from any other plant. There was an extra size forest of limes near the town of Kowno, in Lithuania, the honey of which was in

* See *Journal*, vol. V., p. 125.

great demand throughout the Continent, for making particular kinds of liqueurs, and more especially rosoglio. Any one who had tasted many of the imported honeys, and inspected the crude or unbleached waxes which came into commerce from Europe, Africa, India, and America, would find there was a great difference in the odour, character, and colour. The odoriferous grasses from which the several pleasant essential oils were obtained, were of the simplest culture, thriving well in loam and peat soils, and as so much was done in Ceylon with them (40,000 or 50,000 ounces being exported), their attention might be well directed elsewhere to it. From his own experience, he knew the lemon-grass was common in the West Indies, where it was used as a febrifuge. This grass would seem to be a native of Arabia, and was cultivated in the East Indies and the Moluccas, as well as in Ceylon. Although the leaves only were used for oil, it was not impossible that the rhizomes would also contain the active principle in a concentrated form. This grass grew plentifully in many parts of the Madras Presidency, and the oil for perfumery seemed to be largely exported from Travancore. When recently made, this oil was of a light straw colour, but age darkened the colour to a deep red. The citronella oil was very similar in properties, although it had distinct characters, and there was a difference in the commercial value. The Roosa oil, also called Namur, or Neman oil, in appearance and quality differed little from lemon grass. It was obtained in several parts of India from the *Andropogon Iwaranchusa*, of some authors, the *A. Calamus aromaticus*, of Royle. These volatile oi's were extremely pungent, with a peculiar rich and agreeable odour. They were mostly used in the East as stimulants, internally and externally, in the same manner as oil of cajeput. They were very highly esteemed by the wealthy natives of India for the cure of rheumatism. Passing over the citrine and spice series, which were all well-known, he would refer to the wood series, where he thought much might yet be done in extracting the odoriferous principles. The high price of sandal wood, and the estimation in which it was held in the East, made it a profitable article of commerce, and yet, even in Western Australia, it was not developed as it should be. Two kinds were met with in commerce—the white, probably the outer layers of the wood, and the yellow, or citron, the inner wood. The refuse cuttings, or knotty pieces, were known in Southern India under the name of Carippu. The odour of sandal-wood was very strong, rose-like, and enduring. The wood and roots of the *Laurus sassafras* were brought over in billets from North America, being highly aromatic, both in smell and taste; indeed the chips used to be used for giving an agreeable flavour to the *saloop* vended in the streets. There was another sassafras bark, that of the *Atherosperma moschata*, which was used for making tea beverage in Tasmania, and had recently been exported to London. The fragrant bark of the *Magnolia glauca*, called in the United States swamp sassafras, was greedily sought after by beavers, and thence derived one of its common names, beaver-wood. The pleasant violet-wood referred to by Mr. Rimmel should not be confounded with another violet-wood of commerce, a species of *Triptolomœa*, of Bengal, which took one of its popular names from its colour and not from the pleasant odour so characteristic of the Australian wood. Rosewood was a name so generally applied to a large variety of woods, both in their colour and smell, that it was difficult to identify them. Time would fail him were he to go over all the other divisions *seriatim*, but he might observe that, owing to the high price and continued demand for vanilla for flavouring chocolate and perfumery, its cultivation was being attempted with success in Ceylon, Mauritius, and several other of our colonies. Lastly, he might state that one or two of the oils named by Mr. Rimmel were always in demand, and could not be obtained in sufficient quantities. The oil of ben, for instance, was one of the best oils, not only for perfumery, but for fine machinery and watchmakers' purposes, as it retained its limpidity and never got rancid. The Moringa tree was common both in the East and West Indies, but very little of the pure oil of ben was met with. What was generally passed off as such being benine oil, another name for that from sesame and gingelly, which was abundant and cheap. The carapa or crab oil, first brought from Demerara, was to be had from Sierra Leone, whence he had received it under the name of mote grease. Mr. Clark, Surveyor of the Gold Coast, brought it under the notice of the Pharmaceutical Society last month, under the local name of Croupee oil, and it was common on the Gold Coast, the Gambia, and Senegal. The Tamanu oil, from Tahiti, was probably obtained from the *Terminalia catappa*, or wild almond of the East Indies. Having taken up much of the time of the meeting, he begged, individually, to thank Mr. Rimmel for the large amount of information he had contributed on this interesting subject.

Mr. S. Piesse said that this was certainly a most interesting and important subject. For more than 100 years prior to the era of Beau Brummel, perfumes were out of favour in England, and it was the dictum of that celebrated leader of fashion that the olfactory nerves should never be made use of. It was mentioned in "Chambers's Cyclopædia," published in 1740, that perfumes were disused here (in England), but were *à la mode* in Italy and Spain. In 1822, the first book devoted to this subject appeared in our language; it was the work of Charles Lilly, edited by Colvin Mackenzie. By a singular coincidence, with regard to the residence of the gentleman who had read this paper, Mr. Lilly was described "as that celebrated perfumer at the corner of Beaufort-buildings, in the Strand," and who was spoken of in the *Spectator*, *Tatler*, and *Guardian*. Now judging this work to represent the knowledge of the art of perfumery in this country at that period, it must be admitted that it was very imperfect—a century of neglect had done its work, and the art had been lost. Five-and-twenty years elapsed, and the whole commerce of England began to show considerable vitality. The founding of the Australian colonies—the discovery of gold in California and in Australia—the introduction of railways—the application of steam to shipping—and other causes, produced a great increase in our commerce. Amongst other things, the exports of perfumery increased. In Italy, Sardinia, Sicily, and Southern France, some half dozen flowers, jasmin, rose, acacia, orange, bergamot, tuberose, and violet, were extensively grown for perfumery, and easily imported for use in England. The Colonial produce, of course, came first to England. There was no reason why the perfumery trade should not take the highest position in this country; even if it did not exceed that of Germany and France, it might at least be equal to it. The excise duty on spirits of wine, however, prevented England from fairly competing in her own colonies with her German and French neighbours in this particular trade. The spirit used by the perfumery factors of England paid twelve shillings per gallon duty; this (three hundred per cent. on the value of the raw material) checked the art of perfumery. There being no excise duty on paper on the Continent, all sorts of ornamental carton boxes for packing were employed, giving elegance and neatness to the goods, and thus increasing their sale. Till recently there was an excise duty on soap. Refined scented soap was only known as a luxury, and, of course, this was a check to the art of perfumery. When the excise was removed perfumers immediately sent large quantities of scented soap into the market, and it had now come into ordinary use. A great impetus was giyen to the perfumery trade by the removal of the excise duty on glass. France used to ship all her perfumery in stoppered bottles, but England had to be content with a cork. It was well known that scented spirit could not be preserved very well in a corked bottle, and essences sent from England to Calcutta in the old corked bottles, suffered 10 per cent. ullage. Prior to the removal of the excise on glass 2 oz. stoppered bottles were worth 6s. per dozen, and now they were to be had for

2s. 6d. Transparent soap was the invention of an Englishman, yet he was still prevented from reaping the benefit of his very valuable invention by the excise duty on the spirit which was necessary for its manufacture. German and American soap was to be had cheaper in London than that made in this country. He did not view these excise duties on trade products as affecting the individual manufacturer, because it was admitted that the individual must suffer for the multitude, but in consequence of these excise duties a multitude of artizans were injured, by being kept out of employment. It was true that under "certain regulations" perfumers could export scented spirits free from duty, but the expenses were so great that they all but equalled the benefit derived. Still the English perfumery trade was rapidly advancing, and finding favour from the Brazils to New York, from Australia to India and Russia. He was sure he was justified in saying this favour was not ill bestowed, for England now produced the finest perfumes in the world.

Mr. Low said he had much pleasure in hearing that paper read, and he concurred in all that had been stated by Mr. Rimmel, particularly with regard to the statistics of exports of fancy soaps from England to all parts of the world. It was manifest that there was a great mistake in the blue-book as to the quantity of soap exported from England, inasmuch as his own house exported to the United States alone four times as much as was mentioned by Mr. Rimmel. We were to a great extent dependent on France for a variety of perfumes, and we obtained a large supply from that country; but there were also large supplies from the East Indies. In the price of those articles there was very great fluctuation, particularly in those which come from the East, and that circumstance materially affected the profits derived by the perfumers in this country. The consumption of perfumery was considerably on the increase. They found every year their trade increasing, which he in some measure attributed to the lower prices of perfumery in general; and he thought they must all agree with Mr. Rimmel that a trade which gave employment to thousands and pleasure to millions was not to be despised.

Mr. LEWIS had also listened to this paper with much pleasure, and he fully participated in the desire expressed by Mr. Rimmel that the trade in this country should unite, and endeavour to arrive at some means whereby the various products from foreign countries, which were used in the perfumer's art, might be largely increased. His own opinion was that a great deal might be done by a union of the trade; but at present they were so disunited, in consequence of the large amount of competition, that all attempts to act in concert for their mutual benefit had hitherto been unsuccessful. The manufacturer of perfumes in this country laboured under disadvantages, as compared with France, where spirit of wine, which was extensively used in perfumery, was obtained at a much lower rate than in England. He had himself waited upon the principals of some of the largest houses in the trade in London, with the view of forming a deputation to the Chancellor of the Exchequer, to ascertain whether some means could not be devised by which perfumers might be allowed the free use of spirit of wine for the manufacture of their articles, so that they might be able to compete, as far as price was concerned, with the French manufacturers; but he found the trade so unwilling to cooperate for that end—the exceptions being Mr. Low and Mr. Cleaver—that he abandoned the proposal in despair.

The CHAIRMAN said it was now his duty to ask this meeting to accord their thanks to Mr. Rimmel, for the very able, learned, and interesting paper with which he had favoured them. Perfumery was at all times agreeable, but never had it been more so to him, and, he would undertake to say, to everyone present, than it had been that evening; for Mr. Rimmel had communicated to it a special charm, by the able manner in which he had treated the subject. The members of this Society frequently listened with great patience to papers upon subjects of great importance, though sometimes rather dry—very useful but dull — rendering it difficult for the audience to keep up that due amount of attention which the subject perhaps deserved. But Mr. Rimmel had that evening taken them away from the smoke of factories and machinery—from the smith's anvil, and from the founder's forge, and had indulged them with the fragrance of the rose and the scent of the violet. Nevertheless, he confessed he was greatly dissatisfied with one observation which Mr. Rimmel had made respecting the Queen of Hungary. He had great fault to find with his scepticism as to the attractions of a lady of any age, even without the aid of cosmetics. It was, indeed, an unchangeable belief of his that no lady ever arrived at the advanced period of existence attributed to the Queen of Hungary. For his own part, he had never seen a lady who had gone beyond thirty-five, though he was aware that some calumniators had said that ladies did sometimes exceed that age. From the earliest periods perfumery had been a subject upon which great attention had been bestowed by the luxurious and the wealthy. In the later periods of the Roman empire, when the Eternal City was glutted with the treasures of the East, perfumes were necessaries of existence. Mr. Rimmel, amongst other perfumers, had spoken of spikenard. He believed that no perfume was held in greater esteem than spikenard, or royal unguent. What was the nature of that substance he was unable to say. Whether it would now be considered pleasant to the nostrils he could not say, for it was a curious fact that assafœtida, which was intolerable to the olfactory nerves of modern fine gentlemen, was the favourite perfume of the Romans. Musk, the much admired perfume of the present day, when it was first taken from the Thibet deer, possessed an odour which was overpowering. As Mr. Simmonds had observed, the musk scent was obtained from a variety of animals, such as the alligator, which had glands in the lower jaw secreting this scent. A short time ago, he extracted from an alligator two of these kernels. The odour at first was intense and disgusting, but when dried he had no doubt it would be very agreeable to those who delighted in that perfume. He recently presented to the Zoological Society an animal which possessed on its back an orifice from which exuded a most offensive liquor. He had very little doubt, if that liquor were diluted with water or spirit, it might become a very popular perfume. At all events, he would recommend the experiment to be tried. In conclusion, he begged to propose that the thanks of the meeting be tendered to Mr. Rimmel for the very excellent and interesting paper with which he had favoured them.

The vote of thanks having been passed,

Mr. RIMMEL begged to express his gratitude for the manner in which they had received the chairman's kind proposition. He was only too happy to think that his paper had afforded them some little pleasure. With regard to what had been stated by Mr. Simmonds, as to the extraction of the musk from the crocodile, this was the first time he had heard of it. In Ovid and Horace mention was made of a particular perfume called *Crocodileum*, which was supposed to be extracted from the crocodile. He treated this, however, with disbelief; and thought that it was an invention of the Roman perfumers, who perhaps were not quite so truthful as their modern successors in the art. With reference to what had fallen from Mr. Lewis as to the reduction of duty upon spirits, &c., used for perfumery, he (Mr. Rimmel) was afraid that in the present state of the revenue such an application to the government would not be successful. He had not, however, found that circumstance militate against the sale of perfumes in this country, because they were articles of luxury and people who used them could afford to pay the price that was charged for them. He, therefore, did not attach much importance to that difficulty.

The Paper was illustrated by a collection of materials used in perfumery, as well as by some of

the more curious and costly perfumes referred to in the paper.

The Secretary announced that on Wednesday evening next, the 23rd inst., a paper by Mr. W. P. Jervis, F.G.S., "On the History, Geological and Geographical Distribution and Commercial Bearings of the Marbles of Tuscany and Modena, and of the Boracic Acid Lagoons," would be read. W. A. Miller, Esq., M.D., F.R.S., Professor of Chemistry in King's College, London, will preside.

Home Correspondence.

MECHANICS' INSTITUTIONS AND DISCUSSION CLASSES.

Sir,—I have just read a letter in the *Journal*, of February 17th, from Mr. Barnett Blake, recommending the formation of Discussion Classes in Mechanics' Institutions, and giving rules for their formation, and hints to the members, as circulated by the Yorkshire Union of Institutes. Mr. Blake points out the advantages of such classes in promoting the practice of speaking and writing correctly; but he only indicates sources of inconvenience when he says "care should be taken to exclude all subjects connected with theology or party politics, or which are calculated to excite angry feelings." The "Hints to the Members" also anticipate some of the disagreeables scarcely avoidable in free discussion under the most favourable conditions, and peculiarly apt to disturb the true course of argument among youths and inexperienced young men. No doubt, as the hints point out, it is most desirable to avoid personalities and egotistical expressions, and to check the slightest inclination to ill-temper, and that a respectful tone and gentlemanly demeanour should be preserved; but anyone who has felt the excitement of a lively discussion will be disposed to shrug his shoulders, and exclaim, with Portia, "I can easier teach twenty what were good to be done, than be one of the twenty to follow my own teaching." Even in the ventilation of subjects at the meetings of the Society of Arts, I am afraid more than one of the principles laid down in these sensible hints are very frequently violated, but "in the world's broad field of battle" we give and take many rubs and not a few buffets, and the world is prudent enough to regard such passages of arms with entire complacency, and seldom, indeed, is there any outcry about a breach of the peace.

In deciding to form or permit the formation of such classes, then, let the Committees of Institutions take a common-sense view of the probable result, and be prepared to find that, however stringent their regulations, or sagacious their counsel to the young people who will take part as essayists and critics, there will be personalities, grand sarcastic allusions to an inability to supply brains, as well as arguments, scarifyings, and "cuttings up," over which dummy members will chuckle, whatever may be the emotions of the victim, and the charge of sinister motives will be craftily insinuated or rudely blurted out; in short, all the incidents of debate will occur in a Mechanics' Institution discussion class as plentifully as at St. Stephen's, a Town Council, or a Pickwick Club. Again, with respect to the limitation of topics, your correspondent recommends, and most of the rules of such classes ordain, that all subjects connected with theology and party politics should be excluded. Depend on it, the meetings will take their character from a few of the most active members. In a class conducted by a teacher, any reasonable discipline is submitted to, and a score or two of young men may meet together for several years to study mathematics, for instance, and nothing occur to bring their respective religious or political tenets into criticism, or even into notice. But in a mutual instruction class, and one engaged in considering miscellaneous questions, historical, social, commercial, literary, and educational, the prevailing opinions which each member has imbibed in youth relative to the vital doctrines of religion, and the engrossing question of politics, inevitably come out in the papers and discussions, to which they impart zest and vivacity, usually more or less to the sacrifice of some of the amenities of discussion, and to the tampering with the prohibited topics. This is not a speculative notion; it simply expresses the result of the observations of more than a quarter of a century, during which such classes have from time to time come under my notice.

I will not on this occasion trespass further on your space, but I may in a future number request permission to canvass the actual uses of such classes, and also their attendant evils to their members; the reasonableness or policy of sanctioning their formation; and their relation to the training of the young man as a citizen, a point sadly neglected in our institutional organisations.

I am, &c., W. H. J. TRAICE.

MR. NEWTON'S PAPER ON PEAT.

Sir,—At the time when Mr. Reece commenced the distillation of peat for chemical products, there was not then any demand for parrafin oil or photogen.

I know that in several parts of Bohemia, works have been erected for this special manufacture, and are answering very well.

Sir Cusack S. Roney stated that all coal imported into Holland paid a duty of £1 per ton; this is not quite correct, inasmuch as, for all manufacturing purposes, nineteen-twentieths of the duty is remitted.

I speak from experience, having erected several gas-works there, and I know that this is the Dutch law.

I am &c., GEORGE BOWER.

St. Neots.

Sir,—On reading over my paper on peat, as published in the Society's *Journal*, I notice an error, which I am desirous of correcting. In the left-hand column, page 438, it is stated that, "during the process of conversion, each ton of *peat* will yield 2 cwt. of black peat grease." It should have been "each ton of *charcoal*." As I have received many communications, making inquiries respecting Mr. Buckland's process, I may perhaps be permitted to state that the process is not at work in the neighbourhood of London, but that Mr. Buckland is willing to enter into arrangements with proprietors of peat to put the invention into operation on their properties.

I may also mention (as assertions have been made to the contrary) that no pressure is used in Mr. Buckland's process to compress the peat. The Archimedean screws shown in his specification are merely for the purpose of discharging the worm peat through the die plate, and not for compressing the peat in the sense that compression or pressure is usually understood as applied to that material. It will, no doubt, be recollected I clearly stated that pressure was not necessary to consolidate the peat, and that a piece of hard prepared peat was produced which was simply rolled up in the form of a ball by the hand of a workman. This sample I now forward to you for inspection.

I am, &c., W. E. NEWTON.

BLACK-BONED FOWLS.

Sir,—Having seen, by a letter in your *Journal* of April 28, that the existence of fowls with black-bones is disbelieved by several osteologists, I beg to say that we have in our possession two white silk fowls from China, the bones, skin, and muscles of which are all quite black; nor does this appear to be at all the effect of disease, but is, I believe, the natural condition of the fowl. The gamekeeper who has charge of them informs me that the bone is black throughout.

Hoping that some explanation may be offered of this singular anomaly.—I am, &c.,

CHARLES JECKS, Jun.

Woodlands, Thorpe, near Norwich, May 7, 1860.

UNLEAVENED BREAD.

SIR,—I read in the report of the discussion which took place after the reading of Dr. Dauglish's admirable paper on bread-making, that "The Turks lived entirely upon unfermented bread." I beg leave to state, as far as my experience goes, after a residence of ten years in that part of Turkey called Eygpt, and two years in Syria, that I never met with any persons but Arabs who for want of means on a journey ate unfermented bread, except as a Scotch or Irish gentleman may eat oat cakes.

The bread in those countries is fermented with a little of the leaven of the previous day.—I am, &c.,

JOSEPH BONOMI.

Portsdown-road, Maida-hill, May 9, 1860.

MEETINGS FOR THE ENSUING WEEK.

MON. .....London Inst., 7. Rev. Henry Christmas, "On Eminent Personages of English History living between the years 1640 and 1660.'
Brit. Architects, 8. Mr. Arthur Ashpitel, "On the Origin and Development of the use of Crypts in Christian Church from the earliest period."
Medical, 8½. Mr. H. Haynes Walton, "On the Ophthalmoscope and its application, with practical illustrations.
United Service Inst., 8½. Captain Tyler, "Answer to Mr. Fergusson's Paper upon his system of Fortification."

TUES. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbivorous Mammalia—The Zebra."
Civil Engineers, 8. 1. Mr. M. Scott, "On Breakwaters, Part II." 2. Mr. J. M. Heppel, "On the Methods of Computing the Strains and Deflections of Continuous Beams, under various Conditions of Loads, &c."
Medical and Chirurg., 8½.

WED. .....Royal Soc. Literature, 4½.
Society of Arts, 8. Mr. W. P. Jervis, F.G.S., "On the History, Geological and Geographical Distribution and Commercial Bearings of the Marbles of Tuscany and Modena, and of the Boracic Acid Lagoons."

THURS. ...Linnæan, 1. Anniversary.
Royal Inst., 3. Professor Ansted, "The Decay and Preservation of Building Materials."
Philosophical Club, 6.
Numismatic, 7.
Antiquaries, 8.
Royal, 8½.

FRI. .....United Service Inst., 3. Mr. C. W. Siemens, "Electric Telegraphs."
London Inst., 7. Prof. Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Royal Inst., 8. Mr. W. Pengelly, "On the Devonian Fossils of Devon and Cornwall."

SAT. .....Royal Inst., 3. Mr. F. A. Abel, "On Gunpowder and Gun Cotton."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on April 26th, 1860.

84. III. Trade and Navigation Accounts (31st March, 1860.)
164. Bankruptcy—Returns.
195. Berwick-on-Tweed Election—Minutes of Evidence.
219. Portsmouth Dockyard—Correspondence.
231. Parliamentary Boroughs—Return.
238. Poor Rate Assessments—Return.
92. Bill—Landlord and Tenant (Ireland).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 11th*, 1860.]

Dated 24th March, 1860.

770. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in the method of and apparatus for the manufacture of candles. (A com.)

Dated 29th March, 1860.

812. B. Cooper, Frome, Somersetshire—Imp. in warping and beaming yarns preparatory to weaving.

Dated 14th April, 1860.

932. E. J. Hughes, Manchester—Imp. in machinery or apparatus for sewing. (A com.)

Dated 16th April, 1860.

948. A. C. Richard, New York—The manufacture of improved machine belting and apparatus connected therewith.
948. C. Broglia and P. Pouchaut, Clerkenwell—An improved apparatus to be employed in the roasting and preparation of coffee, cocoa, and chicory.

Dated 18th April, 1860.

972. R. A. Brooman, 166, Fleet-street—A method of, and apparatuses for, communicating to railway passengers the names of the stations which the train successfully approaches. (A com.)
976. W. Davenport, 7, Bread-street, London—Imp. in roller window blinds.
978. M. L. Byrn, New York, U.S.—An imp. in cork screws.

Dated 19th April, 1860.

980. B. Lauth, Manchester—Imp. in machinery or apparatus for straightening metal bars, rails, rods, tubes, plates, and other similar articles.
982. B. Harben and R. I. Hathaway, Leadenhall-street—A substitute for ordinary butter, especially adapted for the use of pastry-cooks, biscuit-makers, and general culinary purposes.
984. J. Willis, Little Britain, London—Imp. in the manufacture of umbrellas and parasols, part of which improvements is applicable to walking sticks.
986. J. F. Mayr, Vienna, Austria—Imp. in the obtaining of light, and in the apparatus employed therein. (A com.)

Dated 20th April, 1860.

988. C. F. Sebille, Nantes, France—A non-metallic composition to be used in the manufacture of water, gas, and other pipes or conduits, and machinery or apparatus to be used in such manufacture.
992. W. C. Ridings, Middleton, Lancashire—Imp. in machinery or apparatus for reading and repeating designs for perforating cards or paper for Jacquard weaving.
994. H. A. Silver, and J. Barwick, Silvertown, Essex—Imp. in moulding india rubber and other like gums in cells for galvanic batteries, and in insulations for telegraph wires.
996. A. Denny and E. M. Denny, Waterford—A revolving feed apparatus, as applied to singeing pigs, to facilitate the introduction of the carcases into the singeing apparatus.

Dated 21st April, 1860.

998. W. Clark, 53, Chancery-lane—Imp. in enclosing or covering opium and other matters. (A com.)
1000. W. Butlin, Northampton—Imp. in apparatus for superheating the steam and heating the feed water in steam boilers.
1002. J. Lewtas, Manchester—An imp. applicable to outside sun blinds.
1004. W. Buckwell, Phœnix Stone Works, East Greenwich, Kent—Imp. in the manufacture of slabs, plates, and panels for the transmission of light.
1006. J. Walker, Walsall, Staffordshire—Imp. in railway points or switches, and also in the keys for securing the rails in the chairs of railways.

Dated 23rd April, 1860.

1008. J. Parkinson, Victoria Brass Works, Bury, Lancashire—Imp. in machinery for separating small particles of iron or steel from brass and other metals or materials.
1012. R. A. Brooman, 166, Fleet-street—Imp. in milk cans. (A com.)
1014. G. H. Birkbeck, 34, Southampton-buildings, Chancery-lane—Imp. in machinery or apparatus for printing woven or other fabrics or tissues. (A com.)

Dated 24th April, 1860.

1015. A. Ritchie, Glasgow—An improved system of book-keeping.
1017. E. Hillam, Baildon, near Leeds, and R. Wilson, Halifax, Yorkshire—Imp. in apparatus employed in finishing textile fabrics.
1019. E. Wilkins, 8, Bath-terrace, Camberwell New-road—Imp. in the manufacture of boots, shoes, and goloshes.
1021. J. Brodie, Bow, Fife, N.B.—Imp. upon latches and bolts employed upon locks and other fastenings.
1023. F. Wrightson, Birmingham—Imp. in applying certain waste or refuse products to the purification of coal gas, and in utilizing compounds obtained in purifying coal gas.
1024. J. Stafford, Oakerthorpe, Derby, and B. Stafford, New Lenton, Nottingham—An improved method of applying heated air or steam for drying stoves, or boiling liquids, or for other purposes.
1025. C. E. Albrecht, Radnor-place, Hyde-park—An improved apparatus for sifting or screening.
1026. J. W. Fuller, Deptford—An improved method of fitting dead-eye-chain and preventor plates to ships.
1027. W. Clark, 53, Chancery-lane—Imp. in the manufacture of ammonia. (A com.)
1028. J. W. Ford, Change Alley, Cornhill—Imps. in the driving gear of pumps. (A com.)
1029. H. J. Morgan, 48, Gloster-terrace, Hyde-park—Imp. in rockets.
1030. A. V. Newton, 66, Chancery-lane—An improved construction of ship's stove. (A com.)

Dated 25th April, 1860.

1032. J. Kennedy, Church-street, Millbank-street, Westminster—Imp. in the construction of sliding sash frames or windows.
1033. T. A. Claeys, Ostend, Belgium—Improved machines for the manufacture of corks, bungs, and shives.
1034. V. Lardin, Montigny-le-Roi, France—Imp. in water pumps.

1035. C. Minasi, 3, St. James's-terrace, Kentish Town road—Imp. in music stools and other seats and in stands for supporting music books and other articles.
1036. A. K. Eaton, New York—A mode of manufacturing steel.
1037. G. J. Parker, Church-street, Stoke Newington—Imp. in the means or apparatus for raising water and other fluids.
1038. J. Mason, Jun., Preston—Imp. in looms for weaving.
1039. S. Nichols, 7, Buckland-street, New North-road, Hoxton, and H. Leonard, 45, Arlington-street, Islington—An improved fire guard or protector.
1040. X. Tarte, 20, Rue de l'Union, and W. Toovey, 3, Rue de la Pompe, Brussels—Imp. in the construction of floorings and roofings and other parts of buildings and other structures, which improvements are also applicable to the construction of bridges and other works.
1041. R. Seager, Ipswich—Imp. in the manufacture of boots and shoes.
1042. J. G. West, Fleet-street—An imp. in compasses.
1043. J. A. Hartmann, Mulhouse, France—The extraction of a certain colouring matter from rags and other waste vegetable textile fabrics containing the same.

Dated 26th April, 1860.

1045. J. Clark and W. Cross, Glasgow—Imp. in power looms for weaving checks.
1046. A. Robertson, Neilston, Renfrew—Imp. in steam-boiler furnaces.
1047. E. W. Fernie, 11, Old Jewry-chambers, London—Imp. in open fireplaces and in their flues.
1048. W. Bate, Wolverhampton—Imp. in attaching knobs to spindles of door locks and latches.
1049. J. Wright, 42, Bridge-street, Blackfriars—A new mode of preventing incrustation in boilers using sea or calcareous waters. (A com.)
1050. W. Maltby, De Crespigny-park, Camberwell—Imp. in the treatment of rice in order to manufacture starch, starch gum, and gums.
1051. G. F. Train, Liverpool—An improved system of railway or tramway to be used with horses or other power, and passenger carriages for the same.
1052. W. Buckwell, Phœnix Stone Works, East Greenwich—Imp. in the construction of iron roofs and bridges, and in apparatus to be used in their erection.
1053. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in portable bedsteads, and in the mattresses to be used therewith. (A com.)
1054. R. A. Brooman, 166, Fleet-street—Imp. in lamps. (A com.)
1055. W. Clark, 53, Chancery-lane—Imp. in boring bits. (A com.)
1058. W. J. Harvey, Exeter—Imp. in the manufacture of breech loading fire-arms, also in cartridges applicable for the same.

Dated 27th April, 1860.

1057. W. Northern, 14, Vauxhall-walk, Lambeth, Surrey—An imp. in the internal construction of kilns used for the burning of stoneware or earthenware of every description.
1060. W. B. Taylor, Ballymena, Antrim, Ireland—Certain imp. in looms for weaving.
1061. P. Thorn, 70, Cumberland-street, Pimlico—Imps. in signals applicable to domestic and other purposes.
1062. G. Ager, Aylsham, Norfolk—Imp. in means or apparatus for breaking up or opening land.
1063. J. Nichols, Pendleton, Lancashire—Imp. in looms for weaving.
1064. J. Bullough, New Accrington, Lancashire—Imp. in looms for weaving.
1065. F. Thonet, Vienna—Imp. in the construction of wooden wheels.
1066. J. Lorkin, Brighton—An imp. in the manufacture of gunpowder. (A com.)
1067. H. S. Rosser, Kensington—An improved sole to be worn in boots and shoes.
1068. W. E. Newton, 66, Chancery-lane—Imp. in ordnance and fire-arms. (A com.)
1069. L. A. Floire, 29, Boulevart St. Martin, Paris—An improved electric break.
1070. T. Sibley, Ashton-under-Lyne, Lancashire—Imp. in looms for weaving.
1071. G. Withers, West Bromwich, Staffordshire—Certain imp. in fire-proof wrought iron safes, chests, or closets, in locks for the same, and other purposes, and for certain apparatus to be used in connection with the same.
1072. J. V. Scarborough and D. McMillan, Belfast—Imp. in the manufacture of boots, shoes, and clogs.
1073. W. Low, Edinburgh, Mid-Lothian, N.B.—Imp. in machinery or apparatus for rubbing or finishing printing types.

Dated 28th April, 1860

1075. T. Molineux, Manchester—Imp. in pianofortes.
1077. A. L. Dowie, Glasgow—Imp. in gas-burners, and in pressure-regulating apparatus for the same.
1079. W. H. Samson, St. Brelade's Bay, Jersey—A machine or apparatus for the cultivation of the soil.
1081. E. Southorn, Broseley, Salop—An imp. in, or addition to, tobacco pipes, and improvements in the manufacture and ornamentation of tobacco pipes.
1083. H. Rawson, Leicester—Imp. in machinery for combing wool and other fibres.

Dated 30th April, 1860.

1085. G. Masure, Brussels—Imp. in the construction of railway crossings.
1087. J. P. Gillard, Alfred-road, St. John's-ville, Upper Holloway—Imp. in apparatus for manufacturing gas for lighting and heating, and for obtaining motive power.
1089. H. T. Green, Moreton, and S. B. Wright, Parkfields, Staffordshire—Imp. in machinery for the manufacture of plain and ornamented bricks, slabs, tiles, and quarries.
1091. E. T. Hughes, Chancery-lane—Imp. in jointing or connecting rails of railways. (A com.)
1093. J. H. Bennett, 7, Vanburgh-place, Leith—Combined direct-action balance safety valves.

Dated 1st May, 1860.

1095. F. Preston, Manchester—Certain imp. in breech-loading fire-arms, and in projectiles, also in the machinery employed in manufacturing projectiles.
1097. J. H. Walsh, Kensington—An imp. in breech-loading fire-arms, and in rests to be employed therewith, which rests are also applicable to other descriptions of fire-arms.
1099. W. Anderson, Glasgow—Imp. in the manufacture or production of nitrate of potash and soda, and in the application and use of certain products of such manufacture in the manufacture of soap.

Dated 2nd May, 1860.

1101. A. Bain, Rahere street, Goswell-road—Imp. in the means of obtaining copies of letters and other writings or documents.
1105. B. Browne, 52, King William-street—A self-heating ironing apparatus. (A com.)
1107. M. Bonnor, Eurville, France—Imp. in machinery for rolling bar-iron, steel, and other metals or malleable matters.
1109. T. Silver, Philadelphia—Imp. in the machinery for, and method of driving or communicating motion to, a ship's propeller.

Invention with Complete Specification Filed.

1121. D. West, 2, Egremont-place, Euston-road—An imp. for working the geometrical cotton press with steam power.—5th May, 1860.

Patents Sealed.

[*From Gazette, May 11th*, 1860.]

May 11th.
2568. W. Burgess.
2569. J. Scott.
2570. A. Vickers.
2573. E. A. S. Burgess-Burgess.
2577. J. Madin.
2581. C. H. Brooks.
2583. H. J. Daniell.
2584. W. H. Ward.
2585. W. H. Ward.
2586. E. Borlase.
2587. J. Donald.
2590. C. P. Alvey.
2592. W. Wilkins.
2597. W. Baker.
3650. W. Keates.
2666. W. Smith.
2714. J. Lawson and S. Cotton.
2876. R. P. Busk and T. Greenwood.
2946. W. E. Newton.
662. A. V. Newton.
664. W. E. Newton.

[*From Gazette, May 15th*, 1860.]

May 15th.
2603. J. Ward and H. Burman.
2607. R. Laming.
2609. J. L. Jullion and G. Pirie.
2612. W. Gossage.
2613. J. Pinchbeck.
2623. A. Godchaux.
2631. W. Whittle.
2637. J. T. Pitman.
2661. J. Fyfe.
2692. C. Sells.
2704. G. J. Wainwright.
2758. C. Sells.
123. T. G. Dawes.
155. J. F. Belleville.
437. T. H. Morrell.
510. C. Wetter.
709. R. Briggs.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, May 11th*, 1860.]

May 7th.
1289. C. W. Ramié.

May 8th.
1317. R. Wilson.
1372. W. H. King.

May 9th.
1362. D. Hesse and M. Hesse.

[*From Gazette May 15th*, 1860.]

May 10th.
1344. T. Barnes and J. Starkey.
1351. R. D. Kay.
1559. E. Roy.

May 11th.
1350. J. R. Cochrane.
1375. I. Whitesmith and W. Whitesmith.
1407. W. Whitehead.
1450. S. Fox.
1453. W. Carron.
1470. J. Crossley.

May 12th.
1400. C. F. Vasserot.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, May 11th*, 1860.]

May 7th.
1136. D. Law and J. Inglis.

May 9th.
1143. J. Clapham, T. Clapham, and W. Clapham.

[*From Gazette, May 1 th*, 1860.]

May 10th.
1156. M. P. F. Mazier.

May 11th.
1223. B. P. Walker & J. Warren.

May 12th.
1204. R. W. Swinburne.

Journal of the Society of Arts.

FRIDAY, MAY 25, 1860.

THE INTERNATIONAL EXHIBITION OF 1862.

The Council of the Society of Arts have the satisfaction of announcing that the sum of a quarter of a million, which was the minimum fixed for ensuring the Exhibition, has been guaranteed. The amount already promised (including the subscription of H.R.H. the Prince Consort for £10,000), is £265,750, and is daily increasing. It is the wish of the Council that it should be made as large as possible.

The satisfactory state of the Guarantee Fund has induced the Council to apply to the Commissioners of the Exhibition of 1851 for a portion of the land at Kensington, purchased out of the surplus fund of the last Exhibition, in order that it may be secured for the next and future International Exhibitions, in accordance with the decisions of the Commissioners made in 1850 respecting the disposal of the surplus.

The Council will deem it necessary to apply for a Royal Commission, so that the managers may be in a proper position to correspond direct with foreign countries.

Shortly after Whitsuntide a meeting of the Guarantors, and others interested in promoting the Exhibition, will be held in the Metropolis, at the Mansion House, at which the Lord Mayor has kindly consented to preside.

The First List of Subscribers to the Guarantee Fund will be made public at this meeting.

GUARANTEE COMMITTEE FOR THE EXHIBITION OF 1862.

The Council have much pleasure in announcing that the following noblemen and gentlemen, representing Arts, Manufactures, and Commerce, have agreed to act on a Committee for promoting the Extension of the Guarantee Fund, as far as possible, beyond the sum of a quarter of a million.

Abel, F. A., Woolwich.
Ashburton, Lord
Appold, John George, F.R.S.
Bagnall, Charles
Bazley, Thomas, M.P., Manchester.
Bell, John
Binns, R. W., Worcester
Bodkin, W. H., Assistant-Judge for Middlesex.
Brassey, Thomas
Bridson, Henry
Brocklehurst, T. V., Macclesfield.
Chambers, T. K., M.D.
Chance, Frank, M.D.
Chester, Harry
Clabburn, W. H., Norwich.
Clegg, Thos., Manchester
Cole, Henry, C.B.
Cubitt, Wm., Alderman, M.P.
Dillon, John
Donkin, Thomas
Doulton, Henry
Elkington, Fredk., Birmingham.
Ewart, Wm., M.P.
Fairbairn, Wm., F.R.S., Manchester.
Frith, J. G.
Godwin, George, F.R.S.
Graham, Peter
Gurney, Samuel, M.P.
Hollins, M. Daintree (Messrs. Mintons', Stoke-upon-Trent).
Hankey, Thomson, M.P.
Hawes, William
Hope, Henry Thos.
Hoskyns, C. Wren
Lapworth, Alfred
London, The Lord Mayor of
MacGregor, John
Mackrell, W. T.
Mechi, J. J., Alderman
Myers, George
Nicoll, Donald, M.P.
Owen, Lt.-Col. H.C., R.E., C.B.
Pakington, Rt. Hon. Sir John, Bart., M.P.
Paxton, Sir Joseph, M.P.
Peel, George, Manchester.
Portal, Wyndham S.
Prescott, W. G.
Redgrave, Samuel
Rock, J., Jun., Hastings.
Roney, Sir Cusack
Salisbury, the Marquis of
Salomons, Aaron
Salt, Titus, Bradford.
Sandford, F. R.
Saunders, W. Wilson
Simpson, W. B.
Sopwith, Thomas, F.R.S.
Stanley, Rt. Hn. Lord, M.P.
Twining, Thos., Jun.
Tylor, Alfred
Uzielli, Matthew
Westmacott, R., R.A.
Whatman, James, Maidstone.
Wilson, G. F., F.R.S.
Winkworth, Thomas
Wodderspoon, James
Wood, Vice-Chancellor Sir W. Page

The Council have asked the Marquis of Salisbury, K.G., to act as Chairman, and the Lord Mayor of London, the Lord Stanley, M.P., the Vice-Chancellor Sir Wm. Page Wood, and Mr. Thomas Bazley, M.P., to act as Vice-Chairmen of the Committee.

Members of the Society, willing to act on this Committee, are requested to send in their names to the Secretary.

The Committee will meet for the first time on Tuesday, 5th June, at the Society's House, Adelphi, at 12 o'clock.

CONVERSAZIONE.

The Second Conversazione of this Session will take place to-morrow (Saturday) evening, at the South Kensington Museum.

The Elliston Collection of Water-Colour Paintings will be exhibited for the first time, and in addition to the Museum under the charge of the department of Science and Art, the Vernon and Turner Galleries of Paintings, and the Collection of Models belonging to the Commissioners of Patents, will be thrown open, by permission of the Trustees of the National Gallery and the Patent Commissioners.

The band of the Coldstream Guards will be in attendance.

The doors will be opened at 8 o'clock.

NINTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS.

The Ninth Annual Conference between the Representatives of the Institutions in Union and the Council will be held on Friday, the 22nd June, at 10 o'clock in the morning. Sir Thomas Phillips, Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, as soon as possible, to the

Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference, stating at the same time (if possible) whether those gentlemen will also be present at the Society's Annual Dinner, which will take place on the same day, and of which particulars are given below.

The Chairmen of, or Representatives from, the several Local Boards of Examiners are invited to attend.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Friday, the 22nd June, at six o'clock punctually. The Right Honourable Benjamin Disraeli, M.P., will preside.

Members and their friends are invited to be present, and tickets (price 10s. 6d. each) may be obtained at the Society's House.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William C. Ross, R.A., is now open at the Society's House, and will remain open during the month of May only.

The public are admitted on payment of one shilling each person.

Members of the Society of Arts have free admission, and may *personally* introduce one friend.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th April, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 23, 1860.

The Twenty-fourth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 23rd instant, Dr. W. A. Miller, Professor of Chemistry in King's College, London, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Brodhurst, Bernard E. | Jackson, John, Jun.

The Paper read was—

ON THE HISTORY, GEOLOGICAL AND GEOGRAPHICAL DISTRIBUTION, AND COMMERCIAL BEARINGS OF THE MARBLES OF TUSCANY AND MODENA, AND OF THE BORACIC ACID LAGOONS OF THE MAREMME.

By W. P. Jervis, F.G.S.

Were I treat of the mineral resources of Australia, I should dwell entirely on the future; in speaking of our own mines I should enlarge on their present condition; but the name of Italy instinctively calls up recollections of the past. In the paper which I have drawn up I will, however, view the subject in all these lights, as being, perhaps, most interesting.

Owing to the division of Italy among numerous sovereigns, there has necessarily existed great jealousy regarding the interchange of productions of the various states. For this reason the Tuscans have been encouraged by their government to work their own marbles near Serravezza, in opposition to those of Carrara, in the Duchy of Modena, though only ten miles off.

Serravezza, a little town with a population of about 2,000, lies six miles from the coast of the Mediterranean, and thirty-six north of Leghorn, at the foot of the spurs of the Monti Altissimo and Matanna, where two rivulets, the Serra and Vezza, join to form the Versiglia or Serravezza river. Starting from this town, and proceeding eastward up the Vezza for four miles, we reach Ruosina, passing on the road a multitude of quarries of slate-coloured or *Bardiglio* marble, chiefly situated on the lower slopes of the hills. Some is perfectly plain, *bardiglio unito ;* when dark, it is known as *bardiglio scuro :* other quarries, near Farnocchia, higher up towards the Monte Matanna, on the Canale delle Mulina, produce a light blue variety, with black veins, called *bardiglio fiorito*. A similar marble occurs near Carrara, but as the Tuscan beds yield a stone of greater hardness, they are preferred, and have been worked for the last sixteen centuries at least. Signor Santini, of the School of Fine Arts, informed me that the "Lion" and the "River" of the Vatican, and the "Slaves" of the Campidoglio at Rome, which date from the time of Antoninus, are sculptured in Serravezzan bardiglio. The same marble has been employed in many buildings in Florence. It is of Triassic origin, and the oldest in Tuscany.

Above this comes a celebrated ornamental stone, termed *Mischio di Serravezza*, formed from the fragments of rock which have been chipped off the parent mass, or separated by violence or pressure; they have become subsequently united by a hard cement of amphibole, or specular iron, filling up all the interstices, as if semifluid matter were poured over a heap of broken stones by the roadside; the result being a hard, compact breccia, perfectly free from fissures. The paste, when highly ferruginous, tinges the fragments of white marble of a pale pink; the presence of a large quantity of silicates often renders the breccia very much harder than ordinary marbles.

The analysis of the cement made at Pisa by Passerini, gave—

Silica	39·0
Peroxide of Iron	22·0
Alumina	30·5
Magnesia	3·0
Lime	2·0
Water and Loss	3·5
	100·0

The stratification of the metamorphic marbles is exceedingly difficult to trace, but in a quarry of mischio, opposite Ruosina, it is perfectly evident, the beds being there seen resting at a small angle on older rocks. I there observed a huge block of mischio which had been recently

taken out, and could not have contained less than 250 cubic feet, without any flaw.

White saccharoidal marble is found immediately above the beds of Mischio, while underneath is a compact limestone. Specimens which I procured exhibit very nicely the secondary metamorphosis of the fragments of the white crystalline marble. They are tinged with pink, the colouring matter not, however, penetrating the entire mass, as though the heat had been insufficient to produce an uniform appearance. The result has been a delicate ribband-like veining, the full colour of the cement being often communicated to the adjacent portion of the marble, so as to obliterate their outline, and gradually softening off through every shade till it blends with the pure white. Professor Savi is of opinion that the cement contains talc, chlorite, and amphibole. (*Nuovo giornale di Letterati di Pisa*, No. 51. 1830.)

The Paleozoic strata in this district are composed of steaschists, as at Levigliani, anagenite, near Azzano, where this very hard conglomerate contains pebbles of quartz as large as a fowl's egg, but though it has evidently been rendered more compact by heat, the quantity of silica appears to have prevented fusion from resulting. In the direction of the Monte Forato, more to the east, the quartz appears in smaller fragments, the rock has assumed a perfectly crystalline character, and is used as a refractory stone, being eminently adapted for reverberatory furnaces.

No two blocks of mischio are alike, an endless variety of tints and patterns producing a lively effect, especially as it bears a high polish. This stone is too variegated to be suited for anything but internal decoration, the colours being only developed when polished. It is stated that the columns of the cathedral of Pietra Santa, made of mischio, are of the 14th century, and a large part of the Campo Santo, at Pisa, that marvellous national monument of celebrated Tuscans of the Middle Ages, is formed of mischio. The first particulars of the quarries being worked is in 1565, by Michael Angelo, who discovered an eligible place while exploring the Versiglia, by order of Cosmos I., Grand Duke of Tuscany. Vasari was subsequently sent to report on the quality of the stone; his reply being favourable, it was soon largely employed in Florence, as for the pilasters of the Church of the Annunziata, and the Pitti Palace; also some of the horses in the fountain of Neptune, on the Piazza del Gran' Duca; also the two obelisks on the Piazza Sta Maria Novella. Cosmos I. ordered an immense column to be made of mischio at Stazzema.

Several beds are formed of marble, with white ground and purple veins; it is commercially distinguished from the mischio under the name of *Affricano di Serravezza*. It was employed in the construction of the Palace of Versailles, and for tables in some of the rooms. The mischio is an excellent Lower Liassic stone, and weathers but little.

By far the most important in the same localities are very extensive beds of white marble, also Lower Liassic, as between Serravezza and Ruosina, and some just opened on the hill side south of the Vezza, a little below Ruosina, which I visited also, on the Alpe de Levigliani; the best and most abundant is that of the Falcovaja quarries, on Monte Altissimo, eight miles north of Serravezza. Here the limestone to the very base has been transformed into white marble of great beauty. The stratification is completely gone; it is difficult to find it free from veins, but the yellowish tinge of the finer parts causes it to be much prized. With what justice, I do not pretend to say, the best statuary from the Falcovaja is pronounced by Tuscans to be superior to Carrara marble, on account of its uniformity of structure and absolute freedom from grey veins. Comparing specimens which I procured from the Campanino quarry, with others from above Carrara, the grain is much finer and less lamellar, characterised by being very sonorous; the action of the atmosphere is said to improve and render it harder.

Nothing can be grander and more imposing than the sight of Monte Altissimo, as it suddenly bursts into view in ascending the little rivulet Serra; one can scarcely believe that these precipitous crags are composed of sedimentary rocks. The mountains,

"On whose barren breast the labouring clouds do often rest,"

here form an amphitheatre, with rugged bold summits rising to the height of 5,440 feet; so steep is the ascent of its almost perpendicular sides that for a whole morning I tried in vain, by every exertion, to reach to one of the most celebrated quarries, which can only be approached by the skilled mountaineers who work there. Below the quarries the slopes are often covered with loose angular stones, the fragments of marble and rubbish turned out by the men, or the masses broken off by the weather. These steep inclined planes afford an easy means of sliding down the blocks without injuring them, or necessitating the use of mechanical contrivances. They reach the bottom by their own weight, carrying along with them much *débris*. Being pure white, and less weather-worn than the mass of the mountains, these rubbish slopes present a brilliant appearance in the sun, especially on the Modenese side, and may be readily distinguished for seven or eight miles. The whole summit of Monte Altissimo seems to have borne the brunt of more than its share of destructive thunder-storms and tempests; it is rugged and denticulated in the most surprising manner; the crest in many places is as narrow as the ridge of a roof. At a distance I should have considered it was the interior of a volcanic crater.

Towards the east the summits of the mountains are chiefly composed of white marbles; such are the Pania della Croce; the nearer Alpe di Levigliani, which is only a branch of Monte Corecchia; and Monte Trambiserra. It is an inexhaustible and little tried field of wealth. All these lofty mountains form part of the Apuan Alps, and are in Tuscany; Monte Corchia, two miles west of the Altissimo, forms the boundary between it and Modena; and no sooner do we pass the crest than the eye soars, as in a panorama, over a very extensive new series of quarries, extending with little interruption northwards towards the Monte Tambura, and along the numerous minor spurs above Massa to the celebrated town of Carrara.

The white marble approaches within a mile of Carrara, at Torano and Miseglia; in fact, a gentleman informed me that the best kind of statuary marble was obtained at the former place. Two spurs descend from Monte Sagro towards Carrara; suddenly terminating in the slopes above Torano, they enclose a deep narrow ravine, having nearly a straight course to its junction with the Carrione. The steep sides of this precipitous valley are entirely composed of white marble, and are quarried in their whole extent, according to the caprice of the respective proprietors, who mine here and there, as they consider the quality of the marble likely to be best. These are the spurs whence I may say all the Carrara statuary marble is obtained, the names of the eight quarries producing it being as follows:—Betogli, Crestola, Carpevola, Cavetta, Mossa, Polvaccio, Poggio Silvestro, and Zampone. The marble is almost pure carbonate of lime. Berthier (*T. des essais*, tom. 1., p. 614) gives the analysis:—

Lime	55·4	or, Carbonate of Lime	98·1
Magnesia	0·4	Carbonate of Magnesia	0·9
Carbonic Acid	43·2		
Clay and Quartz	1·0	Clay and Quartz	1·0
	100·0		100·0

I will refrain from giving any calculation of the thickness of the beds—which, however, is very considerable—as it is a very difficult matter to trace them to their base, on account of the vast amount of *débris* lying about in every direction; planes of cleavage are also very numerous, as at Serravezza; frequently oxide of iron has penetrated into scarcely perceptible fissures, staining the marble around a dirty reddish-brown, and rendering it unfit for use.

Numerous thin talcose beds occur here, as I have also observed in the Serravezza quarries, accompanied by crystals of iron pyrites a sixteenth of an inch in the cube, gypsum, sulphur, talc, and pure white rhombohedral crystals of dolomite. By far the most interesting mineral is the quartz, which crystallises in the cavities of the marble, sometimes attaining one inch in length. It is perfectly limpid, whence the name *Carrara diamonds*. Some which I procured enclose foreign substances. I observed that in general they presented a very small point of attachment to the rock. These numerous associated minerals are eagerly sought for by the quarrymen, as they accompany the best statuary marbles.* They are known as *Madre-macchie* (mother spots). Some fissures thus filled up are several inches in thickness, others do not exceed one line in width, and contain a few scattered crystals of iron pyrites, firmly imbedded in the marble on one side. It is due, I consider, to the oxidation of these crystals that, on exposure to the air, the marble is discoloured and tinged reddish-brown.

As the statuary marble is the most highly crystallised, it is the most difficult to obtain free from flaws, though slightly veined white forms the mass of the mountains, and might be obtained to any extent desired, provided the market were good, and a better system of working introduced. The saccharoidal structure of the statuary marble is most perfect north-east of Carrara, and next on the Altissimo; in other parts it is less so, till finally it is scarcely perceptible. I would ascribe the coarseness of the grain to slower cooling, and imagine that the localities mentioned must have been protected from the influence of the air at the time of the metamorphosis, by a great depth of superincumbent strata in the form of *hills*, while they were most nearly connected with the focus of igneous action below.

To attempt any description of the first opening of the white marble quarries of Carrara would be vain; they evidently sprung into existence in very remote times. Etruscan antiquities are frequently sculptured in marble, though they are so much worn that I have not been able to ascertain if the material employed came from this district. The Romans, however, having brought over a large quantity of Grecian statuary, especially during the luxurious days of the Empire, directed their attention to their own beautiful white marbles of Carrara. I noticed two monumental inscriptions about a mile from Miseglia, the property of a gentleman, who had discovered them close to his house. Another, of the time of Septimus Severus, was found in the neighbourhood many years ago; others have, doubtless, been destroyed by the villagers, to whom fragments of statuary marble are but road-metal. One quarry, four miles north-east of Carrara, called Polvaccio, is acknowledged to date from Roman times, and to be the spot whence the marble of the Pantheon was obtained. Though originally erected by Agrippa, B.C. 26, that superb building is still in a state of good preservation.

In the dark ages of superstition marble was extensively employed in Tuscany for building churches and palaces. Agostino del Riccio mentions that Carrara marble was brought for the cathedral of Florence in 1366 and 1389, though white marble had been previously obtained from Rosia in the Senese, in 1364, of which more hereafter. But particularly at the time of the first sovereigns of the Medici dynasty were the quarries worked to any extent. Cosmos I., amidst his many vices, had a great passion for the fine arts, and was a liberal friend to architects and sculptors. Buonarotti, better known to us as Michael Angelo, was commissioned to undertake many great works, and not being able to trust to others to send him the best stone, frequently went to Carrara to visit the quarries. He directed his attention to that of Polvaccio, renowned for the size of the blocks; thence he procured the material for his celebrated David, in the Piazza del Gran' Duca at Florence, and for those speaking statues of Day and Night, Dawn and Twilight, on the tombs of Julian and Lorenzo de' Medici, in the church of San Lorenzo (Vassari, *Vite dei più excellenti pittori, scultori, ecc.;* Siena, 1793. Tome 10, p. 61.) which must have left on the mind of every traveller who has once seen them the belief that they only want life to be perfect. About the time of which I am speaking, the Neptune of the fountain of Ammanato, and the group of Hercules destroying Caccus—also in the Piazza del Gran' Duca—were chiselled from blocks taken from the Polvaccio quarry.

Up to this time it appears that the Tuscans invariably obtained their statuary marble from Carrara, which then belonged to the Marquis Alberigo. Somehow, however, Leo X., who was a Medici himself, having heard that in the Florentine dominions there existed, near Serravezza, on one of the loftiest peaks, called Monte Altissimo, marbles of the same quality and beauty as those of Carrara, ordered a letter to be written to that effect to Michael Angelo, who was then at the latter place superintending the extraction of the stone for the tombs of Julian and Lorenzo. The sculptor, to whom the fact was by no means new, whether from fear of offending the Marquis Alberigo, Signore di Carrara, to whom the quarries necessarily brought in a very considerable revenue, or from dislike to go so far, thereby incurring great loss of time, did not seem to desire to pay any attention to the command. He was, nevertheless, compelled to comply, in spite of the manifold objections he raised on the score of expense, which proved perfectly correct. Passing into the *enclave* of the Tuscan Grand Duchy, which took in the valleys of the Versiglia, not long before ceded to that government, he ascended the Altissimo above Serravezza, and discovered an eligible spot for a quarry on the Costa de'Cani, on Monte Capella, in 1518. He then speedily completed five columns, one of which was taken to the church of San Lorenzo, in Florence, in 1521, (Giov. Cambi; *Cronica fiorentina*) the rest still lay on the shore near Pietrasanta when, thirty years subsequently, Vasari wrote his life of Michael Angelo. Thus did the Marquis Alberigo, spoiled of his monopoly, become one of the bitterest enemies of Michael Angelo. (Vasari; *Vite dei più eccell. pit. ecc.*, tome 10, p. 98.)

Michael Angelo had a very laborious task before him. He is acknowledged to have been an universal genius, emphatically styled "the man with four souls;" but it is not generally known that on this occasion he had to become a road engineer, for the first necessity was for him to make communication through several miles of the most rocky country, along the narrow valley of the Serra. This object being in a certain manner attained, he was able to ship off his blocks for conveyance by sea, and up the Arno to Florence. He seems to have been very averse to the task, and writes to his sovereign in very quaint and plaintive style, "The mountain in which the quarry has to be made is very rugged; the countrymen excessively ignorant of the duties required of them; great patience and a long time will be requisite before the mountains have been (addomesticati) made accessible, and the men (ammaestrati) trained." (Quoted in *Studj di Statistica sull' Italia, Torino*, 1859.)

To show what progress these quarries of statuary and white marble, and those of *mischio* and *bardiglio* mentioned above, must have made after the lapse of a few years, I will quote a passage written by Cosmos I. to Matteo Inghirami, in 1565:—"As for us, and the works in our State, we will not, in any way whatever, permit the marbles of Carrara to be employed."—(Repetti, *Diz.*, tom. v., p. 264.) We soon find other sculptors and architects besides Michael Angelo and Vasari proceeding by royal mandate to the valleys of the Versiglia. Amongst others, Giovanni Bologna went there two years later, in 1567-8. From this time the interest of the Grand Duke Cosmos I. and his son and successor Francis I., in the mineral wealth of the newly-explored mountains increased to such a degree that we find the Medici sovereigns making Serravezza their summer retreat, locating themselves in a palace in that town. Here they delighted to while away their time

amid the glorious scenery of the marble mountains, and spent many an hour in trout-fishing in the streams.

But this sudden prosperity was not to last. The favour of princes is proverbially fickle. Mining cannot be permanently successful in the hands of any but the people, and all the restrictions put upon it by the Medici, by which they constituted themselves sole proprietors of the minerals and marbles of their state, was the surest way of destroying this branch of industry. That splendid family, steeped in crime of deepest dye, had probably thought to propitiate high Heaven by erecting marble altars, and to screen themselves under marble vaults, but they were scon extinguished in ignominy, and the quarries fell into oblivion. Things remained in this state up to the latter half of the eighteenth century, when Leopold I. released the marbles from government monopoly.

In 1820, Signor Borrini began to re-open quarries on the Altissimo, which had been neglected for two centuries, and discovered that of Polla. His exertions have lately been rewarded by finding the statuary marble of Giardino. The merchants of Carrara and Serravezza distinguish three kinds of statuary marble, named first and second quality, and *Ravaccione* or *Ordinario*. Of the latter, from the Altissimo, are those employed from 1835 to very recently, in making that series of statues of celebrated Tuscans under the porticoes of the Palazzo degli Uffizi at Florence, which were the result of lotteries patronised by the government. The statue of "Florence Victorious," in the *Salone ducale*, is equally of Altissimo marble.

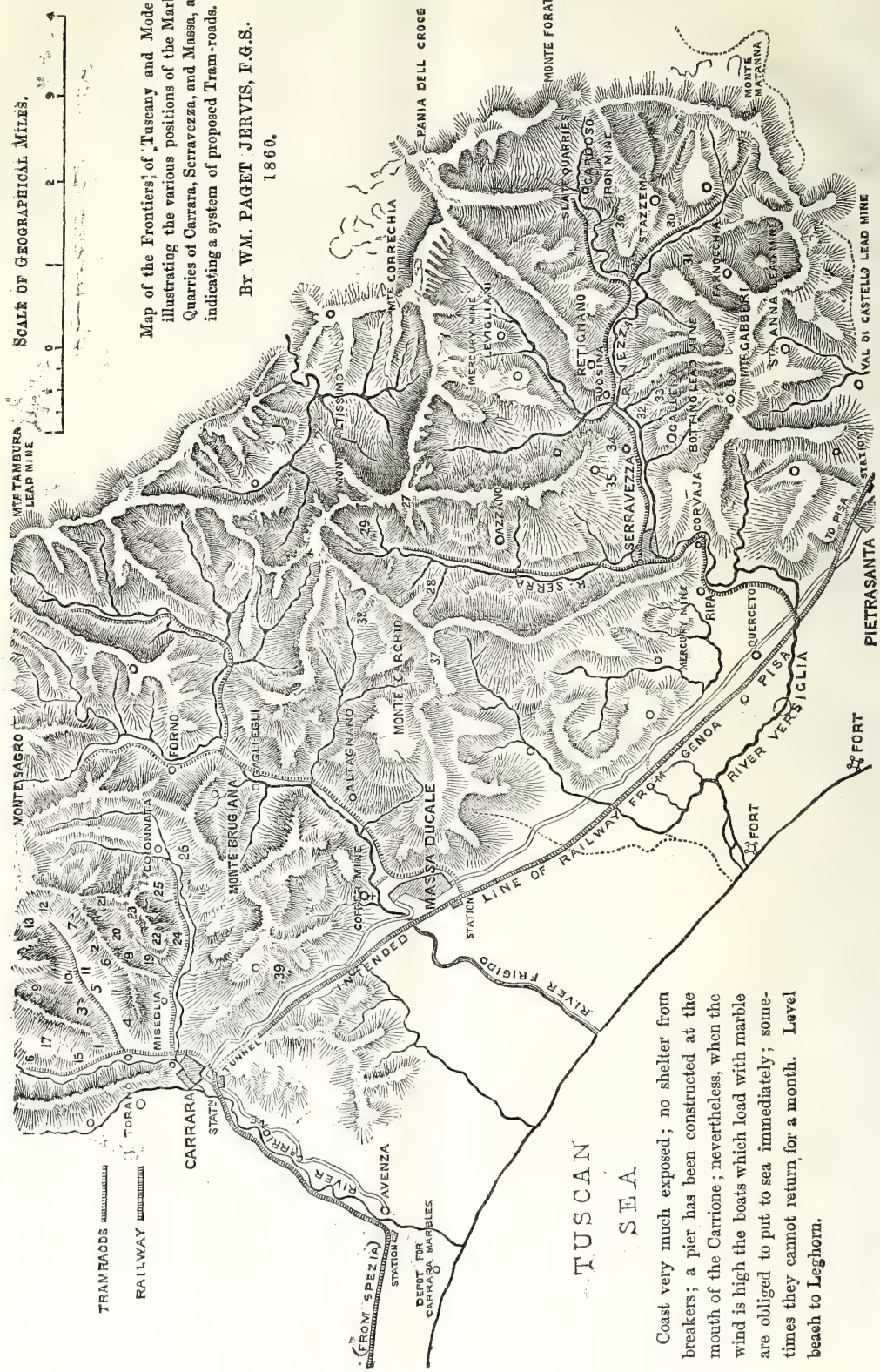
In the Pisan hills most of the Tuscan rocks, as Prof. Meneghini observed to me, are represented in miniature. Some of the Lower Liassic limestones have there also been converted into white marble, but never into statuary. The quarries are on the southern slope, near Asciano. This marble is not so sonorous as that of Carrara, though polishing tolerably; it is probably derived from a more impure marly limestone. Many of the ancient churches and public buildings of Pisa, as recorded by historians, are constructed of this marble. The celebrated Campanile, or leaning tower, built in 1174, is of Pisan white marble: this remarkable building—whether it has undergone complete repair or not, I am unable to say—looks as perfect as if erected yesterday. The greater part of the Duomo, and much of the Baptistry, are also of this marble. Along with them numerous ancient stones, brought by the Pisan vessels from foreign parts, have been built into the walls of the cathedral, the inscriptions being still legible on them. The pavement has much suffered; some consider it liable to exfoliate. Pure white marble is also found in the Campiglese; and at Cape Ortano, in Elba, the ancients had quarries, owing to its proximity to the sea. The grain is very lamellar, resembling Parian marble; the quarry was re-opened by Napoleon while exiled in Elba: that great genius at once saw the excellence of the stone, but since his departure no one has followed up his wise proceeding. Surely this has been a great oversight.

I will now pass to the Senese. In going from Sienna to Massa Marittima the road follows a south-westerly course; after proceeding eight miles, having reached the village of Rosia, we finally quit the Tertiary formations, and enter a narrow gorge between two hills, and ascend the Rosia for two miles, a rivulet which debouches at the eastern end in a plain, falling into the Merse, a branch of the Ombrone. A fault is to be noticed near Rosia; the rocks have been much upheaved, disclosing the Palæozoic strata, consisting of quartz pebbles in a talcose matrix, a very hard metamorphic rock, called anagenite. At the western extremity of the gorge are schists, containing quartz and asbestos veins. I noticed in one place the interesting passage of a variety closely resembling ordinary tremolite, through true asbestos, into silky amianthus—all in the space of a few yards. These are confirmatory evidences of the plutonic agency which has upheaved the Montagnuola Senese, and produced the white marble, slightly veined with grey, seen in the middle of the valley close to the water's edge, and in the cuttings by the road side opposite Spanocchia. This marble was employed in 1364 for the Cathedral of Florence, and has been largely used for the public buildings of Sienna.

Thus much for the Lower Liassic group of marbles. Of the Upper this neighbourhood affords abundance. Ascending the eminence on the right, we arrive in front of the ruined castle of Monte Arienti, and enter the famous quarries of *Giallo di Siena*, a marble of an Indian-yellow tint, sometimes brecciated, the fragments being cemented together by a dark purple substance, so as to form an agreeable variety of veins. Yellow predominates when the fragments are large, but the interlacing purple veins often entirely replace it, and constitute the *Broccatello di Siena*. Less abundant than these is a breccia, which I was informed is no longer worked; a white or pale grey ground, clouded over with dendritic impressions of a circular form, not one-sixteenth of an inch in diameter, clearly defined, and perfectly distinct from each other, due to the presence of a minute quantity of oxide of manganese. It appears to be Upper Liassic. The mode in which the quarries are worked deserves all reprobation, no inclined planes, or even a decent track has been made for the conveyance of the blocks down the hill; as usual, much of the material is wasted.

Another limestone ridge runs north of Montieri, and passing west of Gerfalco, forms the Cornate, a sharp rocky crest, seen from Elba and other distant places, as a prominent land-mark. At its northern end are quarries of rose-red marble, apparently less altered, not being crystalline; and in the neighbourhood are seen numerous casts of Ammonites, of Forbes' group, Arietes, and more rarely Belemnites. Such marbles are known as *Rosso di Gerfalco* and *di Montieri*. A Siennese writer, of the 15th century, quoted by Targioni, mentions their being then employed. More variegated marbles are found near the Val di Cecina, at Gherardesca; such kinds as are much veined are known as *Broccatello di Gherardesca*. They were employed for the *façade* of Sta. Maria della Spina, at Pisa, and for the sumptuous Royal Chapel in the church of San Lorenzo, in Florence. (Targioni Targiotti, *Viaggi in Toscana*, tom. IV., p. 263). Cesalpino says that the front of the Baptistry at Pisa, is of the breccia of Sta. Maria del Giudice, in the Monti Pisani. This is placed by Savi in the Upper Liassic, so is the *Porta Santa* marble from near Caldana, in the Grossetano—a delicate peach-coloured stone, little esteemed, and not very durable.

I know of no Oolitic marbles in Tuscany, but of the Cretaceous group may be mentioned the Campiglese pink and pale red varieties, more properly limestones. To this period belongs the celebrated and widely-used *Portoro*, of the Island of Palmaria and Porto Venere, on the western promontory of the Gulf of La Spezia, near the confines of Modena and Piedmont. The village of Porto Venere, bombarded during late wars, and still half in ruins, is of great antiquity, having been known to the Romans as *Portus Veneris*. I should imagine it highly probable that they employed the beautiful marbles so near this place. A great convulsion which has occurred, and has been so ably described by Sir Roderick Murchison, may now be more easily studied than formerly, for half-way to La Spezia, and near the newly-erected arsenal, is a lofty conical hill, crowned with a fort; the strata have been laid bare from the base to the summit by the engineers, who are constructing a military road up the hill. The marble is chiefly black, with bold yellow veins, and may be obtained in very large blocks. Seldom does it ever fall to the lot of the geologist to have natural sections so admirably supplemented by human art as here, where the strata of hard limestones verging on marble are seen alternating with thin beds of softer rock, and the violent upheaving power may be traced to perfection; in one part of the valley, forming a large synclinal axis, the strata inclining on either side at an angle of 60° with the horizon; further down, the distortion increasing, the lower beds are actually turned over on the upper.



Coast very much exposed; no shelter from breakers; a pier has been constructed at the mouth of the Carrione; nevertheless, when the wind is high the boats which load with marble are obliged to put to sea immediately; sometimes they cannot return for a month. Level beach to Leghorn.

All along the streams, both at Carrara and Serravezza, are numerous water-mills, where the blocks are sawn into slabs for table-tops, and the smaller pieces cut into squares for pavements, &c. At one mill at Serravezza which I visited, several sawing frames are placed parallel to one another, and perpendicular to the axis of a wheel, to which they are attached, motion being communicated by an eccentric. The saws are simple iron blades, 9 or 10 feet long; two dozen are fixed into a massive rectangular wooden frame, at intervals of an inch; thus a large block of marble is at once cut into numerous slabs with great precision; no attention is required beyond supplying sufficient sand and water to trickle over the cutting edges, and weighting the machine properly.

The population of Serravezza was less in 1745 than in 1551, in the days of Cosmos I. In 1833, after the quarries had been re opened, it was half as much again, and is now on the increase.

An efficient mode of sawing blocks *in situ* is much to be desired; the extensive use of gunpowder is wholly unsuited, as the rock is frequently much shattered already. Hitherto it has been the custom to extract the marble only at or near the surface. I doubt whether the white kinds would not be obtained better by cavern working, by which means it would be far less exposed to the action of the atmosphere and every variation of temperature, which must considerably augment the tendency to shiver; water enlarging and extending almost imperceptible flaws as it freezes in winter or evaporates in summer. Road communication is established between Serravezza and Cardoso up the Vezza; elsewhere, I am sorry to say, I cannot speak very favourably of the means of transit; blame is not to be laid on private individuals, but to be ascribed to maladministration on the part of the Government, especially in Modena, where actually 40 per cent. *ad valorem* duty has been levied on marbles excavated in the Duchy. Under the wise rule of the new Sovereign we may hope better results. Hitherto the argument of Cosmos I. has been considered convincing, who, having commenced an enormous obelisk near Serravezza, some one inquired of him how it should be transported to Florence? "Let us first think of quarrying it," replied he, laconically, "and then how we can manage to bring it here."—(Agostino del Riccio.) The true motto should be, make your communications; quarries will soon be found to line the road.

Sig. Adami, of Leghorn, having just obtained concession of a railway from Genoa, *viâ* Carrara, &c., to Pisa, I should recommend a system of tramways down certain valleys (as I have drawn on the accompanying map), instead of an apology for an ox-track, which now leads from the most celebrated statuary marble quarries in the world to Carrara and Serravezza. On the Modena side this could be done without trouble. Instead of the Government levying duty on the marbles, I would suggest that they should concede to the three towns of Massa, Carrara, and Serravezza, the right of making a perfect set of tramways from the main railway stations to the mountains, and that the proprietors of the quarries, ceasing to pay any tax to the State, should be compelled to make use of the tramroad, for which they could annually compound for a certain sum. By this means the antediluvian ox-waggons would be done away with entirely; and instead of barges below Carrara and Serravezza having to put off from the beach, as is now the case, whenever the wind sets on the exposed shore, thereby often incurring months of delay and much expense, the whole of the marble would go by railway to La Spezia or Leghorn, where the ports are always accessible. By these simple tramways, constructed at a sufficient height above torrents, communication would be permanently established with the towns; and, without diminishing the profits of any of the proprietors, marbles could be obtained at a far lower price, and this would ensure an increased consumption at home and abroad.

I have been unable to find the statistics of the productions of the late Duchess of Modena in any publication issued in that state. The *Annuario economico statistico dell' Italia*, Torino, 1853, gives little more satisfactory information. It is there stated that the exports of marble from Carrara, from 1837 to 1846, were valued at £370,341. The total produce in 1847, including that for home consumption, was estimated as worth £66,139. At the same period, 2,258 persons were employed directly or indirectly in the marble trade. Through the kindness of Sig. Fabbricotti, a gentleman who owns extensive quarries, I am enabled to publish more particulars than have probably been yet set before the English public. That gentleman has made out a table, which, though not official, may be considered as pretty accurate:—

	Statuary Marble, in Blocks.	All other kinds in Blocks.	Sundries:—Slabs, Mortars, Sculpture, Architectual Works.	Total.
	Tons.	Tons.	Tons.	Tons.
Carrara produces about	2,900	46,367	5,518	54,785
Massa produces about...	106	2,792	1,511	4,409
Total in Modena	3,006	49,159	7,029	59,194

REFERENCES TO MAP.—(*See opposite page.*)

1. Quarries of Grestola ... ... Statuary marble.
2. ,, Betogli ... ... ditto
3. ,, Cavetta ... ... ditto
4. ,, Zampone ... ... ditto
5. ,, Poggio Silvestro ... ditto
6. ,, Mossa ... ... ditto
7. ,, Polvaccio ... ... ditto
8. ,, Carpevola ... ... ditto
9. ,, Forsa del Angelo ...Ordinary & white.
10. ,, Piastra ... ditto
11. ,, Grotta Columbara ... ditto
12. ,, Ravaccione ... ditto
13. ,, Canal Bianco ... ditto
14. ,, Vallini ... .. ditto
15. ,, Porchinaccia ...White veined & Bardiglio.
16. ,, Peschina ... ditto
17. ,, Boccanaglia ... ditto
18. ,, Calacatta ... ditto
19. ,, Canal Piccinino ditto
20. ,, Valbona ... ... Veined white.
21. ,, Fantiscritta ... ... Blueish ordinary.
22. ,, Vara ... ... } Fined veined in
23. ,, Para ... ... } enormous blocks.
24. Quarries of Belgia ... ... Veined Bardiglio.
25. ,, Fossa cava ... ... Veined ordinary.
26. ,, Nartana ... ... Bardiglio fiorito.
27. ,, Capanino ... ... Statuary.
28. ,, On Monte Carchio ... ditto
29. ,, Falcovaja ... ... ditto
29a. ,, Polla ... ... ditto
29b. ,, Giardino ... ... ditto
30. ,, Affricano ... ... Mischio.
31. ,, Rondone ... ... ditto
32. ,, — ... ... ditto
33. ,, — ... ... White Statuary.
34. ,, — ... } Bardiglio.
35. ,, — ... }
36. ,, — { White marble with Veins of Magnetic Iron.
37. ,, — ... ... White marbles.
38. ,, — ... ... Ordinary.

Bardiglio is also obtained at Miseglia, Zampone, Pescina, and Gioia; black and gold marble at La Padula, half a mile west of Carrara.

Of the marble in blocks about half is exported to the United States, which appears to be a steady and good market. Of the other half one-third is exported to Great Britain, and two-thirds to the rest of Europe. A heavy duty is levied on Italian marbles in France, in order to keep up the demand for home produce. Notwithstanding these disadvantages, Carrara marble is much used there. The weight of Carrara marble is about 160lbs. per cubic foot. That of Sienna marble is about 180lbs.: it is sold by weight. The price of labour at Carrara is about 2s. per diem for common labourers; 2s. 6d. to 3s. for skilled quarrymen; 4s. for the best and most intelligent workmen.

No vessels can load at the beach below Carrara, Massa, or Serravezza direct for this country, as the depth of water is so inconsiderable, though coasters go as far as Naples, Marseilles, Genoa, and Leghorn. As we obtain all the marble *via* Leghorn, the Custom-house returns which I here append do not specify which is Modenese produce and which is really Tuscan marble.

Imports of Marble from Tuscany—(Inclusive of Carrara Marble):—

Years.	Sawn, or otherwise Manufactured.		Value.	Rough blocks or Slabs.	Value.
	Tons.	cwts.	£	Solid feet.	£
1854	443	3	11,079	106,601	66,627
1855	265	19	7,979	99,231	54,577
1856	524	14	20,988	56,804	31,242
1857	491	0	19,640	84,524	46,488
1858	585	16	29,288	68,553	37,704
1859	593	12	29,678	89,740	49,358
	2,904	4	118,652	505,453	285,996

The prices of marble in London fluctuate. Sig. Fabbricotti has informed me that they are now quoted as follows:

	Per cubic foot.						
Superior statuary marble fetches as much as	£0	0	0	to	3	0	0
First quality	1	15	0	to	2	0	0
Second quality	0	16	0	to	0	18	0
Ravaccione, called in English, for some unaccountable reason, *Sicilian*	0	7	6	to	0	9	6
Veined white, *Bianco chiaro* ...	0	8	0	to	0	10	0
Carrara, Dove, or Bardiglio ...	0	9	6	to	0	11	6
Serravezza, Dove, or Bardiglio...	0	11	6	to	0	16	0
Portoro	0	14	0	to	0	18	0

Boracic Acid.

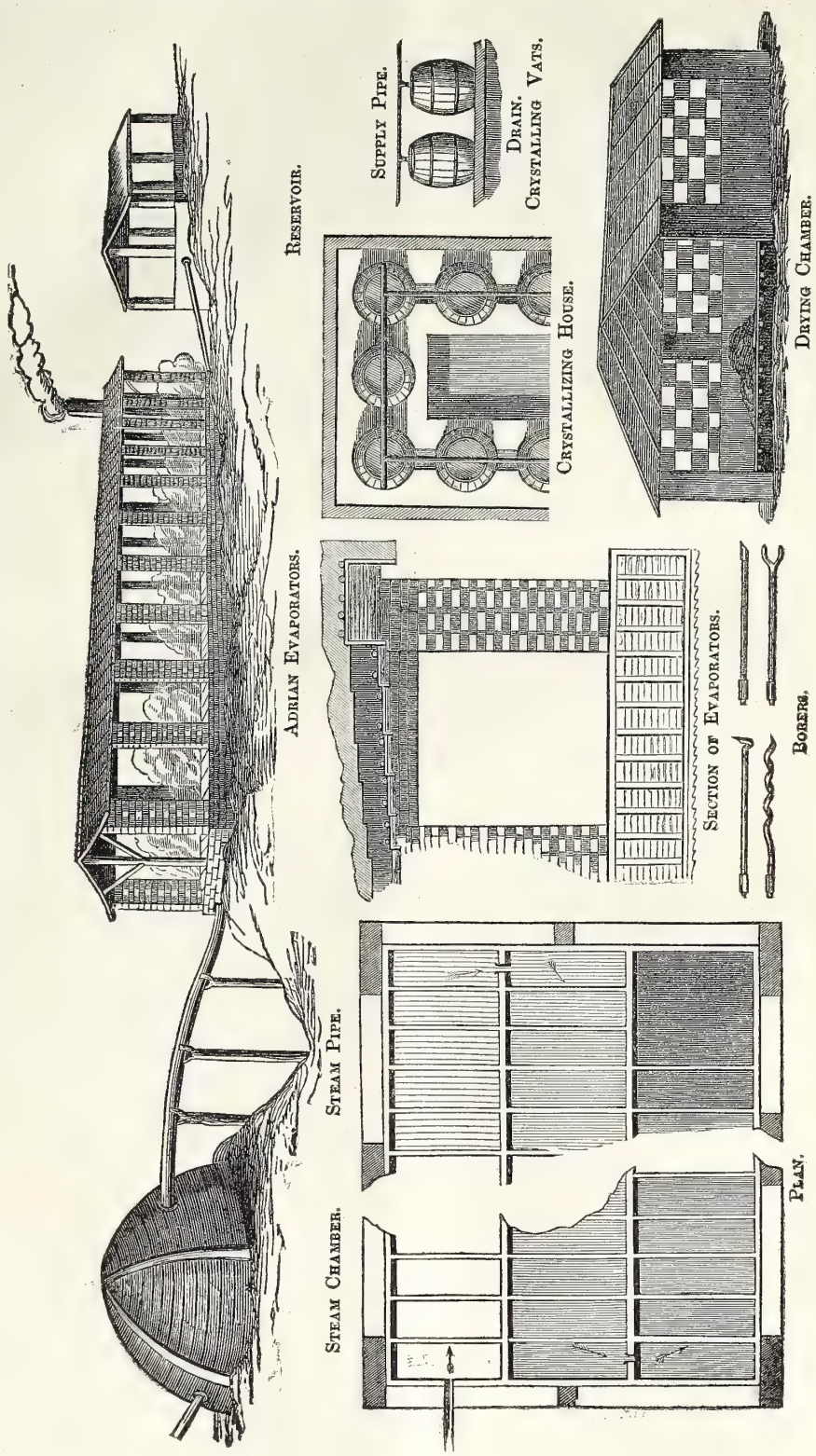
In 1742 a Tuscan traveller visited the salt works of Volterra in his rambles through the Maremme, and proceeded southwards by Pomarance to Monte Cerboli, in order to examine the curious phenomenon of hot vapours which abounded in the neighbourhood. Having given the account of the saline in considerable detail, he relates in the following manner how he took a stroll in the long valley which stretches south-east from Monte Cerboli, and in a few minutes reached the little torrent Possera. All around him was a scene of desolation, well fitted to strike dismay on the ignorant, but eminently suited to the contemplative mind of the naturalist, to whom the most dreary plains and barren rocks yield ample subject for useful and agreeable study.

He was, however, rapidly brought to his senses by the scene around him; he stood close to a yawning gulf, from which issued sounds and odours unearthly; he would fain look down and peep into the mysterious chasm to learn something more of its nature, but his temerity was rewarded by a surly growl from within, and his guide told him that the noise sometimes resembled an hundred bellows, as if Vulcan himself were hard at work, while flames issued forth at night after very hot days. Though he saw no fire, the vapour served as a warning for him to keep at a considerable distance; but before long he came upon more fissures and *soffioni* and little *lagoni*, or pools of muddy blue waters, boiling vehemently, the imprisoned gases producing bubbles increasing in size till sufficiently large to cause them to burst. Dense white vapour, smelling strongly of rotten eggs, rose from the *lagoni*, and ascended to a considerable height into the atmosphere. The ground on which he stood was soft and crumbled under his feet; the decomposed rocks, and many of the efflorescent minerals, were new to him, and the subject of many curious speculations. The whole of the valley was apparently studded with these lagoons, any attempt to define their number was futile, connected as they were in many places by cross fissures and superficial cracks. Not a tree was visible throughout the extent of the valley, and scorched by the subterranean heat, the opening of a new fissure was a signal for the destruction of all neighbouring shrubs. Occasionally, he was told, the lagoni would be overcharged by the rain, and their contents flow into the Possera, where the heat would immediately kill all the fish for a considerable distance down its course, the density of the atmosphere in cloudy weather, pressing on the columns of vapour, causing them to lie more close to the ground and spread themselves horizontally, while the grumbling sounds in the bowels of the earth redoubled in fury. Passing on towards Castelnuovo the same lagoni were abundant, but of smaller dimensions, where, according to tradition, they were on the increase; on the other hand old lagoons dried up, only emitting steam at intervals.

A farm-house, near Castelnuovo, built 200 years before, had been suddenly undermined, a *fumacchio*, or incipient lagone, having unceremoniously made its appearance in the kitchen, and rapidly assumed the dimensions of a true lagoon. The inhabitants were utterly defenceless, and bade adieu to their ancestral tenement, the stone walls of which were soon attacked by the corroding influence of the vapours, and speedily destined, as our traveller truly predicted, to crumble to pieces. Within certain limits fertile fields were subject to be laid waste, and poisonous gases escaped, which had frequently proved fatal: thus he relates how a swineherd in charge of forty pigs had been overtaken by the noxious gases; all the poor animals were killed but one; the witty peasant would have shared the same fate, but for his presence of mind, for, according to the version he made of his exploit, while unable to walk away he rolled himself over and over on his side till he arrived at the bottom of the hill, where the air was pure. A less fortunate man, who was working in an alabaster pit, was suddenly overpowered by the escape of mephitic gas through the marls, and cried loudly for help from his fellow at the mouth of the shaft; while he was being hauled up he was stifled by oppression of the lungs, and fell lifeless to the bottom. Should any luckless wight approach a lagone too closely he stood the chance of sinking into a quagmire and losing a leg. Sheep occasionally fell victims when rushing too carelessly along, and after remaining a short time in the water, nothing but the bleached skeleton remained. Though this is perhaps rather overdone, the temperature being very considerably above the boiling point of pure water, very serious, and generally fatal, accidents must have resulted.

It would be unjust to say that the *soffioni* were utterly useless. The skilled peasants would cleverly manage to roast their chestnuts in sacks—no small convenience in a district where this article is a substitute for bread—placed over these vapour rents; birds, game, and cattle made the lagoni their winter resort, in order to escape from the cold snowy ground; the latter, indeed, occasionally frequented the neighbourhood to rid themselves of gad-flies and mosquitoes. Our travellers traced the vapours principally along the course of the rivulet, where they found their way out from beneath huge masses of rock; in their vicinity a hole made with a stick would frequently originate a little pool or *lagoncello*, from whence sulphurous vapours poured forth. As to the noxious vapours, which are nothing but carbonic acid gas, he was told that the introduction of a copious supply of water into the vents destroyed their power.

DETAILS OF BORACIC ACID MANUFACTURE.



The origin of these remarkable fissures, the graphic account of which by Targioni Tozzetti I have translated and abridged, was first pointed out by Sir Roderick Murchison, whose great generalising mind proved them to have the same lineal direction as the axis of the Appennines and the serpentine eruptions of Tuscany, and to be closely connected with recent earthquakes. From the fact of the fissures being easily blocked up by detritus, &c., I would argue that they did not exist before the Deluge, at which time they would have been completely choked and destroyed. Earthquakes, however, are common in Tuscany, one having occurred within the last eighteen months. The *Codice della Gaddiana* mentions that in 1320, near Velieno (Vegliani?) in the Volterrano a fissure was produced by an earthquake, whence water rushed out in large quantities. Great heat being also evolved, and a lake was soon formed, which finally attained the depth of 80 feet. Ugolino di Monte Catini, quoted by Repetti, while speaking of the neighbourhood of Monte Cerboli, made no mention of lagoons, though he dwells in detail on those of Castlenuovo, whence Repetti concludes that in the middle ages, when Ugolino lived, there were no fissures or lagoons in the former place.

In 1777, Hœffer, the chemist of the Grand Duke of Tuscany, found boracic acid in these lagoni, a fact confirmed two years subsequently at Monte Rotondo, by Professor Mascagni, well-known for his researches on the lymphatic system.

Mascagni was too much engaged in his scientific labours to carry out his idea of working the lagoons, for which he even obtained a patent during Napoleon's rule in Italy; he therefore ceded his right to Sig. Fossi, to whom he communicated his propositions for placing cauldrons of the solution of acid in the lagoons, as in a water bath, in order to concentrate it. Fossi was the first to obtain boracic acid in any quantity from Monte Rotondo, and I find (from the Atti dei Georgofili, tom. xvii., 1839. Firenze.) that he even exhibited white glass in Florence as early as 1818, prepared with borax made from the lagoons. Messrs. Guerazzi and Brouzet worked the lagoons of Monte Rotondo from 1815 to 1818, employing as their engineer Sig. Ciaschi, who made a further improvement in constructing artificial lagoons round the dry soffioni to utilize the hitherto waste vapours. The poor fellow was one day superintending an operation of this nature when, in 1816, he fell into a fissure. He was dragged out half-dead, and only lingered for a few days, during which time he suffered the most excruciating torture from violent spasms and frightful burns. Guerrazzi and Brouzet, with great difficulty managed to export to France 3 tons and 5½ cwt. of very impure crude boracic, in the nine and a half months ending April 1, 1818. A small quantity of these mineral waters had been for many years employed in pharmacy, under the name of *Sale Sedativo di Hombourg*, borax being considered a calming medicine.

Thus, for 40 years, little or nothing was done, when in 1818, M. François Lardarel, a French gentleman then in Tuscany, resolved on the formation of a small establishment for the collection and extraction of the boracic acid. For many years his labours were attended with small success. The sale of the acid was steady, but the profits were but miserable. He was thus induced to study the most economical way of evaporation, the expense of firewood used for that purpose up to 1827 having swallowed up the greater part of his proceeds, the more so as it was particularly scarce in that neighbourhood, where not a blade of grass was to be seen, and road communication had all to be made for bringing it by the proprietor of the works.

After much thought the brilliant idea struck M. Lardarel that by some ingenious method he might turn to account the natural steam jets or soffioni arising so plentifully from the soil, and at the period I have mentioned, he devised the means of imprisoning them and turning them to account, which I shall presently describe. The process was a magnificent triumph for those days when, let us remember, steam was little known as an element of manufacturing industry. From that time the produce of the works rapidly increased, and the uses to which the boracic acid was applied became equally numerous.

At the present time there are no less than nine separate establishments belonging to Count Lardarel, all situated within a few miles of Castelnuovo, a little commune in the government of Leghorn, half-way between Volterra and Massa Marittima, viz., Lustignano, Lardarello, Lago Sasso, Monte Rotondo, Serrazzano, San Federigo, San Edouardo, Castelnuovo. Monsieur Durval has one establishment at the Lake of Monte Rotondo, but besides these I know of no others. All these places are in close proximity to eruptions of *gabbro* or *Miocene serpentine*, as at Monte Cerboli, Serrazzeno, Monte Rotondo, and numerous other localities, where that rock has pierced or entered the sedimentary strata. No one can call in question the existence of deep-seated subterranean fire in this neighbourhood; though, during the present century, no flames have been seen at the surface. I cannot help thinking that these insignificant vents can only be supplementary to the more capacious craters of the volcanoes in the South of Italy, where more ample space is provided for the escape of the gases produced by the decomposition of mineral matter.

As the works are very similar, I will only describe that of Lardarello, which I examined with great interest. This thriving little colony is entirely the creation of Count Lardarel, and is situated on the torrent Possera, below the village of Monte Cerboli, three miles from Serrazzano, and six from Pomarance. A group of half a dozen or more *lagoni* are seen on the slope of the hill, about half a mile from the main road, from which they are completely hidden by rising ground. Some of these *lagoni* were those described by Targioni Tozzetti, but the vapour-vents—the *soffioni* of which he speaks—no longer exist, as they have been artificially converted into *lagoni*. Singularly enough, boracic acid has never been found in the solid state at any depth to which search has been made; it is probably either the result of the double decomposition of water and a volatile salt of boron, according to Dumas' theory; sulphide of boron and water producing boracic acid and sulphuretted hydrogen, thus:—

$$Bo\,S_2 + 4\,HO = Bo\,O_2 + 2\,HO + HS.$$

in support of which supposition, we only find the boracic acid appear when there is water present; or it may be caused by the reaction of sulphuric acid on borates, such as tourmaline, the granite found not very far off being so rich in this mineral as to bear the name tourmaliniferous granite. It is a point which I should wish to place before abler chemists for their approval. The theory I advance is tenable, provided we assume the heat to be very great. Though sulphuric acid is one of the most powerful, and boracic acid the weakest, next to carbonic acid, at ordinary temperatures, they exhibit the reverse phenomena at very elevated temperatures; in fact, boracic acid under such circumstances will actually decompose sulphates formed by the action of sulphuric acid on borates. Before water is introduced into the fissures they are mere *soffioni;* borates of several bases are most probably abundant at great depth, and are uninjured by the constant passage of sulphurous vapours, and even sulphuric acid, on their way to the surface, whence the latter escape, but boracic acid is not to be detected. Water being now introduced lowers the temperature, and the balance of affinities is altered, the powerfully corroding influence of the sulphuric acid on the borates is set in operation, whence the boracic acid is liberated, and ascends in solution with the ejected water and steam. Sulphates of ammonia and lime, gypsum, alum, &c., are among the minerals abundant around the lagoons.

The first care is in the removal of a certain quantity of clay, and the formation of a lagone or basin, of more or less circular form, the sides of which have to be strengthened by rough stones to prevent them from falling in, but the tenacity of the clay sufficing for the bottom. The usual depth of a lagone is from 4 to 6 feet, rarely as many yards;

the capacity and depth have to be regulated with the utmost care, according to the force of the vapour in that particular vent. During the period that the workmen are employed in digging a lagone, the steam is conveyed away into the atmosphere, far above their heads, by means of a tall wooden chimney, which protects them from being scalded. A stream of water has been brought to the uppermost lagone at Lardarello, from near the Bagno del Morbo, not a quarter of a mile off; the lagone is about 15 or 20 yards in diameter, with a steam jet in the centre. Forcing its way through the fissures by specific gravity, the water comes in contact with the highly-heated gases and rocks, and is immediately converted into steam, which, from its elasticity and enormous increase in volume is ejected with great violence, but is condensed as soon as it reaches the surface of the basin by the colder water around. This incessant vaporization of the water and subsequent liquefaction produces a great commotion in the lagone, a turbulent little fountain rising about a foot, and causing a succession of concentric circular ripples. All this time, as noticed by Targioni, there is a copious discharge of sulphuretted hydrogen, which in one case I distinctly perceived at night time full a quarter of a mile from a lagone, and before I knew of its existence there. Having remained 24 hours subject to this conflict, the water, which has become of a slate-blue colour, is let out of the lagone and passes into a canal, through which it is conducted into a second basin at a lower level; thence it passes through several more, each lower than the last, though of similar construction. In this manner the water dissolves the boracic acid in the fissures, and brings it up mechanically mixed with it. No other object appears to be attained by making all the water pass through the chain of lagoni than to obtain boracic acid of uniform density, though Count Lardarel told me that Dumas had expressed to his father the opinion that it was highly probable that by some ingenious device it might be brought to a saturation of 15 to 16 per cent. —a great desideratum. The temperature of the liquid is considerably above 212 deg. Fahr., and dense vapours rise for many yards in height above the ground, heating the air so much as to render it unpleasant to remain long near them. Efflorescent minerals and decomposed rock, thrown out with the steam, lie scattered all round on the heated surface of the ground, along with sulphur incrustations and many sulphates, besides iron pyrites in minute veins in the fragments of rocks. While still boiling, the water passes at stated intervals into a *Vasco*, or tank, sixty feet square, which is covered by a tiled roof supported at the sides by slight brick pillars. Here the greater part of the mechanical impurities, clay, and the more insoluble sulphates, soon sink to the bottom, and the water regains its limpidity. The next operation is to concentrate the solution of acid, which is effected in the adjoining building containing the evaporating pans: these are so exceedingly ingenious and simple as to merit particular consideration; Count Lardarel, who invented them himself, has given them the name of Adrian evaporators. Three parallel series of shallow leaden divisions, called *Scanelli*, are placed in a line, each being a third of an inch below the one before it, from which it is only separated by a leaden partition half an inch broad, and as deep. The *scanelli* are placed transversly, and are 6 feet by 22 inches; they are arranged under a roof which keeps off the rain, but the evaporation is not in any degree impeded, since the sides are open, and only occasional brick pillars of the lightest construction are employed to support the roof. The length of the building may be several hundred feet. At the commencement of the operation a man turns a tap, which lets the water flow into the first *scanello* from the *vasco*, in regulated quantities, everything depending on this precaution; it now flows on from one division of these diaphragm pans to another, till, arriving at the bottom of the building, it passes into the second row of divisions, and finally back through the last series into the diagonal corner, where there is a large and deep reservoir called the *Caldaja a sale*. In its progress the water gradually evaporates: as I mentioned before, it only contained 1½ or 2 per cent. of boracic acid when it entered the building, but having passed through fifty or sixty divisions, it assumes a decidedly yellow tinge, increasing in intensity until finally it becomes a bright golden yellow fluid having a peculiar odour. The internal arrangements of the evaporators, though they may appear simple enough, were the result of much thought. The leaden pans are supported by beams over a low vaulted chamber, lined with hydraulic cement, to protect the stonework and keep in the heat. For this purpose, a soffione is vaulted over with a stone dome, about ten feet high, firmly bound with wrought-iron bars; water is admitted, and the steam so produced acquires immense power, and thumping loudly against the dome, the jets of water seem ready at every moment to undermine the structure. The steam now passes through a vaulted passage into the lower chamber of the evaporators, and, having traversed it from end to end, finds its way out into the open air through a chimney at the opposite end. What formerly took sixty-two hours to evaporate, is performed by this beautiful contrivance in twelve, the expense being also proportionably diminished.

From the *caldaja a sale* the syrupy liquor is periodically conducted along a wooden pipe to the *Bollajo*, or crystallizing house, in which a series of large *Tonne*, or barrels, 3 or 3½ feet in diameter, are arranged in line. When it is desired to fill them, all that is necessary to be done is to remove a plug placed over the centre of each barrel in the pipe which runs round the building: the liquor remains four days in the *tonne*, during which time it has crystallized at the sides and bottom to the thickness of several inches; the liquid portion is then withdrawn through a hole in the bottom, by removing a second plug, and finds its way along a longitudinal drain, by which it is all saved for future use. I think no one could fail to admire these beautiful processes, whose characteristic merit is that they allow of nothing being lost.

The boracic acid crystallizes in hexagonal plates, about the size and thickness of a wafer, having a flaky appearance and pearly lustre. From their peculiar form they naturally retain much water mechanically mixed, so that they are first put in large wicker baskets, *Corbelli*, to drain, and then emptied out on the floor of a large airy chamber, called the *Asciugatojo*, or drying house. The brick floor is heated, like the evaporators, by steam passing through an underground chamber. The boracic acid being spread out in thin layers on the floor, is stirred from time to time with a wooden rake, and the crystals, while losing their sharp angles, separate in great measure from each other. When dry, nothing remains to be done but to shovel up the mass of crystals and remove them to the warehouse, where the produce of all the establishments is mixed to ensure its being all uniform in quality. It is then put in large barrels, containing 2,000 Tuscan lbs., or 13½ cwt., and carted to Leghorn, whence the greater portion is exported to England.

The following Table, very kindly given me by Count Lardarel, to whom I may be permitted to return my best thanks, shows the production of the works, commenced in 1818 by his late father, and brought down to last Christmas. I have reduced the weights into English tons:—

	Tons.	cwt.
From 1818 to 1828 (ten years) ...	521	16
,, 1829 ,, 1838 (ten years) ...	4,870	6
1839	748	13
1840	878	13
1841	886	6
1842	923	15
1843	923	16
1844	923	16
1845	923	15
1846	1,043	13
1847	1,043	13
1848	1,043	13
1849	1,043	13

	Tons.	Cwt.
1850	1,043	13
1851	1,140	0
1852	1,156	19
1853	1,208	19
1854	1,319	7
1855	1,332	19
1856	1,427	1
1857	1,711	4
1858	2,026	10
1859	1,830	18
Total	29,972	18
Or, Tuscan pounds	86,155,917	

The Custom-house returns show that the importation of Boracic acid from Tuscany into England—and it is all produced by Count Lardarel and Mons. Durval—has been in:—

Years.	Boracic Acid. Quantities.		Boracic Acid. Value.	Value of Olive oil imported from Tuscany during the same period.	Total imports from Tuscany.
	tons.	cwt.	£	£	£
1852	935	1	...	...	...
1853	1,038	8	...	...	...
1854	1,185	9	106,691	68,853	751,595
1855	1,338	16	121,163	142,893	747,967
1856	1,253	0	110,264	130,711	554,437
1857	1,245	12	87,192	103,914	534,494
1858	...		73,157	123,892	538,500
1859	...		94,846	117,398	648,460
	Totals...		£425,310	£446,371	£2,588,483

Thus the sixth part of the imports from Tuscany into England, representing £100,000 per annum, is derived from the evaporation of mineral waters, second only in value to the celebrated oils of Lucca, and other parts of the country.

The first impression produced on my mind, after having gone through the whole establishment, was the marvellous *simplicity* of the successive processes; almost everything being performed by Nature: little has to be effected by human agency but to convey water to the *lagoni* and regulate the supply in the various operations, to empty the barrels, and lay the crystals on the floor to dry. Such is the work allotted to the forty men who are employed at Lardarello on ordinary occasions. They commence at 4 a.m. in summer, and at sun-rise in winter, and only work *four or five hours* on an average daily: thus, I arrived at 10 a.m., but was too late; they had finished for the day! The art of procuring boracic acid is, however, very harrassing; sometimes the sides of a lagone break down, or there is not sufficient water; perhaps through carelessness on the part of the men the steam supply diminishes at a particular spot, as is liable to occur, without their regulating the quantity of water accordingly; the inevitable consequence is that the lagone becomes useless, and the steam seeks an easier vent for itself elsewhere. In some cases it forms a new *soffione* a hundred yards off, or else, unable to force a passage to the surface immediately, it is needful to have recourse to boring, and a perfectly new lagone is constructed. This operation is by no means an enviable task; I felt the ground so hot near a fissure which had not quite reached the surface, and from which steam puffed out in minute jets, that my feet were nearly scalded through a very thick pair of shoes, and I was hastily warned to retreat, since a few steps further on I should, probably, have sunk into a hidden cauldron, or steam-bath. Around this place were fragments of cretaceous limestone, known by Italian geologists as *albereso*: the gradual metamorphoses were very visible; first the rock, which had a dirty-brown discoloration, was rendered friable and shivered, and in other places absolutely converted into gypsum, as has been described by Professors Savi and Meneghini.

The boracic acid crystals are far from pure, containing a small quantity of numerous sulphates mechanically mixed. In 1842, Wittstein, Rapp. ann. de Berzelius, published the following analysis:—

Boracic acid, crystallised ($3\,HO\,BO_3$) ...	76·494
Sulphate of Iron	00·365
„ Alumina...	00·320
„ Lime	1·018
„ Magnesia	2·632
„ Ammonia	8·508
„ Soda	0·917
„ Potash	0.369
Chloride of Ammonium	0·298
Water of crystallization of the above salts	6·557
Silicic acid	1·200
Sulphuric acid combined with boracic acid	1·322
Traces of organic matter and sulphate of iron	—
	100·000

The amount of foreign salts has very considerably diminished since the lagoni were first made use of; I believe it is not more than 13 per cent. at this time. In order to purify the crude produce, which is not done in Tuscany, nothing is necessary but to re-crystallize it once or twice.

It will suffice to mention that the uses of boracic acid are only limited by the supply. The greater part of what Count Lardarel produces is exported to England, that of M. Durval supplying the necessities of the French market. Mr. Wood, in 1820, applied boracic acid to glazing pottery, and for that branch of industry an enormous quantity is consumed. With silicates of the alkalies and various metallic oxides, it forms that beautiful and brilliant flesh-coloured glass, made at Sèvres, of which the composition is as follows:—

Silica	19·23
Protoxide of lead	57·64
Soda	3·08
Boracic Acid	7·00
Peroxide of Iron	6·12
Oxide of Zinc...	2·99
Antimonic Acid	3·41
Potash...	0·44
	100·000

—(Salvetat, *An. de Ch. et de Ph.*, 3rd Ser. tome xv., p. 122.)

The glaze for common English porcelain differs only from that employed for figures and ornaments in the amount of borax and silica. Their respective composition is:—

Felspar	45 ...	45
Silica	9 ...	12
Borax	21 ...	15
Flint Glass	20 ...	20
Nickel	4 ...	4
Minium	12 ...	12

—(Dumas, *Tr. de Ch.*, tome ii., p. 265.)

I was informed by several persons that the vines in the neighbourhood of the lagoons do not get the Oidium disease, which is doubtless attributable to the sulphurous vapours which arise so plentifully and pervade the atmosphere—perhaps even to the sulphuretted hydrogen in a less degree; hence this locality is well adapted for the growth of vines, wherever the soil in the lower valleys admits of their cultivation. May not this continual vapour of sulphurous acid be the chief reason of the excellence of the celebrated *Lacrimæ Christi* vines of Vesuvius, to grow which the Neapolitans incur the risk of having their vineyards overwhelmed every time there is a lava flow. For a similar reason, I would rather ascribe the superiority of the Canary wines to the sulphurous bath to

which they are subjected, than to the richness of the soil, though that is also incontestable.

I should not consider my description of the *lagoni* complete without being permitted for a few moments to turn my attention to the character of Count Lardarel, the originator of the works, who died in 1858, while yet in the possession of all his mental energies, though wasted by long and painful suffering. Endowed with great enthusiasm, combined with indomitable perseverance, he was embued with noble and grand ideas; his mind seems ever to have been bent on some useful project. He became the master of a truly colossal fortune by his well-merited and praiseworthy exertions; nor did he selfishly keep his gains to himself, but laid them out usefully, and, by giving employment to a great number of the working-classes in Leghorn and other towns, as well as on his establishments, he rendered himself a public benefactor. Our own countrymen have to thank him for the extensive use of the boracic acid glaze in the manufactories of Lancashire; and Italy, his adopted country, will ever be grateful for the oasis which he has placed in the midst of the most sterile lands of the Maremme. A picture of the Piazza dell'Industria, at Lardarello, will convey a better conception of the man than any eulogy. On one side is a handsome block of buildings, including the necessary offices, a laboratory, museum of mineralogy, apothecary's shop, philharmonic society, boys' and girls' schools, and weaving looms for the wives and daughters of the workmen. In the centre of this terrace is a very handsome church, the priest also performing the office of schoolmaster. Opposite is a neat and spacious hospital, to which are attached a physician and surgeon, as, indeed, in all the other establishments. On another side is the residence of the count, when he comes to inspect the works, and a neat little theatre, where the men get up plays among themselves. In the centre of two large squares are the marble statues of Leopold I. and an allegorical figure of Industry. I might mention the establishment of road communication, by means of a fine bridge which cost £20,000, the ground having been unfavourable for its erection; the space under one of the archways has been made into a paper manufactory. I must not forget the inn and provision shop, where the men have the option of purchasing the necessary commodities; nor the model lodging-houses, where they have apartments for themselves and families. Who can view these benevolent institutions, so well calculated to advance the moral and social condition of the too ignorant Tuscan working classes, without being pardoned for digressing for a moment from the more beaten track of technical description?

The Count established a *Casa di Beneficenza*, or fund, by which the men, by sacrificing a day's wages per month, were free to the enjoyment of the whole of these liberal institutions, including house rent. As might be anticipated, the apothecary's shop is largely frequented by villagers from the neighbourhood, who obtain drugs free of expense. Though the Grand Duke of Tuscany, alive to the good which Monsieur Lardarel had done, and was doing, ennobled him with the title of Count of Monte Cerboli, his nobility was one of a far higher order than could be imparted by a paltry coronet, and emanated from his greatness of soul. If I were asked to erect a monument to him at Lardarello, I would place no statue, but simply copy the beautiful words applied to one of our own great men: "*Si monumentum quæris, circumspice.*" His memory must henceforth be cherished in the breast of every true Tuscan, as one who has made the desert to blossom as the rose.

DISCUSSION.

Mr. John Bell said the paper which had been brought before them was divided into two distinct heads, one being the subject of boracic acid and the other marble. It was only upon the latter branch that he would venture to say a few words. There could hardly be a more interesting subject for discussion than that of the marbles used in Art, amongst which, perhaps, the white marbles would be the most interesting, because the statues of old and of the present day were usually made from them. Marbles were, however, found with great variety of colour, and in that way, no doubt, they would be extremely interesting as regarded their use in the decoration of public buildings, &c., which opened a field that perhaps had not been of late sufficiently worked. He believed it was contemplated that a great deal of the interior decoration of St. Paul's shoud be executed, if the funds admitted of it, in various coloured marbles, some of the best specimens of which were now to be seen in the apartments of the surveyor, Mr. Penrose, in the Chapter-house. The observations of Mr. Jervis, with respect to those marbles, were very valuable, because he had shown an amount of knowledge upon the subject which very few persons possessed, having, as he (Mr. Bell) believed, recently travelled in the principal marble-yielding districts of the Continent. There was, however, no doubt that, in addition to the marbles which had been brought before them that evening, there many others that might be introduced. There were numerous descriptions of marbles, both from Scotland and Ireland, which were of very beautiful colour, which had been worked for short time, and then, for some reason, laid aside. There were also some fine white marbles obtained in this country, but whether they were sufficiently white throughout for statuary purposes he did not know. The white marbles of Scotland and Donegal were very beautiful. No description of white marble, however, equalled the Parian, which had been principally found in the Island of Paros. He believed, however, that the whole yield of it had been completely exhausted. A similar description of marble had been found in the neighbouring Island of Naxos. Some of the finest specimens of Parian marble were to be found amongst the relics of Halicarnassus. The human forms were very beautifully executed, but with regard to the large lions, it was to be regretted that so much valuable marble had been used in their production, for, as works of Art, very little was to be said in their praise. A very beautiful specimen of Parian marble was to be found in the British Museum. It consisted of the hand of a Psyche holding a butterfly. He considered this to be the most beautiful artistic specimen of Parian marble he had ever met with. The beauty of this marble consisted in this—that it had exactly the same amount of transparency that there was in the human flesh, which made it so suitable for statuary. The Carrara marble was of a different character; it was not nearly so beautiful as the Parian for the purposes of sculpture. It was called lunar marble, from its moonlight colour. It was very desirable that attention should be given to the subject of marbles for statuary, for we had nothing now at all equal to the Parian marble for most purposes: and it was for the geologists who could find out where the coal mines were without seeing the coals, to endeavour to find marble of the same character as the Parian, which appeared to have been quite exhausted. All that they now had of that marble were the remains of antiquity. Mr. Jervis had alluded to the manner in which the blocks of marble were sent rolling down the sides of the hills at Carrara and Serravezza. It was no doubt highly desirable that a better mode of bringing down the marble should be adopted. He believed the blocks were, in the first instance, blasted with gunpowder, which shook the marble very much, and then the rolling down the steep declivities of the mountains tended to increase the "shakes" throughout the block, and deteriorated the quality of the marble for the purposes of art. The consequences of this mode of treatment of the blocks of marble were sometimes very serious to the sculptor, as it might happen that when a work was approaching to completion, a "shake" was discovered in a principal portion of the statue,—for instance, in the arm or in the head, which obliged the artist to throw it on one side, after a vast amount of labour had been expended upon it. Therefore it would be of great advantage to the

sculptor if a better system of quarrying and conveying the marble to its destination were adopted.

Professor Tennant begged to thank Mr. Jervis for the large amount of valuable information which he had imparted with regard to marbles. He had referred to two or three characters of marble which might not be generally known, and he (Professor Tennant) had brought with him an old diagram of brecciated marbles, composed of broken fragments, of which chimney pieces were often made. Another form was that of the conglomerated marbles, which were extensively used some years ago for decorative purposes. Many specimens of them were to be found at Hampton Court, and other of the older palaces in this country. He was sorry Mr. Jervis had not given them a little more information with regard to other materials which were found in the country of which he had principally treated. Amongst other substances might be mentioned alabaster and serpentine. The serpentine was the "green marble" of Italy, and was at the present time used there to an enormous extent. These compact marbles were useful for many purposes, although they were not adapted for external work in this country, owing to the influence of our climate. He would particularly refer those interested in this subject to the house No. 76, Strand, the interior of which was some few years ago fitted up at great expense in various marbles. It was now occupied as a penny news-room, and it would well repay a visit to inspect the beautiful marbles which were let into the walls, although at the same time they would have presented to them the fact of the perishable nature of those Continental marbles under the influence of the London atmosphere. With reference to the other branch of the subject—the boracic acid—he would remark that the complaint of our manufacturers at the present time was, that owing to the monopoly in that material, they would not obtain it at a price which would enable them to use it to a great extent, and the reduction in the price of salt and other materials had facilitated their application to numerous purposes. The manufacturers had sought for boracic acid in South America and other parts of the world, in the hopes of getting that which would enable them to manufacture their articles at less cost; but their attempts had not hitherto been commercially successful. Professor Tennant proceeded to call attention to a serpentine material, which was to be obtained by thousands of tons in Galway —a fact he believed not generally known. In the model-room of the Society's house there was to be found, in a window-seat, a remarkably fine collection of British marbles. They had been roughly used, but if they were repolished they would form one of the oldest and best collections of British marbles that could be met with. Few countries afforded better specimens of marble than the British Islands. They might be placed as "No. 2" in the series of countries which afforded marbles. In Tuscany, however, these materials might be obtained at comparatively small cost if proper machinery were introduced for the working of the quarries on a large scale.

Mr. Varley recollected the period when the Society obtained the collection of specimens of marbles alluded to by Prof. Tennant, and a large window seat in the model room below was fitted with the specimens that were so obtained. He recollected them when they were quite fresh and bright, and he thought it was a pity that they should be allowed to remain in their present condition.

Professor Rogers had been much impressed with the high geological interest of certain portions of Mr. Jervis's valuable communication, particularly upon the question of the origin of the finest varieties of Italian marbles. The world was almost entirely dependent upon the district alluded to for marbles for the highest class of statuary. Whole continents were sought over by geologists and practical men for substitutes for the marbles of Carrara; but to the present hour they were not able to say with certainty to what physical conditions or to what chemical laws they could ascribe the origin of that peculiar texture which rendered marble suitable to the higher purposes of the fine arts. The causes of that evenness of grain, that tendency to cleave equally in all directions, and that absence of lamination which had resulted from this metamorphosis of the limestone formation, until it became as homogeneous as a mass of crystallised loaf sugar, were not fully understood.

Mr. Bell remarked that he had found that marble usually had a slight cleavage one way or the other. In some few cases he found statuary marble which had no cleavage at all, but that was very rare.

Professor Rogers added that he spoke in general terms, and was happy to be corrected by a gentleman of Mr. Bell's large practical experience. The point of chief geological interest was to reach a knowledge of the conditions under which this near approach to homogeneity of crystalline texture had arisen. Ordinary metamorphism did not do it. The very structure of the material was changed, the crystalline character being gradually developed. First the blue became patchy. The colouring matter of the blue limestone was partially removed, and the double carbonate of lime and magnesia remained. This segregation occurred in every kind of limestone, and all this happened without destruction of the grain, or of the lamination produced by the original sedimentary depositing action. It was uncertain what were the volcanic conditions which produced this material, and he would ask the opinion of Mr. Jervis as to whether he attributed it to direct igneous or other heating action. He did not gather from the paper whether there were indications of dykes or other volcanic appearances in the district. The circumstances under which the organic colouring portions of the limestones were so thoroughly expelled and the mass rendered saccharoidal, required further investigation.

Mr. Jervis said he was not able to throw much light on this question. He might say that the marbles of this country generally partook of the character of limestones. All British marbles might be called either marbles or limestones. With regard to the marbles of Italy it was different. All the specimens on the table from Carrara had a more or less crystalline structure, and had lost their original texture. In illustration of this he might state that in the marble districts of England the *detritus* produced by the action of the weather was in the form of a kind of mud. Near Bristol the roads in rainy weather were covered with a close, compact mud, which adhered very tightly to the clothes. On the other hand, in going through Carrara he had noticed that the *detritus* was of a different charcter. The crystalline particles were separated from each other by the weather, and the result was calcareous sand, in particles of considerable size. This seemed to point to the fact which was acknowledged by Italian geologists—that all the marbles had undergone metamorphosis by the action of heat, as specially exemplified in the limestone of Sienna, where the intrusion of the serpentine had produced the change of structure by its heating nature, and thus had formed the marble. At Carrara, where the mountains were more perfectly and extensively transformed into marble, the saccharoidal structure was more developed. Instead of mere "beds," there were mountains, to the height of 3,000 feet, principally composed of marble, and it appeared that the heat had not only been greater, but longer continued, and the rock, in the process of cooling, had been protected, from the too suddenly chilling action of the atmosphere. Referring to a specimen upon the table, Mr. Jervis said that in that there was an intrusion of a large vein, or dyke, of magnetic iron; in another instance they had specular iron, the latter more highly oxydised than the former. The veins in other specimens were considered to be a species of hornblende. All these intrusions had transformed the original limestone. As to the colouring matter of the veined white marbles, this was considered to be produced by a small portion of organic matter; and in the cases where they had the dark and black veins, there they had the metamorphosis largely exhibited. These were, in fact, frequently veins of slate. As they passed up to Cardoso

they found strata of the Oolite period, where the rocks had been transformed by heat into true slate, which was employed in the roofing of houses in Tuscany. Slates were acknowledged to be metamorposed by heat, and their being found in juxta-position with marbles, supported the views already advanced in reference to the formation of these marbles, in contradistinction to the notion of their being formed by the action of heated vapours, as put forth by some authorities.

Mr. C. H. Smith would offer a few remarks of a practical nature. Many years ago he read a paper before this Society, on "Marbles, and their adaptation to ornamental purposes," and since then the subject had been a hobby with him. At that time he had endeavoured to discover some record amongst ancient authorities which would satisfy him that Carrara marble was to be found amongst some of our antiquities. He had, however, hitherto failed to satisfy himself that that there were any antiquities now remaining of Carrara marble, and the circumstance of some of the buildings mentioned in old writings being some twenty centuries old, in his opinion precluded the possibility of their being constructed of that material. In this country no building of Carrara marble had stood one-tenth part of that time. The cornices and capitals of the Pantheon at Rome were of white marble, but he very much doubted whether they were from Carrara, and a great portion of St. Peter's was built of Travertine, which remained very white up to the present day. They knew very well that in this country Carrara marble would not last for any great length of time, and it was scarcely possible to find a specimen 150 years old, unless it had been preserved by repeated painting. The statue of Queen Anne, in St. Paul's Churchyard, had suffered from the weather, and it had been necessary to replace some portions. Since that it had been frequently painted, and might possibly last for many years longer. He admitted, however, that in warmer climates the Carrara marble might be more durable. There was a specimen which was within reach of the inspection of all—the statue of Her Majesty in the Royal Exchange. That was going very fast, and the angular portions might be easily broken off with the thumb and finger. The same might be said of the statue of Charles the Second, which was placed in a niche in the ambulatory of the same building. Another important material was the dove marble, which contained one or two per cent. of carbonaceous matter. In his opinion this colouring matter diffused through the mass made it more durable. A specimen of that marble was afforded by the tomb erected about 30 years ago by Sir Francis Chantrey to the memory of David Watts, in St. John's-wood burying-ground. That, even, was already in a state of decay. Another specimen of perishing marble was to be found in the Marble Arch, at the end of Oxford-street. With regard to the marble of Porto Venere, mentioned in the paper, it had this disadvantage, that it was apt to split under the action of the hammer. With reference to the sawing of the marble abroad, the material was of that extremely brittle nature that it should be transported in larger blocks to its destination, as when sawn into slabs it was extremely liable to split. It could be sawn in this country so cheaply, that it could never in the long run answer the purpose of the merchant to import it already sawn.

Mr. Jervis said he had not advocated sawing the marble into slabs, but into large blocks at the quarries, as that method was better adapted than blasting for many varieties.

Mr. John Bell would ask the opinion of Mr. Smith, as a practical man, as to how far Parian marble could stand the weather in this country, and whether he knew of any example in England in which it had been exposed for a length of time to the atmosphere.

Mr. Smith had no hesitation in saying that Parian marble was infinitely superior in that respect to the Carrara. The only specimens which had been exposed were fragments at the British Museum which had stood out of doors. Carrara marble became disintegrated all through the mass, but the action of the atmosphere upon Parian marble only decomposed the surface, as was shown by the Elgin marbles. In cases were the object was durability, as in the instance of monuments and tombs in cemeteries, he (Mr. Smith) should prefer many descriptions of stone to marble.

The Chairman congratulated the Society upon the interesting paper which had been presented to them that evening, and also upon the practical character of the discussion which had arisen upon it. They must all derive great pleasure from hearing eye-witnesses of facts relate what they had observed; especially when, as was the case in the present instance, the individual was so peculiarly qualified for the task. He was sure he might say that if Mr. Jervis had confined himself to the subject of marbles alone they would have received a valuable addition to their knowledge; for he was persuaded, from conversations he had had with that gentleman, that he had not communicated one-tenth part of the information he possessed on this subject. He should have been glad if that gentleman had an opportunity of giving a series of lectures upon the mineralogy and industrial products of Tuscany, in addition to its geological productions. Facts such as Mr. Jervis could communicate would be of great value in our present imperfect acquaintance with the subject, particularly as to the manner in which the metamorphic rocks were produced, the discussion of which was engaging, and must engage for some time to come, a large share of the attention of geologists. It was well that these observations should be made, not only by good geologists, but also by those who combined a knowledge of chemistry as well, as was the case with his friend, Prof. Rogers. The observations of the geologist could not advance his science in the same way as they would if they were united to a knowledge of of chemical science. It was necessary that the two should be combined in order to make true progress in researches of this description. He would advert for a moment to the disintegration of the stones alluded to, which was so important in an economic point of view. In connection with all these facts, observations were easily made in the laboratory upon the comparative durability of stones. Those who had burnt various descriptions of limestones knew the different way in which the fire acted upon them. Carrara marble if heated in a fire, crumbled to pieces; that disintegration took place to which Mr. Smith had alluded. The particles of Carrara marble were held together by so slight a tie that the heat of the fire destroyed their cohesion. In other kinds of marble, the cohesive power, about which we knew so little, was infinitely greater. The chairman concluded by proposing a vote of thanks to Mr. Jervis for his excellent paper.

The vote of thanks was then passed.

The paper was illustrated by diagrams showing the position and arrangement of the Boracic Acid Works, and the nature of the surrounding country, as well as by a complete collection of specimens brought by the author from Tuscany, and others kindly lent by Signor Fabbricotti, of Carrara, and a beautiful table inlaid with six hundred varieties of marble from different countries, kindly lent by Mr. Daniel Green.

The Secretary announced that on Wednesday evening next, the 30th inst. (the last meeting of the session), a paper, by Mr. George R. Burnell, "On Building Woods; the Causes of their Decay, and the Means of Preventing it," would be read.

Colonial Correspondence.

DECIMAL CURRENCY.

Sir,—A Bill for establishing decimal currency in this province (Nova Scotia) having recently passed the legislature, I have thought that some account of it might be interesting to your readers.

The currency of Nova Scotia is, like that of Great Britain, £. s. d., but depreciated 20 per cent., so that the pound is here worth only 16s. sterling, and so on with shillings and pence. To turn sterling money into Nova Scotia money, we add one-fourth; to turn Nova Scotia money into sterling we subtract one-fifth. One-pound notes are issued by the Province and by the banks, which pass current at 20s. Province money, or 16s. sterling. British silver is the principal coinage used, one shilling sterling being 15d. currency, and so of the other coins. There is no coin to represent the currency shilling, which must be paid in copper, or by an English sixpence (7½d. here) and 4½d. Province copper. The latter bears the same depreciated proportion to the British copper as the pound, 15d. here being equal to the English 12d. or shilling.

Thriving as the British North American colonies are, still Brother Jonathan is the great fact on this side of the Atlantic. The traffic and intercourse between the United States and the British provinces are both very great, and hence, long before the latter dreamed of decimalising their currency, the people in the British colonies were perfectly familiar with dollars and cents., and had got into the habit of naming prices and calculating in dollars. A dollar (4s. sterling), half a dollar, a quarter dollar (shortly, a quarter —the English shilling), are quite common expressions here.

Canada, among the British provinces, had taken the lead in decimalising the currency, and at once assimilated it to that of the United States, with which she has immense traffic along every part of their extensive mutual boundary, from the south of Lake Michigan for hundreds of miles eastward. The British sovereign, which was equal to £1 4s. 4d. Canadian currency, was fixed at a value in the new currency of 4 dollars 84 cents. The Act for this purpose was passed in 1857, and an appropriate silver coinage was prepared. It is now about three years since dollars and cents. were introduced in Canada.

In this province, where the British sovereign passes for £1 5s. currency,* there was much difference of opinion as to the best arrangement for decimalisation. Some desired assimilation with Canada and the United States. To this it was objected that the people of this province had got accustomed to the exact quarter of their pound, or four English shillings, as the dollar, and that it would introduce great confusion to change the value of their dollar to 4s. 1½d. sterling (or 5s. 2d. currency); that entire assimilation was impossible, from differences of exchange; hence, that it would be best to decimalise simply with reference to our previous currency, deviating from that as little as would be compatible with the decimal principle, and that this would place our new unit of value, the dollar, in the easy relation of one-fifth to the British pound. The latter is still retained as our standard of value.

These views prevailed. The Nova Scotia dollar has been fixed at one-fifth of the British sovereign, being one-fourth of the pound currency. The sovereign, the provincial pound note, and the English silver coinage, are all retained at the same value as before. The copper coinage, being incompatible decimally with the silver (120 halfpence to the dollar) will be replaced by a new copper coin, to be called a cent., of 100 to the dollar, which will be nearly of the same value as the British halfpenny (96 to our dollar), and as the English sixpence will be equal to 12½ cents., a few half-cent pieces will be coined for change.

Little has been said about the inconvenience of the change from half-pence to cents, and the difficulty of adjusting matters when six half-pence are to be equivalent to five cents. It is believed that the inconvenience will be trifling and only temporary. The bill is compulsory only as to Government transactions; the public, it is thought, will soon follow the example.

New Brunswick has, I understand, also passed a decimal bill, assimilating with Canada and (disregarding those small colonies, Prince Edward Island and Newfoundland) we may say that the decimal system is now established in the British North American possessions.

I am, &c., HUGO REID.

Halifax, Nova Scotia, April 18, 1860.

* The value of the sovereign is as follows in the currency of the British provinces:—

Canada and New Brunswick	£1	4	4
Nova Scotia	1	5	0
Prince Edward Island	1	10	0
Newfoundland	1	4	6

Home Correspondence.

FORGERY OF BANKERS' CHEQUES.

Sir,—Owing to a notice of my paper on the prevention of forgery arising from the alteration and falsification of bankers' cheques, &c., read before your Society on the 28th March last, having appeared in a country newspaper, the following circumstance has come to my knowledge, and may interest some of your readers.

It will be remembered—although two well authenticated cases which had somewhat recently occurred were mentioned in my paper—it was represented in discussion that the evil did not exist, and that the public, by taking care of their cheque-books, could secure themselves and bankers from all danger from any forgery which it was desirable to provide against.

I have now evidence to show that a London Bank was defrauded only six weeks previous to the reading of my paper, by an alteration effected by chemical means.

A certain number of cheques were sent by post; the letter was stolen. Soon after one only of these cheques was presented at the bank, and paid in sovereigns.

This cheque turned out to be altered in amount, and the words "and Co." abstracted. The successful author of the fraud obtained, by the alteration of this single cheque, a considerably larger amount than if he had presented all the stolen cheques; it therefore appears that he did not think it necessary to incur the risk of presenting the remainder.

I am, &c.,
ROBERT BARCLAY.

29, Bucklersbury, E.C., May 21, 1860.

THE ART OF PERFUMERY.

Sir,—Several persons having applied to me, since I read my paper "On Perfumery," to know in what way I propose to render available fragrant substances to be met with it British Colonies, I beg leave to reply through the medium of your *Journal*, that it may have more chance of reaching all persons interested in the matter.

There is, first of all, a distinction to be made between substances which may be sent to this country in their natural state and those which require to be worked on the spot. Among the former I would class all scented woods, roots, gums, balsams, fruits, or seeds—in fact, any of the materials which will not lose their fragrance in the transit; the latter would comprise aromatic plants and flowers, the aroma of which must be extracted on the spot. An ordinary still, of small dimensions, will suffice for plants, which will all yield a certain quantity of essential oil. As to flowers—if it is found, on experiment, that no essential oil can be drawn from them, they can be treated by the maceration or absorption process, such as I described. If maceration is resorted to, the water bath of the still will suffice, at all events to commence with. If absorption is found to answer better, frames, such as I mentioned, can

easily be made anywhere; or, if there should be any difficulty about it, I shall be happy to send models to those who wish to make experiments. As to the fatty bodies to be used, I can recommend either olive oil, ben oil, or well purified grease, adding a little wax if it is in a hot climate.

No fear need be entertained respecting the disposal of the products. If the perfumes obtained are agreeable, and the price not too high, the London perfumers will be glad at all times to have an opportunity of procuring fresh materials. I am, &c.

EUGENE RIMMEL.

96, Strand, May 22, 1860.

LEEDS EDUCATIONAL BOARD.

SIR,—Notwithstanding the success which has attended the examinations of the Society of Arts, it must be evident to all who have any practical acquaintance with the subject, that the influence of such a stimulus to mental cultivation requires to be far more widely diffused in order to reach the thousands of young men of the industrious classes who, having perhaps obtained a small amount of elementary knowledge in day schools, have little or no inducement to continue their education by voluntary efforts until the age of sixteen, when, after due preparation, they may compete for the prizes and certificates of the Society of Arts. The intermediate time is, perhaps, the most important period of life for laying the foundation of future welfare, or the formation of vicious habits, and yet, in the manufacturing districts especially, the majority of our youth, from the facility of obtaining employment which renders them in a measure independent of parental control, are left without guidance when it is the most needful. The qualifications tested by the Society of Arts require preparation, and this indispensable ordeal requires a similar kind of inducement to promote individual efforts. In the neighbourhood of Leeds there are about ninety Mechanics' Institutions, the majority of which have elementary classes, yet few of them supply candidates for the Society of Arts examinations. In order to supply this deficiency, the Leeds Educational Board, which comprises the Mayor, the members of Parliament for the borough, the Vicar, the Head Master of the Grammar School, and several gentlemen connected with Educational Societies in the town, has resolved to establish an examination of the junior members of Mechanics' Institutes, and the pupils of Evening Schools under the age of sixteen, which is the limit fixed by the Society of Arts. The Board has agreed to undertake this duty in addition to conducting the Oxford University Examinations and the Society of Arts Examinations, in the hope that not only will a greater number of candidates be gradually prepared for examination in the higher branches of study, but that very many will be induced to use exertions in order to obtain the prizes and certificates offered for the local examinations, and so strive more earnestly than they have hitherto done to improve themselves.

The Leeds Educational Board proposes to hold a yearly examination of the members of Mechanics' Institutes and pupils of Evening Schools under sixteen years of age, and to offer small prizes as well as certificates of three several grades, distinguished as first, second, and third class, in the following subjects:—

I. Reading.
II. Writing from dictation.
III. Arithmetic. Four simple and compound rules.
IV. do. to decimals.
V. English grammar.
VI. English history.
VII. Geography.
VIII. Algebra.

In order to meet the unavoidable expenses, an appeal is made to the friends of popular education for the required funds, the subscription for the Elementary Examination being limited to ten shillings from each contributor, though larger contributions will be received for the general expenses of the Local Board, or for any of the special objects of its action.

The examinations will be open to the members of Mechanics' and other Institutions, and to the pupils of Evening Schools, the managers of which shall contribute five shillings to the Local Examination Fund for Institutions having less than 100 pupils, and ten shillings for those having above that number.

If such a plan were carried out in most large provincial towns—and the difficulties to encounter are not very great—there cannot be a reasonable doubt that it would have a considerable influence in stimulating self-improvement, and increasing the number of candidates for the examinations of the Society of Arts. I am, &c.,

BARNETT BLAKE.

MEETINGS FOR THE ENSUING WEEK.

MON. .....Geographical, 1 p.m. Anniversary.
London Inst., 7. Rev. Henry Christmas, "On Eminent Personages of English History living between the years 1640 and 1660."
Medical, 8½ p.m. "Clinical Discussions."

TUES. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbivorous Mammalia—The Elephant and Rhinoceros."
Zoological, 9.

WED. .....Society of Arts, 8. Mr. G. R. Burnell, "On Building Woods; the Causes of their Decay, and the Means of Preventing it."
Geological, 8. 1. Mr. W. P. Jervis, F.G.S., "On certain Rocks of Miocene and Eocene age in Tuscany, including Serpentine, Copper-ores, Rock-salt, Lignite, and the pure Alabaster used in Scripture." 2. Mr. H. Falconer, M.D., F.R.S., F.G.S. "On the Ossiferous Caves of the Peninsula of Gower in Glamorganshire."
Ethnological, 8½. Anniversary.
Archæological Assoc., 8½.

THURS. ...Royal Inst., 3. Professor Ansted, "On the Action of Water in its Circulation through the Earth."
Philological, 8. Anniversary.

FRI. .....United Service Inst., 3. Capt. E. C. Jervoise, "Recreation with reference to the Sanitary Condition of the Army."
Archæological Inst., 4.
London Inst., 7. Prof. Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Royal Inst., 8.

SAT. .....Actuaries, 3. Anniversary.
Royal Inst., 3. Mr. F. A. Abel, "On Heat and Chemical Force."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on April 27th, 1860.

222. Coals, Cinders, and Culm, &c.—Account.
223. Westminster New Palace—Account.
224. Beverley Election—Minutes of Evidence.
225. National Debt—Account.
228. Mercantile Marine Fund—Account.
230. Seamen's Savings Banks—Account.
239. Bankruptcy and Compensation Fund (Ireland)—Statement.
240. Army, &c.—Returns.
243. Malt—Return.
117. Bill—Law of Property (Amended).

Delivered on 28th and 30th April, 1860.

231. Parliamentary Boroughs—Return (a corrected Copy).
242. Brewers, &c.—Account.
246. Navy (Number of Admirals, Captains, &c.)—Return.
249. Acts of Parliament—Return.
250. Immigration Loans—Return.
252. Education—Return.
192. The Serpentine—Report and Evidence.
15. Railway and Canal Bills (151 North Eastern and Newcastle-upon-Tyne, &c., Railway Companies Amalgamation; Newcastle-upon-Tyne and Carlisle Railway and Port Carlisle Dock and Railway, &c.)—Board of Trade Supplemental Report.
116. Bills—Innkeeper's Liability.
118. Sheriff's Court Houses (Scotland).
119. Customs (Amended in Committee and on Re-commitment).

Delivered on 1st May, 1860.

235. Prison Assessments (Scotland)—Return
253. Bishop's Lands (Ireland)—Returns

63. Bills—Aggravated Assaults Act Amendment.
120. Bills—Education.
Switzerland and Savoy—Map referred to in the "Mémoire sur les Rapports entre la Suisse et la Savoie Neutralisée."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 18th*, 1860.]

Dated 11th April, 1860.

906. J. Kershaw, Allerton, near Bradford, Yorkshire—Imp. in means or apparatus used in weaving.

Dated 12th April, 1860.

912. C. Newbold, Nottingham—Imp. in machinery and apparatus for and the method of manufacturing vessels and other articles.
916. T. Trotman, Sheerness, Kent, and A. Trotman, Beresford-street, Walworth, Surrey—Improved apparatus to be used in cleaning windows.

Dated 17th April, 1860.

962. J. Paterson, Beverley, Yorkshire—Imp. in apparatus for churning, which apparatus is also applicable to the washing of clothes and other articles.

Dated 20th April, 1860.

990. R. Roberts, Manchester—Imp. in punching machines.

Dated 28th April, 1860.

1074. J. Silebottom, Broadbottom, near Mottram, Chester—Certain imp. in looms for weaving.
1076. J. Green, Leeds—An improved cutting and sawing machine.
1078. Right Hon. R. Lord Berwick, Attingham-hall, Salop—Imp. in rifling fire-arms.
1082. J. Grantham, 31, Nicholas-lane, London—Imp. in apparatus for feeding furnaces with coals.
1084. J. Grantham, 31, Nicholas-lane, London—Imp. in slips for raising ships and vessels.

Dated 30th April, 1860.

1086. W. Gossage, Widnes, Lancashire—Imp. in obtaining products by means of distillation and condensation, or by one of such means, from oily, fatty, resinous, and bituminous substances.
1088. G. T. Bousfield, Loughborough park, Brixton, Surrey—Imp. in apparatus for working the valves of steam engines. (A com.)
1092. J. Lansley, Brown Candover, Hants—Imp. in harrows.

Dated 1st May, 1860.

1094. A. Upward, Brick-lane, St. Luke's, Middlesex—Imp. in apparatus employed in boring and tapping gas and water mains, and in fitting service pipes thereto.
1096. J. Taylor, Artillery-lane, Bishopsgate-street Without, Middlesex—Improved apparatus for preventing a downward draught of air in chimneys, and for causing the smoke to ascend, applicable also for the purposes of ventilation.
1098. G. Bower, Droylsden, Lancashire—Certain imp. in metallic pistons.
1100. A. V. Newton, 66, Chancery-lane—Improved apparatus for lifting vessels out of water. (A com.)

Dated 2nd May, 1860.

1102. J. Brown, Manchester—Imp. in the spouts or tubes of lubricating cans.
1104. W. E. Gedge, 11, Wellington-street, Strand—An improved apparatus for obtaining pneumatic power. (A com.)
1108. J. Gardner, Eversholt-street, Middlesex—Imp. in metallic bedsteads.

Dated 3rd May, 1860.

1110. A. Dixon, Birmingham—Imp. in screw stocks and dies.
1111. J. Brickhill, Saint Leonard's-road, Bromley, and J. Noble, York-street East, Stepney, Middlesex—Imp. in screw propellers.
1112. A. R. le Mire Normandy, Odin-lodge, King's-road, Clapham-park—Imp. in the construction of steam boilers.
1113. G. E. Toomer, Hoaden-house, Ash, Sandwich, Kent—An improved construction of plough.
1115. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of boots, shoes, and other coverings for the feet, and in apparatus connected with such manufacture. (A com.)

Dated 4th May, 1860.

1116. H. Reid, Lee, Kent—Imp. in hoops for hooping casks, barrels, and such like purposes.
1119. T. Heatley, High Hatton, Shawbury, and W. Paddock, Shrewsbury, Salop—Imp. in threshing machines.

Dated 5th May, 1860.

1122. E. Hardon, Stockport, and L. Lee, Manchester—Certain imp. in finishing woven fabrics.
1123. E. Smith, Keighley, Yorkshire—An imp. in machinery for preparing wool, cotton, flax, and other fibrous materials.
1124. J. Grimond, Dundee—Imp. in weaving.
1125. W. Denley, Exeter-place, Hans-place, and J. Perrin, Walton-street, Chelsea—Imp. in fire places and flues.
1126. W. Hunt, Tipton, Staffordshire—Imp. in the manufacture of carbonate of soda, and in apparatus to be employed in the said manufacture, also in utilizing waste products obtained in the said manufacture.
1127. A. Tweedale and J. Tweedale, Healey Hall, near Rochdale, and S. Taylor, Rochdale, Lancashire—Imp. in temples for looms and in indicating the number of picks made in such machinery for a given length of cloth.

Dated 7th May, 1860.

1128. J. D. Dougall, Glasgow—Imp. in breech-loading fire-arms.
1129. W. E. Newton, 66, Chancery lane—Imp. in the manufacture of glass. (A com.)
1130. W. E. Newton, 66, Chancery-lane—An imp. in rotary planes (A com.)
1131. M. J. Roberts, Crickhowell, Brecon—Imp. in breech-loading fire-arms.
1132. J. A. Eisenstuck, Chemnitz, Saxony—Imp. in knitting machinery.
1133. J. Harris, City Bank Chambers, Threadneedle-street—Imp. in the manufacture of coke and charcoal from lignite, and obtaining products therefrom.
1134. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in pipe couplings. (A com.)

Dated 8th May, 1860.

1135. J. Corbett, Stoke Works, near Bromsgrove, Worcestershire—Imp. in evaporating pans for the manufacture of salt.
1137. W. R. Barker and J. Schweitzer, 29, Chapel-street, Belgrave-square, Middlesex—Imp. in the manufacture of artificial mineral chalybeate water.
1139. D. Sutton, Broad-street, Banbury, Oxon—Imp. in the construction of rollers for rolling and crushing land.

Dated 9th May, 1860.

1143. R. Geoghegan, Dublin—Imp. in machinery or apparatus for expressing liquids from various substances.
1145. J. B. J. de Buyer, Rupt, near Scey-sur-Saone, France—A new system of cast-iron cart wheels.
1147. A. G. Shaver, New Haven, Connecticut, U.S.—An eraser and pencil sharpener.
1149. R. A. Brooman, 166, Fleet-street—Imp. in horse mills. (A com.)
1151. W. L. Johnson, Manchester—Imp. in steam engines and boilers, and apparatus connected therewith.

PATENTS SEALED.

[*From Gazette, May 18th*, 1860.]

May 17th.
2614. J. Willcock.
2615. S. Corbett.
2624. J. Petrie, jun., and J. Lord.
2688. P. R. Hodge.
2719. T. Silver.
2736. T. Hall.
268. W. Ingham and W. Hinchliffe.
424. W. H. Elkin.

[*From Gazette, May 22nd*, 1860.]

May 22nd.
2647. W. H. Ward.
2648. W. H. Ward.
2649. E. T. Hughes.
2651. E. T. Hughes.
2653. B. Bagster.
2659. W. C. Maniece.
2664. W. S. Losh.
2670. I. A. Read.
2676. L. J. Vandecasteele.
2678. W. Moseley.
2680. T. Watson and G. Healey.
2682. W. MacNaught and J. L. Taylor.
2683. J. Eastwood.
2684. J. Eastwood.
2695. F. H. Wenham.
2708. E. Dorsett.
2709. J. M. Wilson.
2747. E. Kelly.
2757. F. Coignet.
2765. F. Levick.
2767. J. Anderson.
2782. J. R. Foord.
2797. J. D. Dunnicliff.
2808. I. L. Bell.
2839. G. Leach.
2840. S. Bentley.
2858. W. Gadd.
2898. G. Collier and J. Collier.
2900. W. Henderson.
2917. W. E. Newton.
2992. H. Cochrane.
196. S. Beardmore.
276. A. Denny & E. M. Denny.
284. T. Blackburn and M. Knowles.
624. A. Paget.
629. T. Veal.
702. W. Wood.
712. T. Richardson and M. Prentice.
763. G. N. Snow.
792. H. M. Clarke.
795. W. E. Newton.
825. A. Crosskill.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, May 18th*, 1860.]

May 14th.
1382. R. A. Brooman.

May 15th.
1428. E. C. Kemp.
1432. W. Owen.

May 16th.
1459. T. Silver.

[*From Gazette May 22nd*, 1860.]

May 17th.
1434. W. Todd.
1625. G. Jarrett.

May 18th.
1405. J. F. P. L. Von Sparre.

May 19th.
1409. G. W. Burton and G. Pye.
1413. J. Hardley.
1448. B. H. Hine and W. Onion.
1490. W. Holland.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, May 18th*, 1860.]

May 14th.
1232. W. Gossage.

May 15th.
1360. W. E. Newton.
1369. J. Hayes.

Journal of the Society of Arts.

FRIDAY, JUNE 1, 1860.

THE INTERNATIONAL EXHIBITION OF 1862.

The Council of the Society of Arts have the satisfaction of announcing that the sum of a quarter of a million, which was the minimum fixed for ensuring the Exhibition, has been guaranteed. The amount already promised (including the subscription of H.R.H. the Prince Consort for £10,000), is £292,000, and is daily increasing. It is the wish of the Council that it should be made as large as possible.

GUARANTEE COMMITTEE FOR THE EXHIBITION OF 1862.

The Council of the Society of Arts have much pleasure in announcing that a Committee consisting of the the following noblemen and gentlemen, representing Arts, Manufactures, and Commerce, has been formed for promoting the Extension of the Guarantee Fund for this Exhibition, as far as possible, beyond the sum of a quarter of a million already subscribed.

Abel, F. A., Woolwich.
Appold, John George, F.R.S.
Ashburton, Lord
Bagnall, Charles
Bazley, Thomas, M.P., Manchester.
Bell, John
Binns, R. W., Worcester
Bodkin, W. H., Assistant-Judge for Middlesex.
Brassey, Thomas
Bridson, Henry
Brocklehurst, T. V., Macclesfield.
Chambers, T. K., M.D.
Chance, Frank, M.D.
Chester, Harry
Clabburn, W. H., Norwich.
Clegg, Thos., Manchester
Cole, Henry, C.B.
Cubitt, Wm., Alderman, M.P.
Dillon, John
Donkin, Thomas
Doulton, Henry
Elkington, Fredk., Birmingham.
Ewart, Wm., M.P.
Fairbairn, Wm., F.R.S., Manchester.
Frith, J. G.
Gilbee, W. A.
Godwin, George, F.R.S.
Graham, Peter
Gurney, Samuel, M.P.
Gwynne, J. E. A.
Hankey, Thomson, M.P.
Hawes, William
Hawkshaw, John, F.R.S.
Hollins, M. Daintree (Messrs. Mintons', Stoke-upon-Trent).
Hope, Henry Thos.
Hoskyns, C. Wren
Keeling, Henry L.
Lapworth, Alfred
Lawrence, Frederick
Leighton, John, F.S.A.
London, The Right Hon. the Lord Mayor of
MacGregor, John
Mackrell, W. T.
Mechi, J. J., Alderman
Moreland, Joseph
Myers, George
Nicoll, Donald, M.P.
Owen, Lt.-Col. H. Cunliffe, R.E., C.B.
Pakington, Rt. Hon. Sir John, Bart., M.P.
Paxton, Sir Joseph, M.P.
Peel, George, Manchester.
Portal, Wyndham S.
Prescott, W. G.
Redgrave, Samuel
Rock, J., Jun., Hastings.
Roney, Sir Cusack
Salisbury, the Marquis of
Salomons, Aaron
Salt, Titus, Bradford.
Sandford, F. R.
Saunders, W. Wilson
Simpson, W. B.
Sopwith, Thomas, F.R.S.
Stanley, Rt. Hn. Lord, M.P.
Topham, John
Twining, Thos., Jun.
Tylor, Alfred
Uzielli, Matthew
Westmacott, R., R.A.
Whatman, James, Maidstone.
Wilson, G. F., F.R.S.
Wilson, Professor John, Edinburgh.
Winkworth, Thomas
Wodderspoon, James
Wood, Vice-Chancellor Sir W. Page

With power to add to their number.

The Council have asked the Marquis of Salisbury, K.G., to act as Chairman, and the Lord Mayor of London, the Lord Stanley, M.P., the Vice-Chancellor Sir Wm. Page Wood, and Mr. Thomas Bazley, M.P., to act as Vice-Chairmen of the Committee.

The Committee will meet for the first time on Tuesday next, 5th June, at the Society's House, Adelphi, at 12 o'clock.

UNIFORM MUSICAL PITCH.

A meeting of Musicians, Amateurs, and others interested in Music, will be held at the Society's House on TUESDAY next, the 5th of June, at Three o'clock in the afternoon, to receive the Report of the Committee appointed by the Council of the Society of Arts.

NINTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS.

The Ninth Annual Conference between the Representatives of the Institutions in Union and the Council will be held on Friday, the 22nd, at half-past 10 o'clock in the morning. Sir Thomas Phillips, F.G.S., Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference, stating at the same time (if possible) whether those gentlemen will also be present at the Society's Annual Dinner, which will take place on the same day, and of which particulars are given below.

The Chairmen of, or Representatives from, the several Local Boards of Examiners are invited to attend.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Friday, the 22nd June, at six o'clock punctually. The Right Honourable Benjamin Disraeli, M.P., will preside.

Members and their friends are invited to be present, and tickets (price 10s. 6d. each) may be obtained at the Society's House.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

An Exhibition of some of the principal works of the late Sir William C. Ross, R.A., is now open at the Society's House, and will remain open until the middle of June only.

The public are admitted on payment of one shilling each person.

Members of the Society of Arts have free admission, and may *personally* introduce one friend.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 9th April, and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONE.

The Second Conversazione of this Session took place at the South Kensington Museum, on Saturday evening last, the 26th May.

The following Divisions of the Museum were open on the occasion:—The Sheepshanks Gallery of Pictures; the Vernon and Turner Galleries (by permission of the Trustees of the National Gallery); the Sculpture Gallery; the Architectural Museum; the Animal Produce Collections; the Ornamental Arts Collections; the Structure and Building Materials Collections; the Educational Collections; the Collection of Patented Inventions (by permission of the Commissioners of Patents); the Art Training Schools.

In addition to the above were exhibited, for the first time, the Ellison Collection of Water-Colour Paintings, arranged, temporarily, in the Sheepshanks Gallery. This Collection of Paintings is presented for public inspection by Mrs. Ellison, of Sudbrooke Holme, Lincolnshire, in accordance with the wish of her late husband, for the purpose of forming the nucleus of a National Collection of Water-Colour Paintings.

The programme distributed to the Visitors included a Plan of the Estate purchased by the Royal Commissioners for the Exhibition of 1851, from the Surplus Funds derived from that scource, showing, also, the proposed Site for the intended International Exhibition of 1862.

The band of the Coldstream Guards was in attendance, and performed the following selection:—

Overture ...	... "A Night in Granada" ...	Kreutzer.
Valse ...	... "The Dream of the Rose" ...	Burkhardt.
Fantasia ...	... "Don Giovanni"	Mozart.
Glee ...	... "Sleep, Gentle Lady" ...	Sir H.R. Bishop.
Quadrille ...	... "The Campbell Minstrels"...	D'Albert.
Aria ...	"O Rest in the Lord," Cornet-à-Pistons—Mr. Buchanan	Mendelssohn.
Operatic Selection	. "Dinorah"	Meyerbeer.
Overture ...	..."A Midsummer Night's Dream"	Mendelssohn.
Walzer ...	... "Immortellen"	Gung'l.
Grand Selection from the New Opera, "Lurline"...		W. V. Wallace.
Glee ...	... "The Chough and Crow" ...	Sir H. Bishop.
Polka ...	... "The British Volunteers"...	A. F. Godfrey.
Selections ...	... "Victorine"	A. Mellon.
Galop ...	... "Crinoline"	Ld.G. Fitzgerald

The company were received on re-entering by Sir Thomas Phillips, F.G.S., Chairman, and the Members of the Council.

Refreshments were served in the Class Rooms at the end of the Library Corridor.

"God Save the Queen" was performed shortly after 11 o'clock, when the company separated.

The number of members and their friends present was about 2,500.

TWENTY-FIFTH ORDINARY MEETING.

Wednesday, May 30, 1860.

The Twenty-fifth Ordinary Meeting of the One Hundred-and-Sixth Session was held on Wednesday, the 30th May, Thomas Sopwith, Esq., F.R.S., Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Brough, George | Fullerton, J. Chamney
Marratt, J. S.

The following Colonial Institution has been taken into Union since the last announcement:—

South Australian Institute.

The Paper read was—

ON BUILDING WOODS: THE CAUSES OF THEIR DECAY, AND THE MEANS OF PREVENTING IT.

By G. R. Burnell, F.G.S., F.S.A.

The use of timber for building purposes being of an importance even greater than that of the use of stone, has naturally attracted more attention from the practical and scientific students of the arts of construction than has been devoted to the study of the cognate subject above-mentioned; but the information recorded upon the conditions under which timber should be employed is dispersed through so numerous a body of authors, that it appears to me to have become almost necessary to condense it into some popular form. At any rate, the introduction of several hitherto unknown descriptions of timber into our markets, the recent startling tale of the decay of our gunboats, and the application of certain processes for the purpose of preventing the decay of timber, seem to render opportune a short review of the state of our knowledge of the subject, and also to render a discussion of the value of the respective new materials and new processes desirable. With these objects in view, it is proposed in the following paper, firstly, to consider the conditions under which timber trees grow and decay in forests; secondly, to describe the various descriptions of timber generally used in England, and their properties; and, thirdly, the causes of the decay of converted timber, and the more generally

known processes applied for its preservation from internal decay, or from external attack.

I.—Growth and Decay of Timber Trees in the Forest.

Timber trees may be described briefly, in botanical terms, as being plants of the dicotyledonous, exogenous families, in which the branches are perennial, and supported upon a trunk. The structure of their stems consists, firstly, of the pith at the centre, above the point of separation between the root and the stem; secondly, of the medullary rays, which establish the communication between the pith; and, thirdly, of the bark. Of these parts of the stem, the bark usually bears a larger proportion in its thickness to that of the heart in young trees than it does in old ones, and so long as it retains its vitality, it allows the wood beneath it to expand by adding new tissue to itself. The bark is usually divided into two distinct parts, under the names of the cortical texture, and the liber, or inner bark; and its function is to protect the woody part of the tree from ordinary external sources of injury. Beneath the liber, and above the wood, occurs a layer of a mucous viscid nature, called the cambium, which was considered by Lindley to furnish the nutriment for the development of the plant, or to be, in fact, the generative sap, and it was said by him to exude both from the wood and the bark.* The medullary rays commence with a sheath surrounding the pith, and from thence they radiate through the various layers of the woody tissue and the vessels dispersed through the latter. One of these layers is formed every year around and beyond the layer of the last year's growth, and it is supposed by some authors that the several zones of woody tissue are separated from one another by a layer of cellular tissue. When a tree has attained a certain age, the wood in the very centre changes its colour and texture, in degrees varying with each particular description of wood; and the heart-wood, or duramen, becomes both harder and darker in its colour than the more recently formed layers (which are known by the name of the alburnum), in consequence of the elimination of a colouring matter in the duramen alone. It must be observed, however, that the law above mentioned, of the growth of wood by means of annual layers, only holds in climates where the alternations of heat and cold are distinctly marked, and that in tropical regions it is by no means rare to find that as many as four layers of wood may be deposited around the former parts of the tree in one year.

The parts of a growing tree are, first, the root, the whole of which is usually, but not necessarily, below the ground; the stem, or bole; the arms, or branches; the twigs; and the leaf-stalks and leaves. For the purposes of economical application, the stem and branches are converted into baulk, or log-wood; the branches, generally speaking, are only fit for the purpose of fire, or cord wood; whilst the twigs are only used for bavins, or faggots. The barks of certain trees, such as the oak, cork, beech, &c., are used for the purposes of commerce, and possess a very great industrial value. One important remark to be made with respect to the structure of the wood of the stem especially, is that each ring evidently consists of two portions, one presenting a close, firm, and horny texture, and the other, an open, vascular texture. The horny part of the layers occurs upon the outside, or nearer to the bark, and the vascular part towards the centre of the tree. The quality of a wood, for building purposes at least, depends greatly on the mode of growth of the horny part of the annual rings, for it is in them that the elements of the tenacity and elasticity of the wood reside. In woods of the best quality, the horny part of the rings is thick, and so dense as only to allow its vascular structure to be detected by the microscope, but it is found practically that woods of this description are exposed to shrink, warp, and crack to such an extent as not to be fitted for use as plank stuff, whereas the woods in which the horny structure is displayed in a less decidedly marked manner are well-adapted for those particular purposes, but are not so well able to support violent efforts of rupture or of compression.

Every description of tree affects a particular description of soil, and requires certain conditions of moisture, exposure to the air, and light, in order to arrive at its maximum of useful development, or at such a stage of growth as to be most fitted for the usages of commerce. Thus, for instance, it is believed that the oak thrives the best in England, in rich sandy loams, and that it attains the greatest length when grown in rather dense forests, whilst it attains the greatest volume when the trees grow in open situations and apart from one another. The elm grows well in rather stiff clays; the beech, in chalky soils; the accacia, in tuffacious, fissured limestones; the maple, in sandstone districts: the poplar, in rather wet clays; and the willow and alder, in frequently submerged alluvial lands; but whether the trees be able to bear such excessive quantities of water as those last named, or only require a moderate amount of liquid food, the character of their wood (so far as grain and strength are concerned) is materially affected by the action of the prevailing winds upon their stems. The bark becomes thicker and more rugged on the exposed sides; the horny part of the annual rings is more distinctly marked also on those sides, but the most serious consequence of exposure to violent winds is to be found in the tendency of the wood to assume a twisted, spiral mode of growth, which materially affects the strength of timber adapted for building purposes. Some people consider that the hard wood trees thrive better when they are exposed to the north and east, than when they are exposed to the south and west; but whether this opinion be correct or not (and it has been very decidedly questioned), it is certain that the timber of the hard wood trees assumes a very lax and spongy texture when the subsoil of the place where they grow is of a retentive, close nature. It would appear also to be the law that the best and soundest timber is produced in the temperate latitudes, or at such elevations above the sea level, in tropical climates, as to allow the trees to enjoy a temperature exempt from the extremes of either heat or cold. The whole of these important considerations of the effect of external climatological and geological causes, have been discussed in the most elaborate manner in De Candolle's *Géographie Botanique*, to which the student is referred for further details. It may suffice for our present purposes to state that the result of M. de Candolle's observations is to show that the distribution of trees, or of plants generally, does not follow so distinctly the course of the isothermal lines as it does that of the lines indicating the existence of equal amounts of heat beyond certain fixed points, varying with the nature of the plant observed. The best timber is, however, grown in those countries where the requisite sum of heat is most equally distributed over the longest period; for in them the grain of the wood is found to be more regular and uniform than it is in the countries exposed to sudden and violent changes of temperature. A considerable amount of moisture in the atmosphere, and in the ground itself, is also an essential condition of the growth of large plants, or of trees; and the equable nature of the supply of this element is again more likely to prevail in the regions where there are no marked extremes of heat and cold at the various seasons of the year.

Some descriptions of trees, after attaining a certain growth, are cut down, and the stump is left in the ground, from which, in course of time, shoots spring, of a size almost equal to the parent stem. Other trees, used for

* The modern writers upon botanical physiology appear to believe that the cambium, and the fluids circulating in the external wood of a tree, occupy, towards the latter, positions analogous to those of the flesh and of the venal blood in the human frame; and it may very possibly be a consequence of this relation that, as in the human frame, the decomposition of the body when vitality ceases begins in the fleshy tissues, so in the timber trees the parts immediately connected with the circulation of the vitiated circulating fluids may be—nay, we know that they are—the parts most likely to decay.

building purposes, are rooted up; and, if replaced, they are so from plants raised from seed, or from cuttings of older trees, generally speaking of the former. Oak trees are often treated in the manner above described (or in forest phrase "pollarded"), but the shoots which spring from the stump are exposed to rot in many peculiar manners, in consequence of the decomposition of the sap in the roots, and in the stump itself, produced by the great change in what may be called the functional conditions of those parts of the tree. The same description of action may take place in trees raised from seed, if a large branch should be suddenly removed from their stems; for the root which supplied that branch is often able to change the mode of growth of the rest of tree, when its sap is no longer able to follow the original course. It must, therefore, be a matter of some importance to the growth of a tree that the lopping of the branches should be carefully performed; but in forests, such as supply our great timber markets, the trees are usually left to themselves, without any such care or superintendence, and the boughs they lose are only detached by storms or by lightning. In whatever way such boughs be removed, the effect of their removal is, however, very frequently to produce a rotting of the inner wood, which indicates itself externally by a sudden and abnormal swelling of the trunk a little above the root; sometimes the trunk becomes hollow at the part affected, and this particular description of rot will almost invariably be found to exist in those trees whose roots are much exposed. The rot itself is either of a red, black, or white colour in the timber when felled, and when either of the two last-named colours prevail, it will be found that the decay does not extend very far into the tree; but if, on the contrary, the colour of the parts most visibly affected should be decidedly red, the wood should be rejected for any building purposes. Sometimes small brown spots, indicative of a commencement of decay, may be observed near the butt, or root-end of trees, and though they do not appear to be connected with any serious immediate danger to the durability of the wood, it is advisable to employ the material so affected only in positions where it would not be confined in anything like a close damp atmosphere.

The growth of trees takes place with comparatively speaking greater rapidity in their youth than it does in the maturer stages of their development; but with all varieties there is a period (dependent upon the nature of the tree, and of the conditions under which it grows) at which all increase, whether of height or of volume, ceases, and the tree then, instead of gaining, begins to lose strength and vitality. It is easy to discover when this period has been attained, for the upper branches begin to lose their leaves, and the tree becomes, in woodman's phrase, stag-headed. Indeed the state of the upper branches of a tree may be considered to be amongst the best indications of its soundness, and provided they be in a healthy condition the withering of the lower branches, is a matter of comparatively small importance. So long, however, as the trees continue to grow, the heart wood is the harder and denser; but, when they are on the decline, the outer rings, which seem to be more actively concerned in the vital processes of the tree, absorb the nutrition from the heart wood, and thus superinduce in it a gradual but sure decay. Trees, under these circumstances, become exposed to the inconvenience of what are called star shakes, or cracks in the body of the wood, radiating from the centre towards the circumference, with their greatest width towards the centre; whereas the star shakes, or cracks of young timber, have their widest opening towards the circumference. If the trees thus affected should be allowed to stand, the heart wood will in the end entirely decay, and the stem will become hollow, especially if a large branch should be broken off, and thus allow external moisture access to the inner wood through the ruptured fibres. It follows from these conditions that wood intended to be used in the more important operations of building, should be obtained from trees which had not exceeded their age of growth; and it also appears that the season of the year when the trees are felled, has a distinct influence upon the durability of the wood. Theoretically, the best period for that operation would be the one immediately preceding the first movements of the sap in spring time; but as it is not possible, in practice, to command the amount of labour required for such purposes, it is customary to fell the timber of regularly worked forests during the whole of the season comprised between the moment when vegetation ceases in the autumn, and the moment when it recommences in the spring. In other words, it is customary to fell timber of the best description between the months of October and April, in our latitudes at least.

There are some other conditions in the growth of trees which give rise to the defects it may be desirable to notice here. Thus, in the very heart of sound, healthy-looking trees, it is by no means rare to meet with circular bands, which form separations, in fact, between the layers of the wood, and which are supposed to be occasioned by the action of violent winds upon the stem of the tree at the period of the formation of the new layers. These cup-shakes, as they are called, are most frequently to be met near the roots of trees, and if they should be black, and accompanied by star-shakes, they materially affect the strength of the timber, though they do not seem to have much influence upon its durability. Sometimes the cup-shakes exhibit themselves externally by an abnormal increase of bulk of the stem a little above the root. In other trees, again, circular bands occur, in which the wood is of a softer and more spongy character than in the rest of the tree, and which even occasionally present a commencement of decay. This accident occurs in the very best timber, and, unfortunately, when it does so occur, the effect seems to make itself felt throughout the whole length of the tree, a circumstance by no means extraordinary—if the generally received opinion as to the cause of the phenomenon be correct—viz., that it is produced by the action of sharp frosts upon the rising sap in the newly-formed layers of the wood. Timber which possess this character will infallibly decay in buildings, and it should therefore be carefully excluded; and great hesitation may also be admitted as to the use of timber which presents large bands of what are supposed to be indefinitely marked annual growth, because the existence of zones of wood so affected may be considered to indicate that the tree was not in a healthy state when they were formed, and that the wood then secreted lacked some of the elements required for its durability upon being subsequently exposed to the ordinary causes of decay.

In many cases, when timber trees are cut down and converted for use, it is found that at the junction of some of the minor branches with the main stem, the roots, as it were, of the branches traverse the surface wood in the form of knots, and that they often assume a commencement of decay, which, in the course of time, will extend to the wood around them. This decay seems to have arisen, in the majority of cases, from the sudden disruption of the branch close to its roots, with an irregular fracture, and with such depressions below the surface as to allow the sap to accumulate, or atmospheric moisture to lodge in them. A decomposition of the sap takes place—in fact a wound is made in the tree—and what are called "druxy-knots" are thus formed, which have a contagious action on the healthy wood near them. The druxy-knots of a foxy colour are the most dangerous; but if the colour should be decidedly black, there is a probability that the mischief will not extend very far. Growing timber is sometimes affected by blows, or by the rubbing of falling timber in a forest, and a species of local decay may be thus created. Lightning, when it strikes a tree, may either shiver it completely, or simply crack it in various directions, or even cause a species of rot by producing a decomposition of the sap. And it may also be observed that the growth of mosses, or of fungi, upon the bark of a

standing tree is so closely connected with the existence of decay in its interior, that it is hard to say whether it be in the relation of cause, or of effect, to that decay.

All the conditions of the decay of trees above described, depend upon the chemical changes produced in the sap and in the alburnum, by the external actions which either determine an undue flow of the circulating fluid to any one particular part of the tree, or give rise to a decomposition of the above-named portions of its organisation. The fungoid growths, it is true, participate of another nature, and are of a much more obscure character, but as they equally affect wood after it has been converted to constructive purposes, and that too in a manner more immediately interesting to the builder, it may be advisable to defer their consideration for the present. The strange nature, and the fearful extent of the ravages exercised by insects, and sometimes by birds and small animals, upon trees still in the forest, cannot, however, be passed over without some specific notice, though, of course, the limits of this paper will not allow of its being treated with the development it merits. The attacks of marine lignivorous insects upon dead wood will be specially noticed in the sequel.

There may be considered to be three classes of destructive insects preying upon timber trees, founded upon the manner in which they carry on their operations, viz., those which feed upon the leaves and tender shoots; those which feed upon the bark and the alburnum; and those which feed upon the heart wood. The leaf-eaters, again, may be divided into those which devour the substance of the leaves without touching the epidermis; those which devour the upper and under surfaces of the leaves; those which devour the whole substance of the leaves; those which devour the flowers; those which devour the farina of the flowers alone, and those which simply extract the circulating fluid from the vessels of the leaves; whilst there are other insects which injuriously affect growing timber by giving rise to galls, or analogous excrescences. These animals injure trees by the interference they produce in the discharge of the natural functions of respiration carried on through the leaves, and by the privation of shade to the stem normally produced by the foliage. They also give rise to a strange disturbance of the circulating system of the trees, of a nature, at times, to cause their rapid decay. Fortunately, this class of insects does not conceal itself in any effectual manner, and it is only on exceptional occasions that the atmospheric changes, and the attacks of insectivorous animals, are unable to prevent their excessive development; thus bats, moles, badgers, hedgehogs, squirrels, foxes, swine, greenfinches, woodpeckers, nuthatches, treecreepers, starlings, chaffinches, titmice, goldfinch, redbreast, redstart, cuckoo, crows, ravens; lizards, frogs, toads; many kinds of beetles, flies, ichneumonidæ, field and tree bugs, spiders, &c., eagerly devour the herbivorous insects, and in conjunction with frosts, rains, and floods, they tend to keep down the number of these plagues. The insects which feed upon the bark in their turn are of several varieties, and some of them only eat the outer bark or rind; others the inner bark or bast, and the alburnum, whilst others feed upon the solid wood. Amongst the two former divisions, Kirby and Spence, and Kollar, place the *Scolytus destructor*, the *Hylesimus fraxini*, the *Tomicus typographus*, the *Bostrichus pinastri*, the *Sphinx apiformis*, the *Curculio abretis*, the *Lymexylon*, and the *Curculio notatus*. Amongst the last division may be included the destructive *Cossus ligniperda*, the *Cryptorhynchus lapathi*, the *Lucanidæ*, the *Cerambycidæ*, (the stag beetle, and the long-horned beetle tribes), the *Sirex gigas*, and the *Sirex duplex*, and even the *Zengera æsculi*. Of these timber devourers the most dangerous are, in our latitudes, the *Scolytus destructor*, the *Tomicus typographus*, the *Cossus ligniperda*, the *Sirex gigas*; and in the East the *Prionus giganteus*. It is to be observed that some of the insects which feed upon the heart of wood do not cease their ravages upon the removal of the tree; but that, on the contrary, the *Cossus*, *Syrex*, of our indigenous fauna, and the larva of the *Callidium bajulum*, which are often found in imported timber, continue to devour the wood long after it has been inserted in buildings. There seem to be very few means of defence against this class of destructive agents; and very few trustworthy indications of their existence, or of the extent of the ravages they have committed, are to be discovered externally; and it thus frequently happens that a sound, hearty-looking stick of timber may be so seriously bored by these insects as to be of comparatively little value for building purposes of any description.

The injurious action of birds and animals upon forest trees is not really a matter of serious importance, for even the woodpecker and the nuthatch do not attack wood unless it be in search of the boring insects on which they feed, and their bills are hardly able to penetrate sound timber. Rooks and crows do real service, by the eagerness with which they hunt for and destroy the larger beetles; and altogether it would seem to be more than questionable whether the tree birds are not the most valuable agents for keeping down the number of destructive insects, and that they thus more than compensate for any injury they may chance to inflict whilst in pursuit of their prey. Nearly the same remark may be made with respect to squirrels, bats, and other fruit and insect-devouring mammalia, and the browsing animals, such as horned cattle, deer, sheep, &c., are only able to attack young trees, or the lower branches of those which have attained a certain growth. No doubt in tropical climates the elephants, giraffes, and other gigantic herbivorous animals, may do greater mischief amongst forests than we are accustomed to witness in temperate latitudes, but the action of all these classes of animals is so immeasureably inferior to that of the tree-boring insects, that the consideration of the former may be passed over cursorily without any great philosophical impropriety. The insignificant *Scolytus destructor* will often do more mischief in a forest in one season than all the birds or beasts it may shade would be able to do in a century.

II. Description of the Timbers generally used for building purposes in England, whether of native or of foreign growth.

1st. *Native-grown Timber.*—The woods employed for building purposes in our large towns, are so exclusively derived from foreign countries, that professional architects especially are apt to overlook the importance of the resources of this description furnished by our own land; yet it may fairly be stated that the supply of the wants of agricultural builders, and of many of the trades connected with that important branch of natural production, is derived exclusively from the English forest trees. Such woods as the lime, the maple, accacia, wild cherry, thorn, and willow, are frequently used for carpenters, joiners, turners, furniture makers, and wheelwrights' purposes in agricultural districts; the holly, pear, walnut, sycamore, and yew, are more eagerly sought for by what are called the Tunbridge ware makers; the poplar is used for box making; the birch, for rough carpentry and scaffolding purposes; the elm is used for farm buildings, for carpentry intended to be constantly submerged, cart building, and for coffin-making; the alder is sought for on account of the extraordinary value of its charcoal for gunpowder manufacture; the horse chesnut and the sweet chesnut are used for farm buildings occasionally; the hornbeam and ash are used for the most important details of millwrights' work, on account of their hardness, evenness of grain, and tenacity, and the ash in large lumps, or wide planks, is used for chopping boards, or blocks, counter tops, ironing boards, or other analogous purposes; the Scotch fir, silver fir, larch, spruce, and other varieties of the pine tribe, are extensively used for rustic carpentry, and even for railway sleepers, or timber platforms kept constantly under ground; the beech is used, as a hard wood, in rustic carpentry, and for pile driving when the wood is permanently submerged; whilst the purposes to which the English

oak are applied are too numerous and too well known, to require detailed notice. In town buildings, the English woods most commonly used, under the directions of architects and engineers are, however, only the elm, ash, oak, beech, and occasionally the sweet chestnut, and it is to them alone that attention will here be called.

The elms grown in England belong to several species, of which the small-leaved elm (*Ulmus compestris*), the cork-barked elm (*U. suberosa*), and the wych elm (*U. montana*), are the most commonly diffused, and the first of which may be taken to represent the type of the group. It thrives in almost every variety of soil in the south and west of England, and grows into trees of from 75 to 100 feet in height and 4 feet diameter. The wood of the full-grown healthy trees is of a deep brown colour, compact, free from knots, and of a fine grain, unfit, however, to take a polish of any description; it loses, according to Loudon, as much as 66 per cent. of its weight in drying. Elm timber has great transverse strength, but even in this respect it is far inferior to the oak; and it is on account of its peculiar powers of resistance to strains that it is hardly ever used to support heavy loads, whilst it is well adapted for such situations as would expose it to concussions. After being seasoned, this wood does not split or crack, and it is durable when constantly exposed to the sun or to water, but it rapidly decays in situations wherein it is alternately exposed to be wet or dry. The piles of the old London Bridge were made of elm, and the wood, after 800 years, was as sound as on the first day of its use. The water pipes used until the commencement of this century were bored out of elm trees; and at the present day, ships' pumps, boxes of wheels, blocks, dead eyes, and other wooden furniture of rigging, are constantly made of this wood. The colour of the wood is, in old elm trees, of an oak brown; in younger ones it is brownish white, with a shade of green; and coach-makers and others who use this material, observe that the old trees yield a wood of a far more brittle nature than the young ones do. The seasoned elm weighs about 36·7 lbs; its specific gravity is 0·588, and there are usually about 61 feet to the ton; its cohesive strength is considered to be 13,489 lbs.; its resistance to a crushing weight, 10,331 lbs. per inch superficial. The great use of elm is, it may be added, for coffin-making, for which purpose its powers of resistance to the decomposing action of damp ground are of great value.

It may be essential, even here, to notice a singular illustration of the lack of practical information on the subject of building woods amongst our official authorities, viz., that Lord C. Paget, in the House of Commons, said that, in consequence of the scarcity of seasoned oak, the contractors for the celebrated gun-boats had been allowed to use elm planks instead of oak. Now, as the gun-boats were nearly all drawn up on the slips, after a few months' use, the elm planking in question was placed in precisely the conditions which would have led to its decay, had it been desired to produce that result.

The description of ash used for ordinary purposes in England is the *Fraxinus excelsior*, or Common Ash, which frequently grows into trees of from 90 to 100 feet in height and about 6 feet in diameter. Ash soon rots in damp, or in alternately wet and dry situations; and if felled when full of sap it is singularly exposed to the attacks of worms, or the boring larvæ. It is very flexible, but tough and elastic, and on these accounts, whilst it is practically excluded from use in ordinary building operations, it is much sought for by agricultural implement makers, wheelwrights, and engineers. The handles of spades, shovels, picks, boat-oars, milk-pails, kitchen tables, and other similar articles, in addition to those previously mentioned, are usually made of English ash. The weight of a foot cube of this wood is about 49lbs., its specific gravity 0·767, and there are usually 45.7 cubic feet to the ton; the tenacity per inch superficial is about 17,207lbs., and the resistance to a crushing weight 9,203lbs. per inch superficial. The best ash is grown on free loams with a mixture of gravel, the trees grown in cold wet soils being sorely exposed to what woodsmen call "the canker," which displays itself in black spongy masses on the stem and branches. The bark and the sap wood of the ash are exposed to the attacks of many destructive insects of which the *Hylesinus fraxini* is the most mischievous.

The oaks most commonly grown in England belong to the respective varieties of the *Quercus pedunculata*, or the *Quercus sessiliflora*, and it may be at once observed that the differences between the qualities of the woods furnished by those varieties are so slight, that, unless when specially mentioned as appertaining to one of them, the following notice of the properties of the oak may be considered to apply to both the above-named varieties. For all building purposes wherein strength is required,—whether to resist crushing loads, transverse strains, or efforts of torsion, or wherein hardness and durability are sought for,—oak is beyond all comparison the most valuable and the most beautiful wood. If the alburnum be removed, the heart-wood will be found to resist almost every condition of moisture, or of alternations of wetness and dryness, provided always that the moist atmosphere be not allowed to stagnate around the wood. In joiner's work the variety of colour in the grain, or as workmen call it "the flower," of the picked oak planks, known by the technical name of "wains-coat," causes it to be highly prized, and the beauty and durability of the woodwork in the roofs, stalls, pulpits, rood screens, &c., of our mediæval churches and halls, may well explain the marked preference of our builders for this invaluable material. It seems that the *Q. pedunculata* yields a timber which is, for some purposes, superior to that of the *Q. sessiliflora*, for the latter does not split so freely, and is, therefore, less fitted for lath or pale rending; and, moreover, although heavier than that of the *Q. pedunculata*, the wood of the *Q. sessiliflora* is said to be more exposed to warp and crack in seasoning. For shipbuilding purposes; for carpentry exposed to water or in damp positions in the air, there are no substantial differences of resistance; and timber of both these kinds may be used as they may come to hand.

The oak trees, converted for building purposes, are not usually of more than 100 or 130 years old, although for naval architecture, wherein large scantlings are required, trees of much greater antiquity are used. It was formerly by no means rare to meet with oak trees ranging from 75 to 130 feet in height, and ten feet in diameter in the middle of their height; but the excessive demand for this class of timber tends to make such monsters of the forest more and more rare; and at the present day it is only on extraordinary occasions that the long straight sticks of English oak are to be met with of more than two feet scantling. The colour of oak wood is of reddish tinge, and the larger septa and medullary rays are numerous and distinctly marked, giving rise to the flower; the grain is tolerably straight and fine, and generally free from knots, the wood itself being of sufficient evenness of character and density to allow of its being polished either by oil or by lac varnishes. It is said that the *Q. sessiliflora* wood has less flower than its congener; and that in its grain it so much resembles the sweet chesnut as to have given rise to the often-repeated tales about the use of the latter in our mediæval buildings. The weight of a cubic foot of seasoned oak is said to be 58.3lbs.; its specific gravity is 0.934; there are usually about 38.3 cubic feet to the ton; the tenacity per square inch is 17,300lbs.; and I have applied a crushing weight of 11,240lbs. per inch superficial on a cube of English oak without producing any permanent change in its elastic powers. All oak presents the inconvenience of splitting and warping in the seasoning, and it is on this account especially that it is so important to use none but seasoned timber in ship-building, and the best oak is liable to objection on the score of the gallic acid it contains, which has a marked action upon any iron nails, bolts, or fasten-

ings used in connection with it.* Young oak is tough, often cross-grained and hard to work; old oak is more brittle, but also more easily worked. Oak trees, it may be added, are exposed to the attacks of numerous insects, some of which, such as the *Cossus ligniperda*, bore holes of more than half an inch diameter into the very heart wood, and continue their ravages at times even after the tree has been converted to building purposes. The *lymexylon* is also a destructive enemy of the oak, but he seems to confine his attacks to the alburnum. Oak trees grow the best upon deep and rather stiff clays, provided the upper surface be kept free and open by means of surface or subsoil drains. The quality of the wood seems to be injuriously affected when there is an abnormal quantity of the peroxide of iron present in the deep soil.

The Beech trees which furnish the best timber for building purposes are obtained from the chalk districts capped with loam around London, and they there attain the dimensions of the largest forest trees of the second class, or present boles of from 30 to 40 feet in height, and from 3 to 4 feet in diameter. This wood is hard and brittle, varying in colour from a pale brown to white, according to the nature of the soil, the darker colour being usually considered to be indicative of the superior description; the transverse fibres and the horny rings are distinctly marked, producing an agreeable variety of colour, and it may be worth while to remark that the difference of colour between the heart wood and the alburnum is less distinctly defined in beech wood than is the case in either the ash, elm, or oak. Beech is much used for piles and for water works generally, provided it be kept constantly submerged; but if exposed to alternations of wet and dry it decays with fearful rapidity. At all times this wood is exposed to the attacks of beetles, and it cannot be used even for household furniture without being impregnated with some kind of varnish, as a defence against those insects—a very curious fact, be it observed in passing, for the growing trees are remarkably free from the attacks of wood-devouring insects. Beech is easily worked, of a close, fine texture, but is not susceptible of receiving a polish. The weight of a cubic foot is 43·12 lbs, or its specific gravity is 0·777, and there are 51 cubic feet to the ton: the tenacity per superficial inch is considered to be 16,817 lbs.; and the resistance to a crushing force to be 9·048 lbs. per superficial inch.

At the present day chestnut wood is not very largely used. Indeed, there is so little of this material brought into the market, that the principal motive I had in view in alluding to it, was for the purpose of referring to the tales so commonly told about the use of the chestnut in Westminster Hall, and elsewhere. Careful examination has shown that the roofs so referred to were really executed of the wood of the *Quercus sessiliflora*, which is very like that of the sweet chestnut, and must always have been more common in North-Western Europe than the latter could possibly have been. The small quantity of chestnut now used near London is employed for gate posts, barrel staves, &c., and it is remarkable for the very small relative proportion of the sap to the heart wood. For general purposes the chesnut is of far less value than either the hornbeam or the common varieties of native-grown firs, which the limits of this paper will prevent us from noticing as they merit.

2nd. *Imported Timber.*—The principal supplies of timber used in our large towns are, at the present day, derived from foreign countries, as was before stated, on account of the facilities which the inland navigation of our country furnishes for their delivery, and of the continually diminishing quantity of English grown wood. We therefore find that the softer woods of the fir tribe are obtained either from America or Northern Europe, the hard woods from every quarter of the globe, whilst the furniture woods are obtained of every variety, and from every imaginable source. This rough classification of the particular class of woods will be adopted in the subsequent notice.

The fir-woods now most generally used in England, that is to say since the equalisation of the import duties on timber, are obtained from the countries situated upon the shores of the Baltic; the large, or baulk timber of 14 inches square or upwards, being obtained from Riga, Dantzic, Memel, or the Prussian dominions and the German provinces of Russia; the scantlings of about 10 or 12 inches square, are obtained from Sweden, and the scantlings of about 8 inches square from Norway. The manufactured goods, as the various kinds of deals and planks are called, are obtained from either, or all, of the above-named sources; and they are known under the names of planks when more than 11 inches wide, deals when about 9 inches wide, and battens when 6½ or 7 inches wide; deals and planks are usually 3 inches thick, and battens are 2½ inches thick. All these manufactured goods may be either white or yellow, and the above specific terms may occasionally be applied to the spruce goods as well as to the true fir woods. As to the quality of these kinds of timber, it may be observed that, as a general rule, the firs obtained from countries where the mean temperature is not severe, are more regular in their structure, though perhaps softer, than those grown in very cold situations, and that the Memel timber is, on that account, superior in its strength to the Swedish or Norwegian, and that the Riga deals, or the Norway deals grown within the zone affected by the temperature of the Gulf stream, are superior to the Archangel deals, or those grown on the more southerly coast of Sweden. In the best timber the annual rings are thin, and the horny parts are of a bright red colour, especially when the trees have not been tapped for the purpose of extracting the resin; an operation which is carried on to a great extent, and which materially diminishes the elasticity and the durability of the timber. Many of the accidents before alluded to, of a nature to superinduce the decay of the wood in the shape of druxy knots, fungoid growths, etc., are to be met with in the baulk fir; and precautious must therefore be taken in employing it to secure a free circulation of air. Good sound fir is, however, very durable, and indeed by some engineers it is considered to be more so than even oak itself. At any rate the permeability of fir renders it more susceptible of some of the processes for the preservation of timber to be noticed hereafter, and this, under some circumstances, gives it a species of advantage over the more naturally durable material. On account of its lightness, stiffness, and durability, the fir is commonly used for girders, joists, rafters, and framing in general; for joiner's work it is used externally and internally, on account of its being more easily wrought, standing better under the ordinary variations of temperature and light than oak, and of its being considerably cheaper. The grain is usually straight and regular, but it is very frequently deformed by knots; and it is very rarely of a character to allow of its being used without being painted. The different kinds of fir vary in their physical properties, but it is usually considered that the Riga timber weighs 47·06 lbs. to the cubic foot, and has a specific gravity of 0·753; the Christiana deals weigh 43·62 lbs. to the foot cube; the Memel deals, 36·87; and Norway spruce, 21·25 lbs. The tenacity of the Riga timber is considered to be about 12,857 lbs. per superficial inch; and the resistance to a crushing weight, 6,856 lbs.

The fir timbers imported at the present day from the Atlantic ports of America, are almost exclusively of the pine tribe, such as the yellow pine and the pitch pine. The former of these woods is much used for joiners' work, on account of the singular beauty, closeness, and regularity of the grain, which renders it of great value for the working of mouldings; it is, however a very soft and by

* It appears, from the account of the experiments recorded in the *Times* of the 28th inst., that the action of this gallic acid upon the coating of the iron plated ships is of a very energetic nature, and it seems, therefore, to me, that if vessels of that peculiar description should be adopted, it would be preferable to use, in their external portions at least, nothing but creosoted fir, which has no destructive action on iron.

no means a durable wood, and it is not, therefore, much used for external works. The pitch pine, on the contrary, is a remarkably close-grained, hard and resinous wood, free from knots or shakes, and possessed of great durability, for which reason it is employed for the treads and risers of wooden staircases, the decks of ships, and floors in first-class houses. The weight of the yellow pine is 28·21lbs. per cubic foot; that of the pitch pine, 41.25 lbs.

There is a description of fir lately introduced from the Pacific shores of America, from our own colony of Victoria, which seems to me to possess such very remarkable properties, that although the numerous philosophical questions it gives rise to have not been examined as yet in any elaborate manner, I cannot refrain from dwelling upon this Vancouver's Island timber with particular detail. The wood comes to this country in logs, and in manufactured goods. Instead, however, of being only 14 to 16 inches square and 60 feet long at the maximum, as in the case of the Baltic timber, I have seen one stick of the Vancouver's Island timber not less than 127 feet long, and about 42 inches square at one-third of the height measuring from the butt-end, which butt was about 50 inches square; this log actually contained 1,307 cubic feet of timber, and it can hardly be considered an exceptional illustration of the capabilities of this peculiar description of timber, for there are at present in our docks or in private ship-building yards, many logs of nearly equal dimensions. Now this timber, from some rough experiments I have myself made, is not only larger and longer than either the Baltic or the American firs or pines, but its tenacity is greater, and its resistance to a crushing weight apparently superior; indeed, when loaded as a girder, with the weight in the centre to the point of instantaneous rupture, the Vancouver's island wood bore weights which were to those borne by English oak as 13 to 12, and to those borne by the Baltic fir as 13 to 8; and I subjected cubes of the three woods, measuring 3 inches on the sides, to weights of 45 tons each, or 5 tons (11,240 lbs.), on the inch superficial, when I found that the permanent elasticity of the oak was not affected, that of the Vancouver's island timber only slightly so, whilst the Baltic timber was permanently and perceptibly compressed. I do not hesitate, therefore, to say that for girders, masts, large timber framed work, &c., the Vancouver's island timber is superior to ordinary fir, on the score of its strength; and as it only weighs about 42lbs. per foot cube, it is equally preferable to oak on the score of its lightness. For joiners' work, the straightness, freedom from knots, deep warm colour, and beauty of the flower, certainly place the Vancouver's island timber in a superior position to any other of the fir or pine woods, whilst its greater hardness would in certain positions (as in staircases, floors, &c.) compensate for any slight increase in the price of labour occasioned by that hardness. I have used this Vancouver's island timber in the joiner's work of the board-room of the Equity and Law Life Assurance Society, a very elaborate specimen of Elizabethan panelling, and I think that the result of the experiment has been eminently successful. On some subsequent occasion it may be necessary to refer to some observations made upon the destructive distillation of this wood; but at present it may be as well to observe that it seems to affect iron nails and bolts driven into it in somewhat in the same manner as oak does.

Large quantities of oak are imported into this country from Northern and Southern Germany, Italy and America. The oak shipped from the North German ports arrives in the shape of logs, and is cut into what is called Dutch wainscoat, by the same strange confusion of words which makes us so constantly translate Deutsche by Dutch. The Dutch wainscoat is not obtained in large sticks, and on that account it is only fitted for joiners' work; but for the latter purposes it is much esteemed on account of the beauty of its flower, its colour, and durability. The oak obtained from South Germany and from Italy is obtained in logs of very great dimensions; it is remarkably sound, strong, and free from diseased knots, and is therefore much used for marine engineering works. Dantzic oak weighs 47.24lbs. per cubic foot. It would be possible to increase the area of supply of this south European oak, for there are immense forests of this wood in Spain, the Mediterranean Islands (especially Corsica and Sardinia), and it would be easy at the same time to obtain from those sources large supplies of the evergreen oak, which for some purposes would even be preferable to ordinary oak, though its extraordinary specific gravity (it is heavier than water) would of course oppose its general use. The American oak is less hard, less beautiful in its grain than the European oaks, and it is liable to decay if exposed to alternations of dryness and humidity. There is a wood known in trade by the name of African oak, though the correctness of the term may be questioned, of great hardness and durability, which has lately been applied for the planking of turning bridges, the entrances of offices exposed to great traffic, &c. It seems to have answered remarkably well in such positions, but it does not arrive here in the scantlings necessary for framed engineering or carpenters' work, and must, therefore, remain of comparatively little use. All these oaks are subject to the attacks of insects, either in the forest, or afterwards when used in buildings.

Teak is a wood which has of late years been much used for shipbuilding, house, and even carriage joinery. The best varieties are obtained from Burmah, or the ports of Rangoon or Moulmein, and it is by no means rare to meet with sticks of perfectly straight teak, 60 or 70 feet long, and about 2 ft. by 2ft. 6 in. scantling. The wood is very hard, tough, and when sound of great strength and tenacity, but, unfortunately, the trees in their native forests seem to be exposed to the attacks of numerous insects, and to accidents of a nature to produce serious local diseases in the timber, so that hidden defects of extremely dangerous character are often to be met with in the soundest-looking sticks. The weight of a cubic foot of dry Moulmein teak is 41.06lbs.; its tenacity per superficial inch is 15,000lbs.; and its crushing force per superficial inch 12,101lbs.; the wood is easily worked, and takes a good polish; though porous, it is very durable in exposed situations, and it is said to contain some oily properties, which render it less injurious to iron than oak.

The Peon, another Indian wood, formerly exported to some extent, has latterly been regarded with such disfavour that it is now hardly ever imported. It may also suffice, for our present purposes to say, of the Kowrie, a New Zealand wood, of the Australian Iron Bark, of the Australian Red Cedar, of the Sabacue, and some other descriptions of East Indian woods, of which samples are to be found in our docks, that, although they may respectively present advantages of some description or other, they are not yet sufficiently known to warrant the formation of any definite opinion as to their comparative merits. The Green Hart timber, imported from our own colony of Demerara, is worthy of particular notice, on account of the reputation it possesses of enjoying immunity from the attacks of marine boring worms; and, for this reason, it is now being largely used at Liverpool and elsewhere, in operations connected with hydraulic engineering. I beg, however, to impress upon engineers the necessity for caution in the use of this timber, because from the state of some logs of it which I saw in the West India docks, on the 14th of this month (especially of two logs bearing the dock numbers 162 and 172, ex-Perthshire), I am convinced that the Greenheart enjoys no immunity whatever from the attacks of land insects. Without pretending to prejudge the question of the immunity of this wood from the attacks of marine insects, it really seems to me important to examine the conditions under which the reputation of the Greenheart has been obtained.* It will be necessary

* Since the text was written, I have been favoured by the communication, from C. Johnson, Esq., of a piece of Greenheart timber from Victor Bay, Panama, completely riddled by the teredo. This only renders it more necessary to seek an explanation for the asserted immunity of this wood in other situations.

to revert, hereafter, to this subject; and after stating that the Greenheart often arrives in our ports in scantlings of 16 inches square, and 70 feet in length, that it certainly is hard, strong, and durable, in alternately wet and dry positions, I would pass from the consideration of these rarer descriptions of building woods, by saying that the hacmatack, formerly used for railway sleepers to a great extent, is now almost forgotten; that the American rock and swamp elms are sometimes used for pile driving and other engineering works (I believe for no valid reason), in preference to the cheaper and more commonly known European woods; that the American birch is also but little superior to the European birch; that the lancewood is only used for carriage building, or substances requiring a light and peculiarly tough material of small scantling; and that the Florida, or the pencil cedar. is never used in England for anything but joiner's or rather cabinet-maker's work. This latter remark may be extended to the rosewood, ebony, bird's-eye maple, Hungarian walnut, satinwood, gutta-percha-wood, zebra-wood, and some fancy woods obtained from the tropical regions of the East, or of the West Indies, so that a notice of them may be dispensed with on the present occasion.

There is one description of furniture wood, however, which has lately been so much used in shipbuilding, and which seems to possess such valuable properties for ordinary building purposes, that it may be expedient to notice it with somewhat more of detail. I allude, of course, to the mahogany, a wood obtained from some of the islands of the Carribean Sea, or from the mainland of Central America. The supply of our market, in fact, is derived either from the island of St. Domingo or Hayti, from the southern extremity of Cuba, or from Honduras, and the qualities of the various woods follow the order in which they have been above named. The best, or the Spanish mahogany, comes from the sea board on the south of Hayti, and is a singularly hard, strong, and beautiful wood, of a rich brown colour, variegated by a flower of an equally remarkable character. It is far too valuable for building purposes, and is sold for sometimes as much as £6 per foot cube, when good fir, of nearly equal value for constructive purposes, would only cost 2s. at the maximum. The Spanish mahogany is, therefore, only used for cabinet makers' work of the best description, and generally in the form of veneers. The Cuba mahogany is frequently as good as the second-class Spanish, and, in these days of fraud and adulteration, it is no doubt often made to pass muster under the name of the better kind; but the Honduras wood is so distinctly inferior to the Spanish, that no ordinary judge could possibly be mistaken in the normal samples. Honduras mahogany is lighter, of a straighter and more spongy grain, without much flower, and on these accounts it is little sought for by cabinetmakers. But it occurs in larger sticks, of a form and scantling more adapted for constructive purposes than the Spanish variety, and on these accounts, as well as on account of its peculiar mechanical properties, and its cheapness, the Honduras wood has lately been much used for ship building. The Spanish mahogany is hardly ever obtained in logs of more than 10 feet in length, by 20 or 24 inches square, whereas, the Honduras trees often yield logs 40 feet long, by from 48 to 72 inches in diameter. The weight of the Spanish wood is said to be about 50 lbs. per cubic foot; the tenacity per superficial inch is 16,500 lbs.; the crushing force 8,198 lbs. All kinds of mahogany are said to be very durable and free from worms when kept constantly dry; they are not exposed to warp or to crack under the influence of the sun's light and heat, but they do not resist alternations of wetness and dryness, and I would therefore venture to suggest that they should not be used in any of the lower framework of ships, or in portions of house constructions, such as sashes, &c., exposed to those conditions of decay. The price of the commoner descriptions of Honduras timber, it may be added, does not exceed that of oak of equal quality. It has been supplied lately in large quantities at the rate of about 5s. or 5s. 6d. per cubic foot. Some small parcels of mahogany are occasionally received from Jamaica or the other West Indian islands; but they are of a quality so much inferior even to the Honduras wood that they are practically unknown to wood buyers.

III.—The Causes of the decay of converted Timber, and the generally known processes for its prevention.

In addition to the causes of decay referred to in the previous portions of this notice (arising from the effects of the vital disorganisation of the trees by the wounds superinduced by the disruption of branches, blows, sun strokes, frost, lightning, or from the attacks of the countless insect plagues to which trees are exposed during their period of growth), timber is exposed, after having been felled, to another class of destructive actions arising from the decomposition of its elements, under the ordinary laws of organic chemistry, and occasionally to the attacks of other insects than those above mentioned, when used in certain positions. The marine boring worms are the most dangerous of these insects, and they will be more especially noticed in the following remarks.

The first description of decay, arising from organic decomposition in wood, is produced by the changes which take place in the sap retained in the wood at the period of felling; for the albuminous portions of that sap commence a putrefactive process directly they meet with the conditions of warmth and heat necessary for its development. All timber must, then, whether it be the sap wood or the heart wood, be placed in situations which would allow the sap to exude, or to evaporate, and this process is the one technically known by the term seasoning. Evidently the period of the year when the tree is felled must have an important influence on the mode of seasoning; for, in the winter, the circulation is torpid, and there is then far less sap in the pores than there is when the vital functions of the tree are in full play. Nevertheless, timber felled in winter requires a certain amount of season ing; and, equally with wood more highly charged with sap, it will decay if that fluid should not be allowed to escape. The sad tale of the decay of the gun boats may be referred to as an illustration of the danger of shutting up unseasoned timber; and unquestionably the dockyard authorities who neglected to provide means of establishing a current of air through the frame work of the vessels, avowedly built of unseasoned timber, should be held partially responsible for their decay. Wood such as Lord C. Paget stated these vessels to have been built of, must of necessity have decayed by what is called wet rot, under the circumstances these boats were placed in. It may be as well to state that the term wet rot is applied to the decomposition which takes place in timber containing sap and exposed to moisture. If the sap wood or the alburnum be cut off from a tree, and the heart wood be exposed to an energetic dry current of air, there will be no danger of its perishing by this particular process, and it therefore follows that if the sap or the sap wood cannot be effectually removed, it is necessary to prevent the destructive decomposition of the sap by treating it with some fluids which should be able to form at once with it indestructible compounds.

It frequently happens, however, that during the growth of trees the druxy knots before alluded to, have established the germs of a putrefactive process in the wood, which cannot be stopped by any method of seasoning; and I myself suspect they can only be arrested by the injection of creosote. There are occasionally no doubt difficulties attached to this mode of preserving timber on account of the impermeability of the wood, and there are practical objections to its application for building purposes. But whenever knots of the description referred to may be suspected to exist in timber especial precautions should be taken to prevent its being used in situations where it is likely to be covered, or where its decay might compromise the stability of the structure into which it enters; and as the mere

lapse of time required for seasoning would allow the decomposition of very bad druxy knots to display itself, there seems to be the more reason for attaching importance to the use of seasoned timber in the framework of ships.

But seasoned or unseasoned timber alike are exposed to the cause of decay specifically known by the name of the dry-rot, which is considered to arise from the development of several species of fungoid growth in the wood; or, according to Dr. Birkbeck, of the *Boletus*, *Agaricus*, *Lycoperdon*, *Mucor*, &c. It would seem as though some of the organic tissues of the wood—not the sap, observe—decomposed under certain conditions of the surrounding atmosphere (as in close, damp, confined, air), and that they thus furnished, as it were, a soil for the growth of the fungi, which, in their turn, disintegrated the remaining portions of the tissues by their mere mechanical expansion in growing. The wood becomes, in fact, reduced to a mere powder, and may then be rubbed away by the finger, sometimes with a rapidity which is quite alarming. There is also this particular danger about the dry-rot, viz., that the germs of the fungi producing it are carried easily, and in all directions, in a building wherein it once displays itself, without necessity for actual contact between the affected, or the sound wood; whereas the communication of the disease resulting from the putrefactive fermentation, or the wet-rot, only takes place by actual contact. It may possibly be the case that woods grown in certain soils are more exposed to dry-rot than others are, and that the germs of the fungoids are taken up by the spongioles of the roots; for timber grown in situations where large fungi abound are said to be more exposed to this disease (the dry-rot) than those which are grown on dry, well-drained, soils. At any rate wood kept for any length of time in situations where it is exposed to become covered with fungi, is very likely "to take on" the dry-rot at an early period; and I feel it, therefore, to be my duty to state publicly that much of the timber arriving from the north of Europe leaves the ships in a state which seems to me to contain the germs of decay; and that the method of stacking the timber and deals in some of our docks is often very dangerous. From whatsoever source the fungoid growth producing dry-rot may proceed, if once it should be recognised to exist in a building, the affected parts, and all the wood-work around them, should at once be removed; if the various processes for preserving timber should not then be applicable, great precautions should be observed to cut off the access of moisture, and to ensure a free circulation of air around the newly fixed wood.

The insects which prey upon growing timber very rarely attack the qualities of wood used for constructive purposes, because in almost all cases the soft alburnum of the trees used for such purposes is cut away, and the bark and bast are entirely removed, so that the few larvæ which may have been left in the rest of the tree perish for want of nourishment, as a general rule. There are, however, as was before observed, some insects which prey on what may be called dead timber, such as the *Lymexylon navalis*, the *Sirex gigas*, the *Callodium bajulum*, and the various tribes of ants. At times their ravages are very serious, especially in the case of oak timber stacked in large quantities, which in the north of Europe is exposed to the attacks of the *Lymexylon*, and of all descriptions of wood in warmer climates which are exposed to the attacks of the destructive termites, or the white ants. In sea-water there are two species of insects which commit great ravages, viz., the *Teredo navalis* and the *Limnoria terebrans*; and they devour indistinctly the alburnum, or the heart-wood, with such rapidity that in a very few years large sticks of timber, whole piers, in fact, are destroyed by them. It is said that the *teredo* was imported into the seas of Northern Europe by the Dutch, from their colonial possessions, about the middle of the 17th century; but I suspect that there is little reason for this opinion, and that the *teredo* has been a constant inhabitant of our coasts at least from the time of the deposit of the London clay. About 1660, however, the safety of Holland was seriously compromised by these animals, and since that period the attention of engineers and naturalists has been earnestly and anxiously directed to the study of the best method of combating this apparently insignificant enemy. The habits of the *teredo* have thus been carefully studied; but those of the *limnoria* are not so well known.

Of these causes of decay it is singular that the most general and the most fatal, viz., the wet rot, has attracted less attention than the more startling, but less common, evils—the dry rot, or the destruction by insects. The methods of prevention and cure for either of the rots are, however, fortunately nearly the same, and they may be described by saying that if some of the more recently discovered processes for the preservation of timber cannot, for economical reasons, be resorted to, no unsound timber, nor timber containing sap or sap wood should be employed in positions where it would be covered in such a manner as to prevent its examination and repair. Great precaution should be taken to ensure a perfect circulation of air and a freedom from moisture, to all unprepared timber, let it be ever so sound, free from sap, druxy knots, star, cup, or ground shakes. If for constructive purposes it be necessary however, to use timber in the above dangerous positions, some one or other of the processes for resisting the chemical changes in the tissues of the wood must be resorted to.

These processes are all founded on the principle that it is essential to inject some material which should at once precipitate the coagulable portion of the albumen retained in the tissues of the wood in a permanent insoluble form, which should not hereafter be susceptible of putreactive decomposition. For this purpose many substances, many solutions, have been employed with variable success, of which the most important and the best known are: 1. Kyan's patent, or the injection of a solution of the chloride of mercury. 2. Margary's process, or the injection of a solution of the sulphate of copper. 3. Sir William Burnett's process, or the injection of the chloride of zinc. 4. Payne's process, or the production of a double decomposition in the pores of the wood, by firstly injecting a metallic solution, such as the sulphate of iron, and then injecting a second solution such as the carbonate of soda, which would form an oxide of iron in the cellular tissues. 5. Bethell's process of creosoting, or the injection of the heavy oil of tar; and Boucherie's process, which is, perhaps, rather a modification of the manner of injecting the sulphate of copper than the application of a new solution, although he occasionally uses the chloride of calcium, and the pyrolignite of iron. The experience furnished by the railway system, and the various hydraulic works of our own and foreign countries, appears to me to have shown that the efficacy of those various processes may be described as follows:—The creosoting one is the most generally successful; the application of the sulphate of copper is successful in many cases; the other processes, although no doubt of occasional value, have practically been abandoned. It will, therefore, only be necessary to revert to the creosoting process, and the use of the sulphate of copper.

Now, the application of any of the aqueous solutions of mineral salts as a preservative process, seems to me to be of limited benefit in cases where the wood is exposed to the action of frequently renewed water, for it has been proved, practically, that the combination between the salt and the albumen is not sufficiently permanent to resist the long-continued solvent action of such water. For piers, bridge foundations, or dock work, or even for railway sleepers, I myself should hesitate to use any of the mineral salts; but for housebuilding purposes, I think that there cannot be any reasonable doubt of the beneficial effects of the application of the sulphate of copper for the prevention of rot in its various forms, and I should decidedly recommend its use for the timbers of ships not immediately exposed to the action of the water, whether the timbers be,

or be not, seasoned. It is also to be observed, that the solution of the sulphate of copper does not communicate any disagreeable smell to the wood, an objection which applies forcibly to creosote, and the former process may, under such circumstances, be adopted for domestic purposes. The proportion of the sulphate of copper in the solution, should be 1 lb. of the salt to 4 gallons of water.

In addition to the objection to the sulphate of copper, and the other metallic salts on the score of their solubility in running water, there is this peculiar objection to them in the case of timber used in sea-water, viz., that the action of the albumen in the wood renders them perfectly innocuous to animal life, however poisonous they might originally be. Woods thus treated are not, then, in any way protected against the timber destroying insects, whereas it is certain that the injection of creosote is a most effectual protection against some of those creatures; for you may observe that, in the section of a pile exhibited, the teredo has gone out of his path to avoid the portions of the wood impregnated with that substance. In India it seems also that the white ants have a dislike to creosote, and they avoid wood which has been prepared by its injection; so that inasmuch as the experience of nearly 20 years has shown that the ordinary causes of decay are arrested by this process, and that it affords an effectual protection against many timber destroying insects, it seems to me that wherever the peculiar odour of the creosote does not constitute an objection to its use, it should be applied. I beg, however, distinctly to call attention to the fact that I do not assert that creosote will protect wood against all descriptions of boring worms, for samples of wood said to have been creosoted have been occasionally shown which exhibit traces of the ravages of the *limnoria terebrans*. I think that much reason for doubt exists on this matter, because in far too many cases the creosote used has been of inferior quality, and in many others the pyrolignite of iron has been substituted for it. I have not been able yet to analyse the samples of the prepared and attacked woods I have seen, but I am very strongly inclined to question whether any authenticated cases of the failure of creosote really exist. The asserted fact of the attacks of the *limnoria* is, however, a very remarkable phenomenon under any circumstances, and it merits very serious inquiry by our scientific and technical bodies. If the pieces of wood in question were really creosoted, it would seem to prove that the material which is distasteful to one animal may be attractive to others, and therefore that the green-heart timber which is said on very doubtful authority to be protected from the teredo by the essential oil it contains, may be exposed to destruction from the *limnoria*; or from the land insects I have myself noticed in it. If the piece of wood just referred to were prepared by the injection of pyrolignite of iron, it would equally seem that that ingredient is no more able to protect wood against insects than it is admitted to be able to protect wood against rot or decay. There are several very obscure points connected with the habits of the marine-boring worms which I am at present studying, and I hope, on some future occasion to be able to dwell more at length on the subject. My present impressions are, that these dreadful pests have peculiar habits, that is to say, that they respectively select the localities for their residence on account of some peculiarities in the chemical composition of the materials of the sea shore, and that they have peculiar and distinct tastes, so that the immunity from the attacks of one of these classes of insects, does not necessarily imply immunity from the attacks of others. But as the teredo is the most destructive of the marine, and the white ant the most destructive of the land devouring insects, it seems to me that the process of creosoting (which is now generally admitted to be an effectual protection against both of those enemies), should be adopted in all cases where wood is likely to be exposed to their attacks. That creosote is able to protect wood against ordinary decay is proved by the state of the sleepers of some of our railways, laid down as far back as 1841, but of course this process, like all practical chemical ones, requires to be applied skilfully and conscientiously. Much prejudice against the use of creosote seems, for instance, to have been created by the decay of timber treated by the pyrolignite of iron, and still more by the shameful manner in which the creosote itself has been used, for in the section of the pile on the table no more of that oil is to be found in the wood than the latter would be able to take up by a very temporary immersion. In the best creosoting works, such as those of Mr. Bethell, or the still more extensive ones of Messrs. Burt and Co., the oil is injected at a temperature of 120 deg., and under a pressure of 150 lbs. on the square inch, so that ordinary fir timber absorbs on the average from 8 to 10 lbs. weight of the creosote to the cubic foot. For all building or hydraulic engineering purposes, fir timber thus treated is far more durable than the best oak, teak, or other hard woods, and as the cost of the operation is very small, it certainly should be resorted to on all occasions where the smell of the creosote is not likely to be objectionable. When this is the case, I certainly think that some modification of Margery's process should be adopted, and that house or ship timbers exposed to damp, warm, and confined air should be treated with the sulphate of copper.*

The above notice of the preservative processes for timber has necessarily been of a cursory and superficial nature, on account of the great range of the subject before us; and I have been unable to refer, in any detail, to the various methods suggested for rendering wood practically non-inflammable, non-absorbent, and therefore, comparatively speaking, indestructible. I hope soon to be able to lay before this Society the result of some experiments of this description I am myself engaged upon in conjunction with some friends, and, in the meantime I beg your consideration for the shortcomings of this paper in all other

* At the risk of repetition, I cannot help saying that it is essential to observe that all these methods of protecting timber from external and internal sources of destruction, depend for their success upon the skilful and conscientious manner in which they are applied; for, as they involve chemical actions on a large scale, their efficiency must depend upon the observance of the minute practical precautions required to exclude any disturbing causes. The purity of the salts, or of the creosote used, the strength of the solutions, the treatment of the wood before the injection of the preservative materials, and the manner in which those materials are injected, all require strict attention, and they certainly render it necessary for the engineer or architect either to resort to those establishments which have a good reputation to lose, or to exercise the most rigid personal supervision. Any one, in fact, who would examine the creosoting works of Messrs. Burt and Co., the largest I have seen near London, must be convinced of the necessity for these precautions, and it will suffice to observe the great practical skill, the care and attention with which in those works the creosote is distilled, the sap or other moisture drawn from the wood, and the fluid subsequently injected, to arrive at the conclusion that operations of this kind should only be carried into effect by experienced persons of high character. The machinery required for preparing a long stick of timber, of considerable scantling, is in itself a very serious matter, for it is necessary, in the first place, to make a vacuum which should allow the sapwood to escape, and to do this in cylinders of 6 feet in diameter, and from 20 to 50 feet in length, is in itself both difficult and dangerous; then the injection of the creosote at a temperature of 120°, and under a pressure of 150 lbs. on the square inch is, as every practical man knows, a dangerous operation, requiring very skilful manipulation and very costly machinery. Emphatically the use of creosote is one which illustrates the advantages of the division of labour; and my own impression on the subject certainly is that it would be preferable for the parties wishing to apply this or any other preservative process, to entrust its execution to men of the position and character of those above named, rather than attempt to execute it themselves. Of course in speaking of Messrs. Bethell and Burt, I only speak from my own personal knowledge. I am far from saying that there may not be others as able and as worthy as they are, and as fit to be employed to creosote wood. All that I am anxious to establish is, that extreme care and skill are required for the purpose.

respects. Art is very long, our faculties are very limited; and however earnestly we labour, it is only a partial view of even questions of detail that the wisest and most laborious of us can attain. If, therefore, any of my hearers should be disposed to study more thoroughly the natural history of woods, I would refer them to the authors I have myself consulted in preparing this paper, and from whom I have borrowed largely:—

Telford's "Carpentry;" Du Hamel, "Transport des Bois;" Barlow "On the Strength of Materials;" Du Hamel, "De l'Exploitation des Forests;" Emy, "La Charpenterie;" "Description des Bois," par Mathieu; Rondelet, "L'Art de Batir;" "Instruction sur les Bois de la Marine;" Selby's "Forest Trees;" Scheden, "Zur Conservirung des Holzes;" Loudon's "Arboretum Britannicum; Lyonnet, "Traité sur la Chenille," &c.; Kirby and Spence's "Entomology;" Ratzburg's "Forest Insects;" Kollar "On the Insects Injurious to Gardens," &c.; Asa Fitch "On the Destructive Insects of the State of New York;" Nördlinger, "Die Technischen Eigenschaften der Holzer;" Caillaud, "Sur les Mollusques Perforants;" Jussien, "Botanique;" "Lindley's "Introduction to Botany;" McWilliams on "Dry Rot;" Chapman on "Dry Rot;" George's "Remedy for Dry Rot;" Papers by Drs. Faraday and Birkbeck on Kyan's Patent; Papers in "Transactions of Civil Engineers," by Messrs. Bethell and Burt; Reports on "Boucherie's Process," and Reports of Juries of the Paris Universal Exhibition, together with occasional references in the "Annales des Ponts and Chaussées, des Mines, de Construction," &c., &c.; De Candolle, "Sur la Géographie Botanique."

DISCUSSION.

Mr. H. P. Burt said much praise was due to Mr. Burnell for the excellent paper he had produced, and he (Mr. Burt) should have entered into some detail with regard to the various processes of the preparation of timber if time had permitted, but as he had offered to lay a paper on that subject before the Society at a convenient opportunity next session, he should be very brief in the observations he had now to offer. His attention was first called to this subject in 1841-2, when he was one of the resident engineers on the Eastern Counties Railway, under Mr. John Braithwaite; and although creosoting was then but little understood, and the apparatus used and the means adopted were of the most primitive kind, still the timber was found to be so durable after that preparation as to have led to the more general adoption of this process. The sleepers used on the line were, at the time he referred to, of the commonest Scotch fir, and the apparatus employed was so small that not more that fifteen or sixteen sleepers could be treated at one time, and the whole operation was very imperfect in comparison with that now in use for the purpose. Some five or six months ago those sleepers were examined, and the majority of them were found to be in as perfect a state as when they were first laid down. With regard to the various other methods introduced, he might say that the processes of Margery, Sir W. Burnett, and Payne, had now become nearly obsolete. He had prepared large quantities of timber according to all the known processes, and he could state, as the result of his own experience, that nothing had equalled the creosoting by the process which had been described by Mr. Burnell. Upon the Buckinghamshire Railway Mr. Dockray, the engineer, determined to try sleepers prepared by all the processes then known. Between thirty and forty thousand sleepers were prepared by Kyan's process, and about the same number respectively by Sir W. Burnett's and Margery's processes, the remainder being creosoted; and he could state that in less than four years a large portion of the sleepers prepared by the process of sulphate of copper, or Kyan's process, were obliged to be removed; those which were treated with chloride of zinc, or Sir W. Burnett's patent, were more durable, which he thought arose more from the timber being of a better description than from any actual merit in the process. These preparations, he thought, became deteriorated by time and the action of the atmosphere; whilst under the creosoting process time and climate appeared to have no such effect. Timber which had absorbed 8 or 9 lbs. of creosote per cubic foot would be as good at the end of several years as when it was first put down; and it might be stated as a fact, that the absorption of the creosote further into the timber, owing to its oily nature, continued to go on for a considerable length of time, a result which did not occur with other preparations. In point of fact, the creosoted wood might be said to improve by time.

Mr. Robert Davison begged to compliment Mr. Burnell upon the excellence of his paper, which he said contained a great deal of useful information. He held it to be a settled question at the present time that the best mode of preservation was by creosoting. This was a very old method of preservation from decay, as they knew that mummies many thousand years old had been evidently preserved on this principle. His own notion was that timber might be effectually dried, imitating nature, by passing rapid currents of heated air through it under pressure. That plan had been carried out with the timber used used for the floorings of the Coal Exchange. The wood was taken in its natural state, and in less than ten days it was most thoroughly seasoned. In some cases, from 10 to 48 per cent. of moisture was taken out of the wood, and although the floorings had now been down for about ten years, there was not the least shrinkage to be found, except in the case of a few pieces which were put down in the latter portion of the work, which had not been submitted to the seasoning process to which he alluded. His plan was to send air at a hurricane rate—say 48 miles per hour—through the timber at 110 or 112 degrees, but the heat was regulated according to the texture of the various woods. Honduras mahogany might be exposed to a heat of 300 degrees, and he had taken out the whole of the moisture from that wood in 48 hours. It might be added that the wood itself was benefited by that mode of treatment, and it was a mistake to suppose that its colour was injured by it. This process merely took the moisture out, and if they coagulated the albumen, whether in vegetable or animal matter, he thought they effected all that was necessary for preservation from decay. In the course of his experiments many years ago he coagulated the albumen of some beef steaks, which he kept in a fresh state for several years, and found to be eatable at the end of the time. With regard to timber for shipbuilding, if the planks could be reduced to a moderate thickness, so as to get the currents of air propelled through them, he had no doubt they could evaporate the whole of the natural moisture of the wood.

Mr. C. H. Smith would carry the argument of the last speaker a little further. He had spoken of imitating nature, and if they wanted to find a remedy for the decay of natural products, they could not do better than, first of all, to see what processes nature took to produce decay, and what to prevent it. With reference to the decay of timber there were two elements to be regarded. The one was decay produced by the decomposition of the vegetable matter, and the other the effects produced upon the wood by the attacks of animals. In both cases, there were portions of timber which escaped animal and vegetable destruction. They knew that vegetable decay first of all took the sap wood of the tree. The soundest timber was that which had the greatest quantity of resinous or oily matters in it. The heart wood, particularly of the fir tribe, was full of turpentine, whilst the sap wood was not so, and the turpentine gave the wood such a character that the insects did not like it. Creosoting was, in fact, producing an action analogous to the further growth of the tree after it was cut down, supplying a preservative material in a similar manner to that employed by nature. The other processes alluded to, such as the injection of metallic salts into the wood, had not been successful, because they were not true imitations of nature; but creosoting was a natural process,

and if they wanted to make wood distasteful to insects they must do what nature had done for ages past.

Mr. P. L. Simmonds said that no one would question the great importance of the subject which had been introduced to their notice, when it was borne in mind how large was the consumption of woods for constructive purposes, notwithstanding the widely-extended use of iron. Irrespective of our home supply, we required an annual importation of 2,500,000 loads of timber from many widely-separated foreign countries, of which about 1,000,000 loads were of hewn timber, and the rest sawn. Often as the subject had been before the members of the Society, it had never, he thought, been presented in so practical and eminently useful a form, for every section of the paper was characterised by a great amount of most useful scientific information, embracing alike forestry, botanical, entomological, chemical, and commercial knowledge. The subject discussed was one not only of interest in the United Kingdom, but in our colonies and many foreign countries. The submarine operations carried on abroad for docks and piers, bridges and railways, rendered the condition and suitability of timber and its preservation a matter of paramount importance. In tropical countries wood was even more subject to decay and to the ravages of insects than in temperate climates. We were still lamentably deficient on many points connected with the quality, supply, and characteristics of timber, although many new woods had been introduced within the last ten or twelve years. What was especially wanted was the concentration of the experimental researches of practical men as to the characters, useful applications, and durability of different woods in various countries. Something had been done towards the accomplishment of this object by the experiments resulting from the tests of woods shown at the Great Exhibition of 1851, and the subsequent ones in India, New York, Paris, and our colonies, and he trusted the projected Exhibition of 1862 would develop something more in this department. What seemed to be most wanted was a good collection of woods, classified into those suited for constructive or ordinary building purposes, ship-building woods, and furniture woods, with fully explanatory labels attached, scientifically naming the tree, describing the place of growth, and its size and especial uses, breaking weight, and other characteristics, &c. A little had been done in this respect in the Kensington Museum, at Kew, and at Sydenham, but none of these collections were so complete as they might be made. There was an increasing demand for wood in general, and many of our supplies were much smaller now than formerly. We used to import, on the average, about 38,000 tons of mahogany, but last year we only received 33,481 tons. So with teak, ten years ago, we imported 27,700 loads, of which the great bulk came from India, and a few thousand tons from Africa: now the average import was only 22,000 loads, and yet there was a good demand for the wood. Every year the sources of supply were getting further removed from the sea board, and hence the cost of transport of the timber to the shipping port became greater. It was much to be desired that tree planting in India and our colonies, should be more generally attended to, to replace the wholesale destruction carried on in Canada, New Brunswick, India, and New Zealand by the demand for wood. Now, we had opened up another fine commercial field in Vancouver's Island, and the timber in our possession on the North-west Coast of America would prove scarcely inferior in importance to the gold discoveries there. There had been little exploration yet in Queen Charlotte's Island, and many of the continental parts of British Columbia, and looking at the magnificent vegetation of that district, as evidenced by the splendid sticks alluded to by Mr. Burnell from Vancouver's Island, and the immense trees of the *Wellingtonea gigantea* of California, there was much to be looked for from these districts if the question of freight did not interfere. With a diminishing supply of timber at home, there was abundance to be had in many countries, which could be seasoned and protected by the important processes described. We imported last year about 6,000 load of ordinary ship-building woods, exclusive of teak and mahogany, and 2,900 tons of cedar. Of the furniture woods there was no special account, except of rosewood, of which we received 1,529 tons. Sabacue, alluded to by Mr. Burnell, was not an East Indian wood, but was obtained from Cuba, and in the classification of Lloyds' Committee it stood in the second rank of durable woods, classing in the ten years' grade.

Mr. John Bethell would refer to a point alluded to in the paper, viz., that in timber where decay had commenced in places where there were druxy knots, it had been stopped by the injection of creosote. He could confirm that fact by stating that about twelve years ago many thousand sleepers were packed upon the Lancashire and Yorkshire Rai way some time before being used; when they were about to be used they were found to be more or less decayed, and it was a question whether the whole should not be sold for firewood, when the subject of creosoting was introduced, and at length it was determined to submit the sleepers to that process. After those sleepers had been down for ten years, it was found that not only had the decay been arrested, but the sleepers were as good as if they had been sound new timber. He could refer to an instance of the same kind on the Great Northern Railway. It had thus been proved, upon a large scale, that creosoting had the effect of stopping decay which had commenced in timber. With regard to the durability of the green heart, teak and pitch pine, it was clear that it was owing to the large quantity of hydrocarbon or oil with which they were impregnated. In some of the pines in Demarara it existed to such an extent that they were used as torch wood. But they must not imagine that all the fir timber which came over to this country would be equally durable, because there was a system of tapping the trees for the turpentine which they contained, and some descriptions of firs yielded turpentine to the value of 11s. each per annum, and when the trees had been drained of their turpentine they were cut down as timber; but they were then almost worthless for constructive purposes. That practice prevailed to a con iderable extent on the Landes in the South of France, but engineers know that such timber was worthless for railway sleepers, but if the timber was sent here before being so drained it would be a good material for such purposes. In the case of the green-heart and teak woods, the timber might be deteriorated by being punctured so that the oil was lost. If green-heart wood had lost its oil, it was liable to be attacked by worms; but that in which the oil had been retained the worms would not touch. There were some woods which the white ant would not touch, whilst other kinds it would eat up greedily, and there was thus always some uncertainty in using unprepared timber; but the process of creosoting which he had adopted was an imitation of the process of nature, and they could be more certain of its preservative effects because they could impregnate the wood with the quantity of oil that was actually required for its preservation. He now used 10 lbs. of creosote per cubic foot of wood, and a piece of timber was not allowed to be sent out without being weighed to ascertain whether it had absorbed that amount. The process of creosoting suggested itself to him more or less from observing the mummies. They found a description of it in Pliny, which he had quoted in the first prospectus of his process. He believed the success of the process was universally admitted, and investigation had proved that after twenty years sleepers on railways were still doing duty, four-fifths of them being as good and as sound as when they were laid down, the removal of the remaining one-fifth being necessary owing to breakage or from the chairs sinking into the wood, and not from decay. With regard to the protection against sea-worms, he would say that he never heard of an instance of a properly creosoted pile being attacked; but with regard to the specimen which had been handed round, the process had

been so imperfectly carried out as not to be worthy of the name of creosoting. He should say, judging by the appearance of it, that it had not absorbed 2lbs. of oil per cubic foot; whereas he had never passed a pile for water unless it absorbed 10lbs. per cubic foot. In the piers at Lowestoft and other places, the process had proved thoroughly successful in the preservation of the timber. With reference to the observations of Mr. Davison as to the artificial drying of timber, he agreed with that gentleman that very much was to be done by that method, and he (Mr. Bethell) had experimented a good deal in that way, but he had found that in drying timber in that mode it split very much, and caused considerable dissatisfaction, particularly with regard to railway sleepers. That splitting did not take place with slow air drying. No doubt, it was important that timber intended to be creosoted should be first of all dried. He had found great inconvenience from contractors for piers, &c., sending piles to be creosoted which had just been taken from the canal. The large quantity of water they contained resisted the entrance of the oil, and the result was that a great deal of timber was badly prepared because the contractors could not obtain it dry. It was different in the case of house timber, because the deals were generally stacked and slowly seasoned before being used, and the aqueous matter was entirely dried out. Still this was not sufficiently attended to for building purposes, because they found frequently that large beams were put up without any attention to drying, and the end of the beam which came in contact with the lime mortar became decayed.

Mr. Davison begged to state in reply to what had fallen from Mr. Bethell with regard to the splitting of wood from the quick-drying process, that many years ago as many as a hundred specimens of wood were submitted for experiment by Mr. Chatfield, under the direction of the Admiralty. The specimens varied from one inch to twelve inches square, and he could assure Mr. Bethell there was not a single instance in which the wood split. When any openings were previously found in the wood the wood they were marked, and it was noticed that they were closer after the operation of drying than they were before. He was afraid Mr. Bethell had experimented in a different way to what he (Mr. Davison) had done. Everything depended upon the rapidity of the current of air. It would not do to bake the wood, but there must be a continual change of air, which must act alike upon both sides of the timber. If that were not attended to there would be unequal contraction and expansion of the wood. He admitted that there was a limit to the size of the wood that could be successfully treated by this quick drying process. He considered that timber nine inches square was a proper size for this operation.

Mr. Wentworth L. Scott remarked that the processes described might be divided into two classes,—one the impregnation of wood with chemical salts, so as to coagulate the juices and to inject a substance poisonous to worms, and the second the impregnation of wood with some volatile principle, of which creosote might be taken as a type. He should be glad to hear from some of the practical gentlemen present whether they were aware of any experiments having been made with powerful oxidizing agents, such as the permanganate of potash, or the pikric acid, otherwise known as carbazotic acid, which possessed antiseptic qualities in an extraordinary degree. From 20 to 24 grains of the latter substance to the gallon of water seemed perfectly to preserve timber. He had tried its properties upon wood half-decayed, and found that it arrested further decomposition.

Mr. Bethell stated that, as far as he was aware, the agent mentioned by Mr. Scott had not been commercially employed.

The Chairman said he need scarcely observe that the subject which had been brought under their consideration that evening was one of that eminently practical character which the Society wished so much to encourage. The way in which it had been treated was most satisfactory, and the paper would be useful not merely to the present audience, but as a means of diffusing information through every part of the kingdom where the *Journal* was distributed. He need not say that there was no place in which the subject could be without interest, both as regarded its application to building purposes, and also as regarded that attention which was now beginning to be paid to the growth of trees, as to the conditions of climate, elevation, exposure to wind, and other circumstances. All these things were beginning to be considered much more attentively than they had hitherto been. He was very much gratified at hearing from an experienced woodman that he had found great advantage from the use of a small microscope, which enabled him to study more minutely than he could do by the naked eye the habits of the insects which infested trees, and there could be no doubt that many of the vegetable processes which took place could not be observed without the aid of such an instrument. The study of entomology was much connected with the subject before them, and had been alluded to by Mr. Burnell. He (the chairman) had been struck by the use of some terms in the paper, which he thought partook in some degree of a local character, for in different parts of the kingdom a number of the terms used would be scarcely understood in other places. He suggested that, through the instrumentality of the numerous Institutions connected with this Society, a glossary of local terms might be prepared, which would be of the greatest practical use. Many gentlemen who were bestowing attention on the preservation of timber and on other scientific subjects, were sometimes at a loss to understand the descriptions given by persons coming to them from the country, which was entirely owing to the use of terms well known in particular localities, but the precise meaning of which was not generally understood. The paper was full of valuable information, and contained many practical and useful suggestions; and he could not but think that they were deeply indebted to the author of it, as also to the gentlemen who had favoured them with some valuable and interesting remarks upon it, and he was glad that those observations would go forth in the *Journal* and would tend to increase their knowledge upon a subject of great importance. There was one wood which had not been noticed in which he had taken a great interest—that was the Canadian wood, butternut. He was glad to find that, owing to the admirable classification, by Sir William Hooker, of the woods exhibited in the Museum at Kew, illustrations were afforded of the practically useful purposes to which the various woods were applicable, following the system of the Museum of Practical Geology, and showing the products of the earth and their adaptation to useful purposes. The remarks of Mr. Davison were of interest to him (the Chairman), because he knew that that gentleman had given great attention to the subject, and had succeeded by artificial drying in bringing wood to a state of great perfection, and, where the size of the timber admitted of that process being applied, he thought it was a valuable one as preparatory to the creosoting, but it was in some degree limited by the size of the timber. Referring to the butternut wood of Canada, he might state that it was extensively used for cabinets for entomological collections, as it had the property of repelling the attacks of insects, and was not liable to warp or twist; he believed it was not so well known for useful purposes as it deserved to be. The Chairman concluded by moving a vote of thanks to Mr. Burnell for his very valuable paper.

The vote of thanks having been passed,

Mr. Burnell, in acknowledging the compliment which had been paid him, said his object in the present paper was to bring a subject of essential importance to the building profession as prominently as he could before them and the public, for at the present day, when they had such enormous hydraulic works going on, and bridges and railways being constructed in all directions, at home and abroad, it became more than usually important to know all the conditions of the decay of the material which was so largely

used for constructive purposes. He knew that amongst engineers there was a great amount of unsound doctrine as to these materials, and he thought the remarks of Mr. Bethell that evening, with reference to green-heart timber, evidenced the tendency which there was amongst professional men sometimes to adhere to old prejudices upon these matters. There was a stick of timber upon the table which he could vouch for as having been sent from Victor Bay to one of the first houses in the timber trade in London; the best price had been paid for the timber by Messrs. Churchill and Sim, and yet that had been entirely riddled by the *Teredo navalis*. With regard to what had fallen from Mr. Smith as to insects always attacking the sap wood first, and the decay beginning in the sap wood, that was scarcely correct, for these reasons—first, if druxy knots were established in the wood, the wood in contiguity with those knots would decay first. The *ligniperda* always attacked the heart wood, and must, of course, penetrate through the outside to reach it, and it was the same with the large boring worms in the heart wood of the teak, so that it did not always follow that the alburnum was the first part which was attacked. With regard to the collection of samples of woods in our museums, it appeared to him that mere samples were of limited utility. They could hardly expect the owners of the wood would send over bad samples, and they could form little better opinion of the value of a wood from a sample than they could of the value of a house from inspecting one of the bricks. What they really wanted was some correct series of observations founded upon the destructive distillation of the wood, and its chemical and mechanical properties. Mr. Burnell, in conclusion, called attention to a piece of wood which had formed part of a mummy case 3,500 years old, which was as good a sample of creosoting as could be produced by any artificial process in the present day.

The paper was illustrated by various specimens of woods, illustrating the effect of attacks of insects and other destructive agencies upon this material.

The Secretary announced that this was the last ordinary meeting of the present session, and that the Annual General Meeting would be held (in accordance with the Bye-laws), on Wednesday, the 27th inst., at 4 o'clock, p.m.

THE MANUFACTURE OF MINERAL TEETH.

An article, taken from an American paper, appeared in the *Journal* a few weeks since,* detailing the process and extent of the manufacture of mineral teeth in Philadelphia, U.S. The public are probably not aware how largely this comparatively modern manufacture has increased of late in this country, and it is very commonly imagined that the Americans enjoy a monopoly in this branch of art.

Such, however, is far from being the case. Not only have mineral teeth been manufactured in England for upwards of sixty years, but also in France and Belgium, as well as in other parts of the Continent.

To English enterprise and perseverance is due that great improvement in their natural appearance which has been the means of bringing them into such general use. From information on good authority it appears that at the present time this manufacture is greatly on the increase in this country. In London alone there are several establishments especially devoted to it; one of these, in which all the appliances of steam and machinery are in full play, is estimated to produce no less than 15,000 per week, or nearly 800,000 per annum, consuming for this purpose nearly £4,000 worth of platinum, and employing a large number of hands, both male and female.

There is a difference between the mode of manufacture of the American and English teeth. The substance of the American teeth is an opaque body, covered by a glaze, whilst the English teeth are made of a compound, which, when vitrified by the process technically termed baking, produces a surface resembling polished ivory, or bone; and the tooth, being of the same substance all through, admits of being ground and fitted without disfigurement. Whilst great credit is due to the New World for their productions in this art, it would be erroneous to suppose that this country is in any way behindhand, for the teeth of English manufacture are esteemed by some of the best judges, including Americans themselves, not only equal to any others in strength and durability, but also as being the most beautiful and highly-finished of any that are made. This is confirmed by the fact that large numbers are annually exported to all parts of the world.

* See *Journal*, No. 388, p. 426.

Home Correspondence.

LOCAL EDUCATIONAL BOARDS.

Sir,—It is much to be hoped that the example set by the Leeds Educational Local Board, in adopting the scheme of Examinations, certificates, and prizes for children under sixteen years of age, which is described in Mr. Barnett Blake's interesting letter in the last *Journal*, may be extensively followed in other places. This is the scheme which I first proposed to the Institutions, at St. Martin's Hall, in 1854, and I have never lost an opportunity of putting it before the friends of education and of the instruction of adults.

There are, however, two points in Mr. Blake's letter in which I should like to see the Leeds plan amended. There appears to be no minimum limit of age. I suggest 13. The Examinations are apparently to be confined to the junior pupils of the Institutional classes, and to those of evening schools. I should like to see the door opened wider, viz., to all children, between 13 and 16, who may reside, or work, or receive instruction within the district of the Board.

Why should they be excluded who, unable to attend a class at an Institution, or at an evening school, yet singly pursue the self-denying course of self-instruction?

There is also another suggestion which I venture to offer to our energetic friends at Leeds. It formed a part of the scheme which I originally proposed at St. Martin's Hall, viz., that those children who take certificates of the first class in the proposed Junior Examinations shall be appointed "Honorary Associates" of the nearest Institution. Such a privilege would cost little to the Institution, would give it an educational character, and would probably create an embryo paying member; while to the child there would be not only an honour but a valuable privilege in the appointment. I am, &c.,

HARRY CHESTER.

THE MARBLES AND BORACIC ACID LAGOONS OF TUSCANY.

Sir,—The brief hour allotted to me the other evening was insufficient to enable me to embrace the whole of my subject, and during the discussion the Society had abler gentlemen present than myself, so that I was unwilling to infringe on the time. A few points may still be commented on.

Mr. C. H. Smith said the other night, that he did not believe the Romans ever worked the Carrara marbles. I can only say that the proofs I brought forward seemed sufficiently evident, though I may mention a few others. In the church of San Frediano, at Lucca, are some very remarkable and handsome white marble columns—one of which is hollow. They are now in the nave of the building, but originally formed part of the Roman amphitheatre of that city, the barbarous architects of those days despoiling that beautiful monument of antiquity to build their church. An old inhabitant of Lucca informed me that

even during his lifetime, in the reign of the last duke, some of the white marble columns of this amphitheatre had been sold by the Government to construct other buildings! No wonder, then, that that edifice has now almost disappeared. With the numerous marble districts around, both in the direction of Pisa and Carrara, and far from any port, can there be any doubt that the Romans employed the stone to be had on the spot, instead of bringing it from Greece, as Mr. Smith would maintain? The etymology of the very name Carrara is stated by Repetti to be derived from a word signifying the quarries, still called *carrière* in French, and quarries of what, if not of marble? Mr. Bell, in his vigorous remarks, mentioned that the ancients knew a certain marble as *lunar*, because it was like the *moon*. I do not insinuate that this is a flighty definition, but can perhaps assign a better reason among sublunary objects. In fact, not far from Carrara are seen the ruins of Luni, the once famous Etruscan city of Luna. *Primum Etruriæ oppidum Luna, portu nobile.* (Pliny, III., 9) while to this day the surrounding district is called Lunigiana. I presume that the Romans shipped the marble from Luni. These are weighty evidences in favour of the Romans having extensively used the marbles of Carrara.

All recent travellers visiting the Cathedral of Milan, one of the most wonderful buildings in the world in point of size and the elaborate finish of its lace-like architecture, must have been struck with the dazzling whiteness of its marble exterior when illuminated by the sun. The popular notion is that it was built of Carrara marble. Though I have only embraced the subject of Tuscan and Modenese marbles, I may appropriately correct this error by saying that when the first Duke of Milan, Giovanni Galeazzo Visconti, had resolved to erect one of the most superb churches in Europe, he thought over in his mind what would be the most suitable stone of which to construct it, and having chosen the white marble of Monte Candoglio or Candido, on the Toce, a tributary of the Lago Maggiore, and in his own territories, he presented the quarries to the church. Two of the reasons for his choice are recorded in a work published at Milan in 1823, entitled "Il Duomo di Milano, &c.," p. 4: The first was that the blocks could be easily and economically conveyed to Milan in boats, by the Toce, Lago Maggiore, and Ticino, and thence into the heart of the city by the Naviglio canal. The other argument was, that in his opinion the stone was more fit to stand the action of the atmosphere than that of Carrara. The foundation stone was laid by the Duke, in 1386, but the durability of the marble cannot now be fairly judged of, as the exterior has just undergone an entire repair, all decayed parts having been carefully removed. With regard, however, to the 4000 statues which stand on brackets or crown the pinnacles, I have no doubt they are all of Carrara marble, as I have proof of some of them having been made from blocks brought from thence.

I may here append some new statistics of the Serravezza quarries, all Tuscan, my authority being Sig. Giuseppe Santini, solicitor at Serravezza, whose acquaintance I made on the spot.

Serravezza (including Stazzema and the Altissimo in Tuscany) produces about 253,158 cubic feet of marble annually, in blocks and slabs, valued at £195,000; while no less than £190,000 is realised by the sale of *quadrelle* or squared paving flags; total about £385,000.

Prices of Tuscan Marbles at Serravezza.

Per Cubic Foot.

	£	s.	d.
Statuary from the Altissimo, &c.	2	8	6
Ravaccione, "Sicilian," from Ceragiala, Salajo, Costa at Serravezza, etc.	0	3	3
Veined, or Bianco chiaro, Trambiserra, Campanice, Carchio, etc.	0	6	9
Mischio di Serravezza	0	16	2
Bardiglio	0	3	0
Bardiglio fiorito, Stazzema	0	6	6

There are twenty water-mills at Serravezza, working night and day—chiefly during the winter months.

A word or two regarding boracic acid. The following is the analysis of the dry gases issuing from a *soffione* examined by Payen:—

Carbonic acid	57.30
Nitrogen	34.81
Oxygen	6.57
Sulphuretted hydrogen ...	1.32
	100.00

Respecting the temperature of the fissures, none have satisfactorily treated the question, though it has excited much attention from Pilla, Murchison, Lardarel, &c. I think I may mention that some light is thrown on the subject by the presence of an instructive mineral round the lagoons, viz., Anhydrite ($Ca\ O.\ SO_3$), evidently formed at a temperature at which water could not combine with the sulphate of lime to produce ordinary gypsum. When gypsum ($CaO.\ SO_3 + 2\ HO$) is heated to 260° Fah., it loses its water, and becomes plaster of Paris; but, on cooling, it again absorbs the original quantity of water. When it is heated to redness this does not take place, but the mass melts into an enamel, which, according to Regnault, is identical with anhydrite. The heat, on the other hand, could not be very much above redness, provided my theory of the borates be correct.

Sulphuretted hydrogen is found in large quantities as at Vulcano. Pilla remarks that Vesuvius emits hydrochloric acid in great abundance, as do Etna and all other active volcanos, while quiescent ones pour forth chiefly sulphuretted hydrogen, which is disingaged at lower temperatures than is necessary to liberate the former.—(*Trattato di Geologia*, tome i., p. 244.)

The following is a list of some of the minerals from the Tuscan Boracic acid lagoons, compared with the products of Vulcano Lipari Islands:—

1. Sassoline, Boracic acid, $BO_3.\ 3\ HO$; also in Vulcano:—

Boracic acid	56·4
Water	43·6
	100·0

2. Hayesine, Borate of lime, $CaO.\ 2\ BO^3 + 3\ HO$; also at Iquique, Peru:—

Lime	20·85
Boracic acid	51·13
Water	26·25
Silica, Alumina, and Magnesia	1·75
	99·98

3. Lagonite, Borate of iron, $Fe^2\ O^3\ 3\ BO^3 + 3\ HO$, as incrustations:—

Sesquioxide of iron	36·26
Water	14·02
Boracic acid	47·95
Magnesia and loss	1·77
	100·00

4. Lardarellite, Borate of ammonia, $NH_4O.\ 4\ BO^3 + 4\ HO$:—

Ammonia	12·73
Water	18·32
Boracic acid	68·56
	99·61

5. Borax? $NaO.\ 2BO^3 + 6\ HO$:—

Soda	19·25
Water	37·19
Boracic acid	43·56
	100·00

(Ordinary borax contains 10 atoms of water.)

6. Mascagnine, $NH_4O.\ SO_3 + 2\ HO$; also in the Lipari Islands:—

Ammonia	34·67
Sulphuric acid	52·33
Water	12·00
	99·00

7. Gypsum, $CoO.\ SO_3 + 2\ HO$ (Impure).
8. Selenite, $CaO.\ SO_3 + 2\ HO$.
9. Anhydrite, $CaO.\ SO_3$:—

Lime	41·2
Sulphuric acid	58·8
	100·0

10. Alum (probably ammonia and iron alums).
11. Sulphate of magnesia (rare).
12. Mascagni even mentions Cinnabar, but I could not myself find any.
13. Iron pyrites, $Fe\ S_2$.
14. Sulphur incrustations, S;—also in Lipari Islands.
15. Resinous quartz.
16. Common Salt:—Na Cl.

In the vicinity of Castelnuovo are two bathing establishments, La Perla and Il Morbo; these hot springs are chiefly sulphurous. The rocks traversed by the fissures are Cretaceous limestones, and Eocene, Miocene, and Pleiocene clays and marls.

The lake of Monte Rotondo, belonging to M. Durval, contains $\frac{1}{500}$ of boracic acid in solution, the maximum of impurities being 15 per cent., chiefly sulphates of lime, ammonia, alumina, magnesia, hydrochloric acid, and free sulphuric acid, with traces of organic matter. The area of the lake is about 18 acres. M. Durval produced from it 64 tons in 1854 and 142 tons in 1855. Finally, I must apologise for an *erratum* in my paper. The corrected totals of the table of imports of boracic acid and oil into England, given at p. 546, col 1, are:—Boracic acid, £593,313; olive oil, £687,661; total imports from Tuscany, £3,377,453. The quantity of boracic acid imported into England in 1858 was 1,156 tons 15 cwt.; in 1859 1,785 tons 17 cwt. This completes the first column of the table.

I am, &c.,
WM. PAGET JERVIS.

Proceedings of Institutions.

Dover Museum and Philosophical Institution.—This Society held its Annual Meeting on the 17th April. The Report was read by Mr. Phillips, one of the secretaries. It stated that the reading-room had been well supplied with newspapers and periodicals during the past year, and had been well attended; that the library had, however, received no augmentation of books, either by donation or purchase. The issues of books were 155. The Museum had had upwards of 12,000 visitors in the course of the year, and had been enriched with numerous specimens of minerals, fossils, coins, shells, stuffed birds and beasts, reptiles, carved ivory, marble, and miscellaneous objects. The number of members had decreased by 10 since last year, the present number being 120. There had been six Lectures and Entertainments during the last session, viz.:—"A Humourous Lecture on Lecturing," by Mr. George Grossmith, of London; an astronomical lecture, entitled "A Night among the Stars," by Mr. W. Radcliff Birt, of London; an Entertainment consisting of Harp Music, by Ellis Roberts, Harpist to H.R.H. Prince of Wales, assisted by Miss Annie Cox, as vocalist; a lecture "On the Maritime Alps," by Rev. John Puckle, M.A., of Dover; "On the Italian States," by Rev. Mr. Maynard, Chaplain to the Garrison, Dover; Entertainment, consisting of Pianoforte Music, by Mr. J. Doorne, Organist of Trinity Church, Dover, assisted by vocalists. The Treasurer's Report showed a balance against the Society, but as this had arisen from unusual charges this year, it was hoped it would be liquidated, or nearly so, by next year. The Report was received and adopted, the election of officers then took place, and a vote of thanks to the chairman, James Pouller, Esq., Vice-President, terminated the proceedings.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. G. W. Hastings, "On Commercial Law, in connection with the Travers Testimonial Fund."
Entomological, 8.
British Architects, 8. Mr. Arthur Ashpitel, "On the Origin and Development of the use of Crypts in Christian Churches from the earliest period."
United Service Inst., 8½. Captain A. T. Blakely, "Rifled Ordnance."

Tues. .....Royal Inst., 3. Dr. Spencer Cobbold, "On Herbivorous Mammalia—The Hippopotamus, &c."
Civil Engineers. Annual Conversazione.
Photographic, 8.

Wed. .....Meteorological, 7. Anniversary.
Roy. Soc. Literature, 8½.

Thurs. ...Royal Inst., 3. Professor Ansted, "On the Antiquity of the Human Race."
Roy. Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8. 1. Prof Greene, "On the Mutual Relations of the Cold-blooded *Vertebrata*." 2. Dr. Jameson and Sir J. Richardson, "On the Poisonous Effects of the Liver of a *Diodon*, inhabiting the Seas of S. Africa." 3. Mr. Lubbock, "On some new *Entomostraca*." 4. Dr. Wilson, "On the Nervous System of *Asteridæ*." 5. Mr. Walker, "Descriptions of New Guinea *Diptera*."
Chemical, 8.
Philological, 8.

Fri. .....United Service Inst., 3. Capt. Donnelly, "Photography, and its Application to Military Purposes."
London Inst., 7. Prof. Bentley, "On the Structure and Functions of the Nutritive Organs of Plants."
Royal Inst., 8. Prof. Faraday, On the Electric Silk Loom."

Sat. .....Royal Inst., 3. Mr. F. A. Abel, "On Explosive Mixtures and Flame."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 2nd May, 1860.

180. Superannuations (Public Offices)—Account.
200. Courts of Probate (London and Dublin)—Account.
244. Tobacco—Return.
256. Poor rate Assessments—Return.
261. Army—Statement.
264. Army—Return.
115. Bill—Companies (1860). Amended.

Delivered on 3rd May, 1860.

203. Civil Service Estimates—Classes 1 to 6.
200. The Serpentine—Return.
265. Committee of Selection—5th Report.
267. Cities and Boroughs (Population)—Parliamentary Cities and Boroughs—Returns.
114. Bill—Bankruptcy and Insolvency (Amended).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 25th*, 1860.]

Dated 15th March, 1860.

691. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved arrangement of apparatus for working and controlling railway signal discs. (A com.)

Dated 30th March, 1860.

828. R. Lakin, Ardwick, Manchester, and J. Wain, Manchester—Imp. in machines for spinning and doubling cotton and other fibrous substances.

Dated 21st April, 1860.

1003. E. Peyton and W. F. Batho, Birmingham—Imp. in the manufacture of metallic bedsteads.

Dated 28th April, 1860.

1080. Lieut.-Col. H. J. Barr, Bombay—Imp. in working railway signals, and in apparatus employed therein.

Dated 8th May, 1860.

1133. W. Evans, Derby—Imp. in machinery for polishing yarns and threads.

Dated 9th May, 1860.

1142. H. Kemp, Saint Marylebone, Middlesex—Imp. in preserving wood, leather, iron, and other substances.

1144. E. Butterworth, Calder-cottage, Spotland, near Rochdale—Imp. in machinery for preparing and spinning cotton and other fibrous substances.

1146. J. Reid, 25, University-street, Middlesex—Imp. in electric telegraph conductors.

1148. J. M. Fisher, Taunton, Somersetshire—Imp. in chimney tops, or cowls.

1152. J. Howard, Bedford, and J. Lilley, Astwood, Buckinghamshire—An improved construction of horse hoe.

Dated 10th May, 1860.

1153. W. E. Gedge, 11, Wellington-street, Strand—Imp. in breech loading fire-arms. (A com.)

1155. R. B. Boyman, Park-crescent, Stockwell, Surrey—Imp. in applying steam or other expansive prime movers by action and reaction for rotary motion and propulsion, and in the machinery for the purpose.

1156. F. Edwards, Great Marlborough-street, Middlesex—Imp. in chimney bars or plates.

1157. A. Wilson, Edinburgh—Imp. in the construction of railway carriages, waggons, and trucks, which imps. are also applicable to vehicles for common roads.

Dated 11th May, 1860.

1158. G. Price, Wolverhampton—Imp. in locks.

1159. F. B. Doering, Ebury-street, Eaton-square, Middlesex—Apparatus for governing and regulating the speed of marine engines.

1160. J. Macintosh, North Bank, Regent's-park, Middlesex—Apparatus for governing and regulating the speed of marine engines.

1161. J. Uttley, and J. Bray, Staleybridge, Chester—Imp. in machinery or apparatus for spinning cotton, wool, silk, flax, and other fibrous materials.

1163. S. Ridge, Hoviley-bridge, near Hyde, Chester—Imp. in the process of ageing printed woven fabrics.

1164. J. Grantham, 31, Nicholas lane, and W. Sinnock, 14, Warkworth-terrace, Middlesex, and L. S. Magnus, 3, Adelaide-place, London—Imp. in the manufacture of wire rope, and in machinery for that purpose, with special application to the manufacture of telegraph cables.

1165. R. A. Brooman, 166, Fleet-street—Imp. in driving or propelling railway rolling stock. (A com.)

1166. A. Robertson, Neilston, Renfrew, N.B.—Imp. in preventing smoke.

1167. T. H. Morrell, Leyland and Littlewood, and H. Charnley, Preston, Lancashire—An improved machine for making bricks and tiles and other articles from plastic materials.

1168. T. Wilson, Birmingham—Imp. in projectiles and cartridges for fire-arms and ordnance.

1169. W. E. Newton, 66, Chancery-lane—Imp. in electric conductors for telegraphic purposes, and in the apparatus for and mode or means of transmitting signals between distant places. (A com.)

1170. J. Owen, Sheffield, and G. Veitch, Birmingham—Imp. in the construction of the bottoms of bedsteads, mattrasses, couches, sofas, seats, chairs, and other articles, for sitting or reclining upon, in order to render them more springy or elastic.

1171. W. Clark, 53, Chancery-lane—Imp. in the manufacture of cyanides of barium and strontium. (A com.)

1173. T. Nasmyth, 31, Rue de l'Etoile, Brussels—Imp. in taps and valves. (A com.)

Dated 12th May, 1860.

1175. W. Basford, Burslem, Staffordshire—Imp. in the mode of constructing brick walls, and in the mode of forming and ornamenting the materials to be used for the same.

1177. W. Senior and W. Statter, Wakefield—Imp. in purifying gas, and thereby obtaining a useful product.

1179. S. C. Salisbury, Essex-street, Strand—An improved construction of metallic fencing. (A com.)

Dated 30th May, 1860.

1181. H. L. Lilley, Stand-lane, Lancashire—Imp. in machinery or apparatus for scraping starch.

1183. W. H. Muntz and H. King, Millbrook, Hants—Certain imp. in marine steam-engines, part of which is applicable also to ships' pumps.

1185. W. E. Newton, 66, Chancery-lane—Imp. in the construction of metallic barometers. (A com.)

1187. E. T. Jones, 8, Ashburnham-grove, Greenwich, Kent, and H. Owen, Llantrisant Rectory, North Wales—Imp. in roasting jacks.

Inventions With Complete Specifications Filed.

1224. H. Conant, Willimantic, Connecticut, U.S.—A new and useful imp. in mechanism for regulating the delivery or letting off of warp in looms for knitting or weaving.—17th May, 1860.

1232. A. R. Turner, Malden, Massachusetts, U.S.—Certain new and useful imp. in penholders.—19th May, 1860.

1241. C. J. de Meyer, Brussels—Imp. in pianofortes.—21st May, 1860.

Patents Sealed.

[*From Gazette, May 25th*, 1860.]

May 25th.
2685. E. Tomey.
2691. J. Bower.
2693. R. A. Brooman.
2694. R. A. Brooman.
2700. L. N. Dejean.

[*From Gazette, May 29th*, 1860.]

May 29th.
2707. S. Mortimer.
2710. H. de Matthys.
2711. J. B. Teil.
2715. A. Mercier.
2741. R. Bond and W. Hayhurst.
2780. J. Arrowsmith.
2781. J. Arrowsmith.
2784. T. Crook.
2792. W. Boaler.
2794. J. Spiller.
2828. J. R. Johnson and J. S. Atkinson.
2909. S. Plimsoll.
406. M. J. Haines.
590. W. Bauer.
704. J. Nixon.
731. J. A. Herbert.
738. J. Blackwood.
748. G. T. Peppe.
839. F. Jaburek.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, May 25th*, 1860.]

May 21st
1456. E. Travis and J. L. Casartelli.

May 22nd.
1511. W. E. Newton.

[*From Gazette, May 299h*, 1868.]

May 24h.
1477. L. D. Aubert.
1508. P. P. Griffiths.
1526. E. Alexandre.
1562. W. Jones.
1643. W. Wilkins.

May 25th.
1968. J. Walker and J. Clachan.

May 26th.
1498. V. Bacqueville-Pieters.
1510. W. Hale.
1528. Dr. H. Bleibtreu.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, May 25th*, 1860.]

May 22nd.
1285. W. E. Newton.
1287. W. H. Mitchell.

[*From Gazette, May 29*, 1860.]

25th May.
1316. C. Hill.
1456. J. Elliott and J. Brown.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,253	April 23rd.	Gas Meter	Andrew Fullarton	Abbey Mount Works, Edinburgh.
4,254	May 5th.	Transplanting Tool	Richard Thomas	Birmingham.
4,255	,, 7th.	Improved Apparatus for Steaming Felt Hats	Edward Clark Grimshaw	Denton, Lancashire.
4,256	,, 10th.	Twitch Elevator	T. and R. Trotter	Lincoln.
4,257	,, 15th.	Cooking Stove	Bradshaw and Sanson	Meadow Foundry, Mansfield.
4,258	,, 15th.	Oblong Double Nut for Bedsteads	Charles Bull	4, Gloucester-terrace, Gloucester-road. Old Kent-road, S.E.
4,259	,, 16th.	A Valve to Regulate the Passage of Gas through Purifiers	Lynch White	Old Barge House Wharf, Upper Ground-street, S.
4,260	,, 24th.	Self-sifting Ash Pan	Wm. Henry Parker	Birmingham.
4,261	,, 26th.	New and Improved Paint Straining Frame	Thomas Long	2, Clarendon-place, Notting-hill, W.
4,262	,, 26th.	Bit of the Head Gear of a Plough, usually designated the Peel or Cross-head	Wallis and Haslam	North Hants Iron Works, Basingstoke.
4,263	,, 26th.	A Child's Shoe	C. and J. Clark	Street, near Glastonbury.

Journal of the Society of Arts.

FRIDAY, JUNE 8, 1860.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council, at their meeting on Wednesday last, the 6th inst., that the amount of the Guarantee Fund promised up to that date, was £304,950.

NINTH ANNUAL CONFERENCE.—NOTICE TO INSTITUTIONS.

The Ninth Annual Conference between the Representatives of the Institutions in Union and the Council will be held on Friday, the 22nd inst., at half-past 10 o'clock in the morning. Sir Thomas Phillips, F.G.S., Chairman of the Council, will preside.

Secretaries of Institutions in Union are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the names of the Representatives appointed to attend the Conference, stating at the same time (if possible) whether those gentlemen will also be present at the Society's Annual Dinner, which will take place on the same day, and of which particulars are given below.

The Chairmen of, or Representatives from, the several Local Boards of Examiners are invited to attend.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Friday, the 22nd June, at six o'clock punctually. The Right Honourable Benjamin Disraeli, M.P., will preside.

Members and their friends are invited to be present, and tickets (price 10s. 6d. each) may be obtained at the Society's House.

TWELFTH ANNUAL EXHIBITION OF INVENTIONS.

This Exhibition will close on Thursday next, the 14th inst.

Exhibitors are requested to give directions for the removal of their articles on Friday, Saturday, or Monday, the 15th, 16th, or 18th inst.

EXHIBITION OF PICTURES BY THE LATE SIR WILLIAM ROSS, R.A.

This Exhibition will close on Saturday, the 16th inst.

The owners of pictures are requested to communicate with the Secretary in reference to their removal.

GUARANTEE COMMITTEE FOR THE EXHIBITION OF 1862.

The first meeting of this Committee took place on Tuesday, the 5th instant, the Marquis of Salisbury, K.G., in the chair.

Sir Thomas Phillips, Chairman of the Council, said that it would be recollected that the Council had originally intended that an Exhibition should be held in 1861, and the Guarantee Fund was commenced last year, when a few gentlemen put down their names, but before the matter could be further proceeded with, all action with regard to the Exhibition was suspended on account of the disturbed state of Europe. When the Council resumed their meetings, in November, the war in Italy having ceased, it was determined again to bring the subject forward; but owing to the time which had been lost, it was found necessary to postpone the period for holding the Exhibition to the year 1862. The Council then proceeded to procure additional names of guarantors among their friends, and on the 2nd of March made the first appeal to the members of the Society. The result of this appeal and of correspondence with other persons (but without any public advertisement), had been that upwards of 400 persons and corporate bodies had undertaken to subscribe the guarantee agreement, for sums amounting in the aggregate to £302,150, including the sum of £10,000 promised by H.R.H. the Prince Consort, President of the Society. The Council thought it desirable that this amount should be increased, and they had therefore appointed the present Committee, whose assistance would doubtless be most valuable in augmenting the fund, and increasing the number of subscribers. Without further preface, he would therefore propose:—

"That the progress made in the subscription to the Guarantee Fund is highly satisfactory, and that the amount of £302,000 now subscribed insures the holding of the Exhibition in 1862."

Mr. J. Griffith Frith seconded the resolution, which was unanimously passed.

Mr. Uzielli said the principal portion of the subscriptions had hitherto been obtained in the metropolis, but he had no doubt that, if proper application were made to persons resident in the provinces, a large accession to the fund would be secured. For his own part, he had subscribed at an early stage, believing the Exhibition would be beneficial, not merely in a commercial, but also in a political point of view, and would further, to a most important extent, the interests of peace in Europe. He begged to propose:—

"That it is very desirable to extend the Guarantee Fund, both as regards the amount and the number of subscribers, in order that all classes may be interested in the success of the Exhibition."

Mr. Henry Thomas Hope said he had much pleasure in seconding the resolution, which entirely coincided with his opinions and wishes.

The resolution was then put and carried unanimously.

Mr. Henry Cole, C.B., said he thought it would be a desirable step to make a public declaration of the state of the Guarantee Fund, and he considered that a convenient mode of doing this would be to avail themselves of the promised assistance of the Lord Mayor, as the chief magistrate of the City of London, and to hold a meeting at the Mansion House, at which the announcement might be made.

Mr. Alderman Mechi said there was a warm feeling in the City in favour of the Exhibition, and he felt sure the citizens would cordially respond to any appeal that might be made to them. Without however pressing upon the Council any specific course of action, he would move—

"That, with the view of making extensively known the number of guarantors and the amount guaranteed, it be recommended to the Council to publish the list in such manner as may seem to them most desirable."

Mr. Wm. Hawes seconded the resolution.

Mr. C. Wren Hoskyns supported the resolution, on the ground that success was found to beget further success, and as the Council had already succeeded to an extent which few would have expected, they might confidently anticipate a great extension of the amount which was already so considerable. For his own part he saw no reason why it should not be increased to half-a-million. He thought that as the Agricultural interest would be largely represented in this Exhibition, as it was in that of 1851, it would be well to afford to those connected with Agriculture an opportunity of evincing their sympathy with the undertaking, by contributing to the Guarantee.

Mr. Wm. Hawes said the observations of the last speaker opened up questions of some difficulty. It might be argued by some that if the Guarantee Fund became unduly large, it might lead to an extravagant expenditure, and thus ultimately tend to increase the liability of the Guarantors.

Mr. Fredk. Lawrence said that as the amount originally fixed had been exceeded, he thought the time was now come for the Council to take the necessary steps for carrying out the Exhibition, without waiting for the further extension of the Guarantee.

Sir Thomas Phillips stated that this was actually being done. No delay was taking place, and he thought there was no reason why the extension of the Guarantee Fund should not go on simultaneously with the arrangements for holding the Exhibition.

Mr. Cole said, in reference to what had fallen from Mr. Hawes, that there was no reason why the expenses should increase because the Guarantee Fund was extended, and he believed this was not contemplated. A large guarantee would diminish the responsibility of each guarantor, and need not be followed by extravagant expenditure.

Mr. Harry Chester was in favour of an extension of the guarantee fund, not indefinitely, but by the addition of really good and influential names. He desired to see all classes join in showing their sympathy with the undertaking, so as to include a large number interested in Arts, Manufactures, Commerce, and Agriculture. He thought, however, that a limit should be fixed to the fund, otherwise many, without risk or interest in the undertaking, might add their names simply with a view of obtaining a voice in the disposal of the surplus.

Mr. Alfred Tylor asked whether the Trustees had been communicated with.

Sir Thomas Phillips replied in the affirmative.

Mr. Uzielli thought the fund should not be limited. It was important in the interest of the guarantors that it should be made as large as possible.

Mr. Henry Thomas Hope said the only limit should be such as to secure really good names.

Mr. John Dillon said that as they had already much exceeded the sum originally contemplated, it would be undesirable to fix a further limit, as, if it happened that this was not reached, there would be an appearance of failure instead of success.

The resolution proposed by Mr. Alderman Mechi was then put to the meeting and passed unanimously.

Sir Thomas Phillips then proposed a cordial vote of thanks to the Chairman for his kindness in presiding on the present occasion.

This was seconded by Mr. Henry Cole, and carried unanimously.

The Marquis of Salisbury acknowledged the compliment, and the meeting then adjourned.

UNIFORM MUSICAL PITCH.

A meeting of the principal Musicians, Amateurs, and others interested in Music, was held at the Society's House on Tuesday, the 5th inst., Sir Thomas Phillips, F.G.S., Chairman of the Council, in the chair

The subjoined Report of the Committee appointed by the Council in June, 1859, having been previously circulated, was taken as read.

The Committee consisted of the following Gentlemen :—

Dr. Arnott, F.R.S.
Mr. Jules Benedict.
Professor Sterndale Bennett.
Mr. H. Blagrove.
Mr. Bowley.
Mr. W. Broadwood.
M. Bruzaud (Messrs. Erard).
*Mr. Harry Chester.
Mr. Collard.
Rev. B. Morgan Cowie.
Mr. F. Davison.
*Mr. C. Wentworth Dilke.
Professor Donaldson (Edinburgh).
Rev. G. T. Driffield.
Dr. Elvey.
Mr. Godfrey.
Mr. Otto Goldschmidt.
Professor Goodeve.
Mr. J. Goss.
Mr. Henry Griesbach.
Mr. Halle.
Mr. Harper.
*Mr. W. Hawes.
Mr. W. Hill.
Mr. Hobbs.
Mr. Edward Hopkins.
Mr. Charles Horsley.
Mr. John Hullah.
Mr. Henry Leslie.
Mr. H. C. Lunn.
Mr. G. A. Macfarren.
Mr. Alfred Mellon.
Prof. De Morgan.
Mr. A. Nicholson.
The Rev. Sir F. Gore Ouseley, Bart.
*Sir Thos. Phillips, F.G.S., Chairman of Council.
Professor Pole.
Mr. Cipriani Potter.
Rev. Dr. Rowden.
*Mr. F. R. Sandford.
Sir George Smart.
*Mr. Thomas Sopwith, F.R.S.
Mr. J. Turle.
Mr. Tutton.
Mr. Waddell.
Mr. Walker.
Prof. Wheatstone, F.R.S.
The Rev. Dr. Whewell, F.R.S.
Professor Willis, F.R.S.
Mr. Henry Willis.
Dr. Wylde.

REPORT.

The General Meeting of Musicians, Amateurs, and others interested in Music, called together by the Society of Arts to consider the present state of Musical Pitch in England, found, after a little inquiry, that their attention would have to be directed to three principal points:—

1. Whether a uniform musical pitch was desirable.
2. Whether a uniform musical pitch was possible.
3. Supposing a uniform pitch to be desirable and possible, what that pitch should be.

1. With the first of these considerations the General Meeting were not long occupied, all testimony going to prove the frequent inconvenience† to which musical performers vocal and instrumental, musical instrument makers, musical directors, and even instructed hearers, were alike put by variations in the pitch, whether of individual instruments or of entire orchestras. The Meeting came early to a unanimous resolution that a uniform pitch was desirable.

2. The second question, "Whether a uniform pitch was possible," was not found to admit of so ready an answer as the first. That a uniform pitch is never for any length of time maintained is well known to all practical musicians. The effects of temperature on musical instruments are so great and so rapid, that a difference in pitch of at least a quarter of a tone has often been remarked between the beginning and the end of the same concert; and instruments not required at the beginning of a performance are frequently tuned to a higher pitch, in order to meet this anticipated elevation. In theatres, instruments to be used on the stage are systematically tuned sharper than those to be used in the orchestra, to compensate for the difference of temperature before and behind the scenes.‡

* Member of the Council of the Society of Arts.

† One instance of this will suffice. An eminent performer, acting on previous experience, provided himself for a recent musical tour with no less than *thirteen* concertinas, tuned to different pitches varying to the extent of about a tone and a half.

‡ This inconvenience might be much lessened, if not got rid of altogether, by improved ventilation of places of public assembly.

Still, though the maintenance of a certain pitch may be difficult, or even impossible, the definition of it is not. A point of departure, if nothing more, would be in the highest degree convenient to musicians. No great practical inconvenience has ever been found to result from any change of pitch possible during a single performance. It is against the gradual elevation, consequent on the absence of any recognised standard, that musical practice requires a security. Physical science is, happily, enabled to afford this, and to bring to the aid of musical art more than one process by which such a standard may be adjusted.

Musical pitch is not a matter of mere comparison. A sound is not merely acute or grave, in relation to another; its pitch is capable of exact measurement, and that measurement once recorded, it may be reproduced at any distance of time, without reference to any other sound whatever. In short, the number of vibrations per second due to a given sound can be ascertained with the same certainty as the number of square yards on a given estate, or the number of tons burthen of a given merchantman.

Several methods of counting vibrations have been adopted by men of science at different periods, by one or other of which the pitch of certain notes (generally either C or A) in this or that musical establishment has been recorded; so that a body of evidence exists, in addition to, and independent of, that of tuning-forks, bells, and other instruments least susceptible of change, by which the variations of pitch, at different times and in many different places, may be ascertained with certainty.

Under these circumstances the Meeting came to a resolution, that a uniform pitch was not only desirable but possible. It remained for them to consider "what that pitch should be."

3. On this question such very wide difference of opinion was expressed, and, indeed, such very conflicting evidence was adduced, that the Meeting, as a prelude to further operations, thought it advisable to devolve on a Committee the task of ascertaining the grounds of these opinions, and of investigating this evidence.

Several meetings of the Committee have been held, in the course of which much valuable information has been collected, and many valuable opinions have been weighed.

The Committee are now in a condition to report.

Their inquiries and considerations have been brought to bear on the following points:—

1. The pitch, or varieties of pitch, obtaining at foregoing periods of musical history.

2. The pitch, or varieties of pitch, obtaining in the most eminent and important English orchestras at this time.

3. Pitch, in its relations (1st) to voices, (2nd) to artificial instruments.

4. The difficulties likely to impede a change of the existing pitch, were any change thought desirable.

5. What pitch it is advisable to recommend for general adoption.

1. With regard to the pitch in the early days of modern music, the sixteenth and seventeenth centuries, some uncertainty prevails; indeed, not only would it seem to have been liable to all those temporary and slight variations inevitable perhaps at any time, but the evidence of musical composition would suggest the simultaneous existence of more than one pitch, and that of these the "church pitch" was, contrary to more recent experience, the highest.* Of the pitch, or rather of *a* pitch common in orchestras, in the first half of the last century, evidence is somewhat more reliable. Several tuning-forks, of the authenticity of which there is no reason to doubt, exist, and many musical instruments have been preserved which would go to prove that the opera pitch in England in the time of Handel (1720-59), was about a tone lower than that at present in vogue. No scientific record of this fact has come before the Committee, but the presumptive evidence in its favour is strong.*

On the state of the pitch during the first half of the present century, a body of evidence exists which is absolutely irrefragable. Whether during the second half of the last century the pitch rose gradually, or whether a sudden deviation took place on the introduction to this country of the first great works of the modern symphonic school (c. 1790), is uncertain, and perhaps unimportant.† But it has been ascertained, that from the year 1813 to the year 1841 or 1842, a tuning-fork, of which numerous duplicates have been preserved, was authorised by the Directors of the Philharmonic Society, the pitch‡ of which is about a semitone higher than that of the tuning-fork said to be Handel's, and about a semitone lower than the pitch now obtaining in that same Philharmonic Society. This Philharmonic fork of 1813-42, gives 433 vibrations per second for the note A, equal to $518\frac{2}{5}$ for the note C.

2. Various observations (made principally during the last season at the Italian Opera, at the Philharmonic, and other orchestral concerts) have established the fact that, at the present time, the pitch has reached an average of 455 vibrations per second for A, equal to 546 for C. So that the C and A of 1859 are identical with the D flat and B flat of 1840, *the pitch having risen, in less than twenty years, a semitone.*

This extraordinary result has been brought about by a variety of causes. The advent of certain foreign vocalists, gifted with voices of exceptionally high register, may have been one; an opinion entertained by many instrumental performers, that increased "brilliancy" of *timbre* is attained by increased elevation of pitch, may have been another; but, perhaps, the present high pitch is due less to these and like causes than to the simple fact that it is always possible to raise, and often impossible to lower, the pitch of an instrument, and, therefore, that, if one important instrument (*e.g.* oboe or clarionet) in an orchestra is found to be higher than all the other instruments, accordance is rarely attained by lowering it, but almost always by raising them. With an exciting cause like this always in operation, and no authoritative standard to which reference could from time to time be made, the wonder is that the pitch has not risen more, rather than that it has risen so much. Nor is it unreasonable to anticipate still further elevation, unless some such standard can be agreed upon by reference to which this upward tendency may be kept in check.

3. Before entering on the consideration of "pitch in its relations to voices and artificial instruments," the subcommittee thought it advisable to try and agree upon some principle by which they might be governed in their choice of a particular pitch, supposing any discrepancy in the interests of vocal and instrumental music to appear.

Nothing is more certain than that while artificial instruments admit of, and receive, continual modification and improvement, the powers of the human voice have now been thoroughly ascertained. There is not the slightest

* "Not the least interesting proof of the former existence of a high *church* pitch, is to be found in the fact that Sebastian Bach, in his Church Cantatas, in most cases, wrote the *organ* part *a note lower than the other parts.*" The Organ, its History, and Construction; By Edward J. Hopkins and Edward F. Rimbault, London, 1855, par. 740.

* The pitch of the organ in Trinity College, Cambridge, about the year 1755, was ascertained by Dr. Smith, then Master. It gave a still smaller number of vibrations than Handel's fork, viz., $388\frac{5}{6}$ for A, and $405\frac{1}{7}$ for C. The pitch of a single organ, never perhaps used in combination with other instruments, would, however, be no evidence of the pitch elsewhere.

† About this time, *i.e.*, shortly after the foundation of the Conservatoire de Musique (in 1795), the French "diapason d'orchestre" was suddenly raised a semitone above the "diapason d'opéra," no change being made in the latter for a long time after.

‡ This pitch was settled by Sir George Smart, in conjunction with Messrs. Braham, Naldi, and Griesbach, and Mrs. Billington. In a letter to a member of the committee (dated Feb. 6th, 1860), Sir George Smart says—"I have conducted forty-nine Philharmonic Concerts, the first in 1816, the last in 1844, and during a great part of that time this pitch was adhered to."

evidence to justify the belief that the average Soprano of our own times differs, or that the average Tenor of the 20th century will differ, from the average Soprano or Tenor of the 18th century.

While, therefore, among other qualities, the pitch of artificial instruments admits of alteration to almost any extent, for the simple reason that the instruments themselves admit of alteration to almost any extent, the pitch of the voice, like the voice itself, admits of no alteration, but at the will and by the hands of Him who made it. If voices and instruments are to remain—as to the delight of all human kind they have remained so long—allies, their pitch must be identical; and if any pitch is possible to instruments, and only one pitch possible to, or rather fit for, voices, the pitch of instruments must be that of voices.

At one of their first meetings the Committee passed unanimously the following resolution:—"That, as the basis of any recommendation of a definite pitch the capabilities and convenience of the human voice in singing the compositions of the great vocal writers should be the first consideration."

Some impediments stand in the way of ascertaining directly the effects of the present high pitch on the quality and probable duration of the voice. A remonstrance in respect of it on the part of a singer might be too readily interpreted into a confession of weakness; and a premature decay of physical power might be imputed to an artist who remonstrated against the gratuitous exertion which an extravagantly high pitch obliges him to undergo.

Such evidence, however, as the Committee has been able to collect directly is, without exception, to the effect that the present pitch taxes unfairly, if it does not seriously impair, the powers of the most gifted and skilful artists; while the evidence of several directors of choral societies goes to prove that, not only is the quality of sound produced by large bodies of voices seriously depreciated by the present high pitch, but that false intonation is an increasingly frequent result of it. Certain it is that entire movements are now frequently transposed, because it is found impossible, by artists whose powers are acknowledged to be in their zenith, to execute them as they were written, at the present pitch; and choral practices are not unfrequently made in keys lower than those in which the music so practised will have to be performed. The depreciation in effect and inconvenience caused by transposition in these cases requires no comment.

The inquiries of the Committee as to the effect of the present high pitch on musical instruments have had reference to organs, pianofortes, the stringed instruments, which form the basis of the orchestra, and the wind instruments of wood and of brass.

No strong opinion appears to prevail among organ builders, or pianoforte makers, in respect to the advantages of any particular pitch. They are, without exception, desirous that some uniform pitch should be established, but it has not been asserted that an organ or a pianoforte gains or loses by a higher or lower pitch.

With respect to stringed instruments, the Committee have ascertained that there is a decided feeling, especially among violinists, in favour of a high pitch, as contributing to increased "brilliancy" in the *timbre* of their instruments. This feeling, expressed as it has been by artists of great experience and acknowledged skill and taste, is entitled to much respect and grave consideration. On the other hand, however, it is contended that elevation of the pitch of a violin or cognate instrument, is necessarily attained either by the use of thinner strings, or by tension so increased as to necessitate, sooner or later, the strengthening of the instrument, by processes which of necessity decrease its volume and, as it would seem, its power and richness in like proportion.*

The Committee have not found many advocates for high pitch among performers on, or makers of, wind instruments. To some of the former a lower pitch than the present would be acceptable. The higher notes of the trumpet and horn have become, as the pitch has risen, more and more difficult of access; the rise, however, seems to have been easily met by the other wind instruments, whether of wood or brass. It has not been contended that any advantage in the power or quality of wind instruments results from high pitch; on the contrary, a strong opinion has been expressed by an eminent manufacturer* that wind instruments would be greatly improved in these respects were their pitch lowered a semitone.

4. On the practical difficulties attending any change of pitch, the Committee find opinions unanimous. The violins, violas, violoncellos, and double-basses, now in use in orchestras, though many of them old instruments, have gradually been habituated, so to speak, to the present pitch, and would, it is said, suffer greatly from, and require alteration to meet, any considerable change. The wooden wind instruments (flutes, oboes, clarionets, and bassoons), are mostly new, and have in every case replaced others of which the ventages were adjusted with a view to a lower pitch. Similar inconvenience would occur in respect to the keyed brass instruments; but the other brass instruments would find a change easy.

5. What pitch is it advisable to recommend for general adoption?

It has been customary, in treating of acoustical science, to assume, as the simplest possible point of departure, the existence of a note corresponding to one vibration per second; the various octaves of which will be represented by 2, 4, 8, 16, 32, 64, &c., vibrations, being a series of powers of the number two. This *theoretical* note is found to agree so nearly with the musician's idea of the note C (the simplest fundamental note in a *practical* point of view), that writers on acoustics, it is believed without exception, have agreed to consider them as identical, and have thus established what may be called a *theoretical pitch*, or definition of the note C.

Thus, the C produced by a 32ft. organ-pipe is assumed to be the result of 16 double vibrations (or 32 single ones) per second. The octave above, or the lowest C of a grand pianoforte, of 32 double vibrations; the lowest C of a violoncello, of 64; tenor C, of 128; middle C of the pianoforte, of 256; and the C on the treble stave, of 512 double vibrations per second.

The divisions of a musical string, necessary to produce a major scale, are as follows:—

C	D	E	F	G	A	B	C
1,	$\frac{8}{9}$,	$\frac{4}{5}$,	$\frac{3}{4}$,	$\frac{2}{3}$,	$\frac{3}{5}$,	$\frac{8}{15}$,	$\frac{1}{2}$.

The number of vibrations due to each sound (being in inverse ratio to the divisions of the string) at the pitch alluded to, will therefore be as follows:—

C	D	E	F	G	A	B	C
256,	288,	320,	$341\frac{1}{2}$,	384,	$426\frac{2}{3}$,	480,	512.

In the year 1842, at the suggestion of a member of the Committee, a tuning-fork, regulated to the above pitch by means of an instrument called the *sirène*,† was made and published. Duplicates of this tuning-fork have been circulated to a very large extent; it has served, for years past, as the standard for many choral societies, and

* Extract from a letter of Messrs. Withers and Co., dated January, 9, 1860:—"Having regard to those instruments with which we are especially conversant, viz., violins, violoncellos, and double basses, we are of opinion, that a pitch somewhat lower than the present would be favourable to those instruments. They would be more free to vibrate, and the tone would be of a better quality."

*Extract from a letter of Messrs. Rudall, Rose, Carte and Co., dated Jan. 11, 1860:—"We have no hesitation in stating it as our full belief, that the tone of the brass, as well as the wood instruments, would be greatly improved by the adoption of a pitch as low as that of the French, or even that of 512 vibrations for C."

† The invention of a French mathematician, Cagniard de la Tour.

been adopted by pianoforte tuners for instruments not intended for public performance; several large and important organs also have been adjusted to it.*

It is certain, however, that the simplicity of the figures which by the octaves to C, and the scale, are represented at this pitch would be a very insufficient recommendation of the pitch itself to musicians, were its adoption found to be practically injurious to musical effect. That this has not been found to be the case two very remarkable facts will serve to show.

1st. The commission recently appointed to report on the pitch in France, who appear to have been governed by considerations of a purely practical kind (their report ignoring mathematical convenience entirely), have decided on a pitch, certainly not identical with the pitch of 512 vibrations, but differing from it only to the extent of ten vibrations per second.

The following are the numbers of vibrations of each note of the scale of C, according to the French normal diapason:—

C	D	E	F	G	A	B	C
261	$298\frac{5}{8}$	$326\frac{1}{4}$	348	$391\frac{1}{2}$	435	$489\frac{3}{8}$	522

It is needless to say that the difference between this (French) pitch and that of C 512 is practically not greater than that frequently produced on the same instrument by a few minutes' change of temperature.

2nd. On testing the A tuning forks, said, on irrefragable evidence, to represent the Philharmonic pitch of 1812-42, they are found to be the result of 433 vibrations per second† = C at $518\frac{2}{5}$; still nearer than the French to the pitch of C 512.

This result again is strongly in favour of the latter pitch; seeing that, like the French, the Philharmonic pitch was avowedly decided upon without reference to any mathematical or scientific test whatever. A few eminent practical musicians consulted together, and came to agreement among themselves that a certain pitch was a convenient mean, neither too high for voices nor too low for instruments, and for thirty years their decision was never impugned.

The authority, therefore, of practice as of theory—of art as of science—belongs alike to the pitch of C 512; seeing that a pitch closely approximate has been adopted at different periods by many different persons having no concert or communication with one another, and having been led to its adoption by very unlike processes and objects.

On grounds of abstract propriety, therefore, the sub-committee would willingly have recommended the pitch of C 512 for general adoption. They are, however, withheld from doing so by certain practical considerations, which it is impossible for them to ignore. These, to which some allusion has been made already, it now becomes necessary to enter upon more fully.

It is certain that a change from the present pitch of C 546 to C 512—a change of about a semitone—could not be made without great inconvenience and pecuniary loss to the body with whom the adjustment of the pitch practically rests—our orchestral performers. Such a change, too, would fall heavily on musical instrument makers, probably to the extent, in many cases, of rendering the greater portion of their existing stock valueless. This objection, it is thought by some even of those who are most anxious for a great depression of the present pitch, would be fatal to any proposition which did not in some way meet it. Information has reached the sub-committee that considerable difficulties are found in enforcing the new musical diapason in France, and that authority such as would never be sought for, or obtained, in this country, has found a powerful antagonism in "the inexorable logic of facts." Why, it has been asked, should we not profit by this experience, and abandoning the chase after that which others, with more advantages than ourselves, have as yet found unattainable, turn our attention to that which would seem to be within our reach?

For, it is believed, though so great a change of pitch as that involved in the descent from C 546 to C 512 would experience an amount of opposition which there is no means of overcoming, a change smaller in amount, while it would afford considerable relief to the vocal performer, would be not unacceptable to the instrumental, since it could be carried into effect without appreciable injury to, certainly without the destruction of, his instrument.

It is well known, that neither by the committee called together by the Society of Arts, nor by the Commission appointed by the French government, has the attempt to deal with the now intolerable evil of an extravagantly high pitch, been made for the first time. Among other attempts, that of a Congress of Musicians at Stuttgard in 1834, has attracted the most attention. This body recommended a pitch of 528 for C, = 440 for A, basing their calculation on 33 vibrations per second instead of 32. The following would be the scale at this pitch—the only one yet proposed which gives all the sounds in whole numbers:

C	D	E	F	G	A	B	C
264	297	330	352	396	440	495	528

This pitch, of which the C is 16 vibrations per second higher than that of C 512, and 18 vibrations lower than the C at the present pitch (of 546), is as near as possible half-way between the two latter, and, therefore, a quarter of a tone above the one and a quarter of a tone below the other.

To lower the stringed intruments to this pitch would obviously be attended with little difficulty. Depression to the extent of a quarter of a tone is said to be easy with the brass instruments and possible with the wooden wind instruments—the flutes, oboes, clarionets, and bassoons—now in use.* Few organs exist of higher pitch than the Stuttgard, and the raising of those which have been tuned to C 512 would not be attended with serious difficulty.

The Stuttgard pitch, then, if not the very best that could be conceived, may be regarded as the one which, with many recommendations, would have the best chance of attaining the general assent of contemporary musicians.

Though higher than the pitch of 512, the Philharmonic pitch, or the diapason normal, the Stuttgard pitch is but a few vibrations higher than the two last of these,—one of which experience has proved to be a good pitch for instrumental music.

It is a quarter of a tone below the present pitch, by general consent voted intolerably high.†

Its adoption would involve little, if any, inconvenience,

* The difficulties connected with the manipulation of the sirène, must always expose results obtained from it to suspicion. The tuning-fork alluded to above, on being tested by the process adopted by Mr. Henry Griesbach, has been found to be the result of $521\frac{6}{10}$ vibrations per second—almost identical with the French Normal Diapason. It must be borne in mind, however, that nine vibrations, in respect to the C on the treble stave, do not represent more than a quarter of a semitone.

† A satisfactory proof of the certainty of two known processes of measuring vibrations has been afforded in the results obtained from duplicates of this fork. The same number of vibrations having been obtained by Mons. Lissajous, in Paris, and (on a method altogether unlike), by a member of the sub-committee, Mr. Henry Griesbach, in London.

* Many of these were originally tuned somewhat lower, and have been raised in pitch by modifications which do not of necessity permanently affect them. The standard adopted by one of the most eminent makers of instruments for military bands is somewhat lower than that proposed above.

† About forty letters have been received in answer to a circular addressed to various directors of musical societies, vocal and instrumental performers, musical instrument makers and others, soliciting information and opinions respecting the objects of the sub-committee. Of the writers of these *none* advocate an elevation of the present pitch, *three* think no change called for, and *twenty-nine* recommend a depression of the present pitch to different amounts varying from $\frac{1}{4}$ to $\frac{3}{4}$ of a tone. Of these twenty-nine *eleven* specify the pitch of C 512.

or pecuniary loss to instrumental performers or makers of musical instruments. It would, therefore, be likely to meet with the support of the majority of those interested in the question of pitch.

The Committee, in bringing their inquiries and discussions to a close, cannot but express an earnest hope that whatever recommendation of a pitch may be adopted by a General Meeting, it will be received by professors and amateurs of music in a spirit worthy of an attempt to deal with a question in which every musician must have a strong interest, and with that respect which must ever be due to a conclusion not arrived at without much patient labour and very serious consideration.

List of the several pitches referred to in the foregoing report:—

Handel's Tuning Fork (c. 1740)	A at 416	—	C at $499\frac{1}{3}$
Theoretical Pitch	A at $426\frac{2}{3}$	—	C at 512
Philharmonic Society (1812-42)	A at 433	—	C at $518\frac{2}{5}$
Diapason Normal (1859)	A at 435	—	C at 522
Stuttgard Congress (1834)	A at 440	—	C at 528
Italian Opera, London (1859) ...	A at 455	—	C at 546

By Order of the Committee,
P. LE NEVE FOSTER, Secretary.

The Rev. G. T. Driffield said he rose for the purpose of proposing that the report of the Committee be adopted. He had had the pleasure of attending many of the meetings of the Committee from which this report had emanated, and was familiar with the evidence upon which it was based. He had been much interested by the valuable information which had been contributed by the various members of the Committee. After much deliberation and a careful examination of all the points adduced, he thought the Committee might be said to have arrived at a judicious conclusion. It would be observed that in the report there was no attempt made to dictate to the meeting, or to the musical public generally; at the same time, without going over any of the arguments adduced in the report, with which they were all familiar, he thought it was easy to see the general conclusion towards which it led, viz., that it was not only desirable to have a uniform pitch, by which all public and private musical arrangements should be guided hereafter, but also that the pitch should be reduced in some greater or less degree from that great height to which it had gradually, and, as he thought, accidentally risen. He could not think there had been any advantage attained by raising the pitch to the point at which it was now proved to have arrived—nor did he think this had been done intentionally. That pitch had been shown to be somewhat detrimental, not only to the human voice, but to the general interests of music; and therefore the Committee had come to the conclusion in settling a pitch to be the guide of the musical world, of recommending that the existing pitch should be lowered. He therefore had much pleasure, not only as a member of the Committee, but as an independent member of this larger meeting, in proposing:—

"That the Report now presented by the Committee appointed by the Council of the Society of Arts on the 3rd of June, 1859, be received and adopted."

Mr. Harry Chester said it having been deemed desirable that this resolution should be seconded by a member of the Council, he had much pleasure in rising for that purpose. He felt considerable interest in the success of this report, because he happened to be the individual who, during the time that the chair was occupied by his friend Mr. Dilke, proposed that the Society should move in this matter. He (Mr. Chester) was placed upon the committee as a member of the Council, but he had purposely abstained from attending any of the meetings, for, having neither musical nor scientific knowledge, he felt that his attendance would be of no service. The report which the Committee had drawn up, he must say, appeared to him an admirable document, because it was so precise, so clear, and, at the same time, so perfectly moderate, that it was impossible for a man having common sense, apart from musical acquirement, to find any difficulty in comprehending either its premises or its conclusions. He was quite certain that the concluding recommendation of the report would be received by the meeting with the same kind feeling as had prevailed throughout the proceedings of the committee. There could be but one common object, and that was to do what was best for the interests of music at home and abroad, and he felt that if the meeting and the musical world generally, came to the conclusion shadowed forth in this report, it would not be found a difficult matter to give practical effect to it. They could not, in this country, make a law for a compulsory uniform pitch, as had been done in a neighbouring state, but he hoped they should show that in this free country they could manage things as well as in other countries; and although they could not have compulsory legislation in a matter of this kind, they might have a legislation of their own by which they could obtain the same good practical results. He had in his mind a particular course of action to give effect to this resolution if it were passed, but the time had not yet arrived to enter upon that. The business at present before them was the reception and adoption of the report of the committee, after which a resolution could be moved inviting the meeting to accept the exact number of vibrations which it had been thought expedient to adopt.

The Chairman put the question, "That the report be adopted," which was carried unanimously.

Sir John Herschell, Bart., F.R.S., would suggest that this question ought to be divided into two parts, first, the reception of the report, and secondly, as to the particular number of vibrations. He should like to know whether the resolution already passed extended to the point of deciding the number of vibrations to be adopted.

The Chairman said the report was so worded that its adoption did not preclude anyone from proposing the acceptance of any particular pitch.

Mr. Cipriani Potter begged to propose the next resolution:—

"That the pitch of 528 vibrations for C be recommended for universal adoption in this country."

There would, he said, be no difficulty attending such a change as this involved, and it would not necessitate any great alteration in wind and other instruments. It was the happy medium, being only a quarter of a note lower than the present Opera and Philharmonic pitch. The great object was to fix a pitch, and it appeared from all the opinions they had heard, that the one he recommended was the most appropriate, and he thought its adoption quite feasible. If they took a lower pitch it would not answer so well for certain instruments. The change would be a great help to the human voice and to musical composers. For his own part, almost all music played in the present day appeared to him to be transposed, owing to the height of the pitch.

Sir John Herschell said he had no right to attend there as a musician, but he attended in the interest of general science, and it was his desire that some general and correct principle, easy of application to this subject, should be recognised, which he thought would place them in a position superior to their French neighbours, under compulsory legislation. It the point to be settled consisted of the number of vibrations, he felt inclined to move as an amendment, that the number of 512 vibrations for C be adopted. If it was not competent for him to move that amendment, he would suggest a modification of the resolution now before them to this extent, that, whatever number of vibrations might now be adopted, it should be only provisionally, so as to leave the question open for re-consideration at some future period. He had the greatest respect for the care and attention which the committee had evidently bestowed, looking at the various and manifold considerations they had to deal with. No doubt there were extensive pecuniary interests involved in the question, inasmuch as instruments now in existence would be rendered unserviceable by a sudden change to

the whole extent of lowering the pitch to 512, and therefore he presumed the medium figure of 528 had been recommended. In course of time the present instruments would disappear. The instruments henceforth made would be lowered, and at no distant period it would not be a matter of great inconvenience to come down to 512. He therefore urged that, whatever number of vibrations might be decided upon to-day, the decision should be provisional, with a view to the final adoption of the standard of 512 as the natural and simple pitch. If it was competent for him to do so, he would move an amendment to this effect:—

"That whatever number of vibrations higher than 512 be adopted for C by this meeting, its adoption shall be considered provisional, and that the subject ought to be reconsidered after a lapse of, say, twenty years, with a view to the final adoption of a pitch of 512, which is that ultimately to be arrived at."

Mr. F. Davison begged to second the resolution proposed by Mr. Cipriani Potter, approving 528 as the number of vibrations for C. The reason why that number had been recommended, in preference to 512, was that it was only a quarter of a note below the present pitch, and the existing orchestral instruments would not be rendered useless by it. That was an important consideration, which must not be lost sight of, and he thought this was the only pitch which was likely to be adopted at the present time. That was the main reason why it had been proposed. It was taking as the basis 33 vibrations for lower C, instaad of 32, which was the basis of the 512 pitch. It was a little higher than the new French pitch, and was one which in his opinion had every chance of being adopted by the orchestras.

Mr. H. F. Chorley seconded the amendment proposed by Sir John Herschell.

Mr. C. L. Gruneisen said if in the original resolution the words "for the present" were inserted, he thought it would meet with general support. He made this suggestion with a view to obtaining unanimity in the meeting.

Mr. John Hullah said that perhaps the addition suggested would tend to promote unanimity, but at the same time he thought it would neutralise the whole object of a year's work on the part of the Committee. He believed that everybody, without exception, was desirous to lower the pitch; but there was one subject in particular upon which there was not the slightest difference of opinion—that was, that some pitch or other (no matter what it was) should be settled; and he took it that the whole object of their meeting had been—not so much to decide what was the best pitch that could possibly be imagined—but to find out a pitch which would meet the various difficulties of the case, and so to settle the question. The Committee had had before them the makers of musical instruments, particularly pianoforte makers, who had been asked if they desired the raising or lowering of the pitch of their instruments, to which they replied that they had no preference at all; all they wanted was that the pitch should be decided, and they would make their instruments to it. The organ-builders, too, had no very strong opinion upon this or that pitch; all they desired was that the pitch should be fixed, and they were the more anxious upon the subject because their instruments were the most costly and difficult to change. If the meeting left the question open, to be re-considered at a future time, they would very much weaken the force of what they did, and they would appear before the public as an undecided body. It was perfectly competent for any set of persons at some future time to undo the work and build it up again. After great consideration, and having collected a vast deal of information, the Committee had decided upon making this recommendation; and it would be stultifying themselves to come to a resolution leaving the matter as open and as uncertain as it was before they entered upon the work. At the present time, instruments were waiting to be finished until a decision was come to upon this point; but if they carried a resolution affirming that a certain pitch was a good one, but that they expected it would be changed hereafter, the matter would remain in *statu quo*, and the labours of the Committee would be thrown away. It was pretty well known that last year he (Mr. Hullah) had appeared as an advocate for a particular pitch, and he had previously brought out a tuning-fork in accordance with those views; but, as he stated at the first meeting, his anxiety was to get some pitch fixed upon—no matter what it was. He repeated that desire at the present time, and what the majority approved, he would most cordially adopt. It was with the greatest respect and deference that he differed from the mover of the amendment, for if that were carried it would be utterly fatal to the whole of their proceedings.

Mr. Chester remarked that it was very desirable that the two parties, who in reality differed to no great extent, should, if possible, be brought together, and he thought words might be inserted in the resolution to meet the views of Sir John Herschell and those who thought with him. He felt with Mr. Hullah the difficulty there was in putting forth anything of a provisional nature. If the trumpet gave an uncertain sound, no one could prepare himself to obey the call, and he thought a resolution of a provisional character would command very little respect. The question would be almost as unsettled as it was before the appointment of this committee. and as much suspense and hesitation would prevail as heretofore. He thought words might be added to the resolution which would admit of the excellence of the theory of 512, at the same time that it accepted practically the 528. He gathered that the meeting was in favour of 512 as a theory, but that to come immediately to that result was beset with so many difficulties, that 528 was the standard which was most likely to obtain general acceptance. He begged to suggest whether they could not say something to this effect, that, looking at the practical difficulties attendant upon lowering the pitch below 528, it be recommended for present adoption, without saying anything about alteration at a future time. If it were now fixed at 528, there might not be the same difficulty in lowering it to 512 some years hence. If the resolutions were to have any practical effect, they must bear, upon the face of them, the appearance of being precise, definite, and final.

Sir John Herschell remarked that 512 was the desirable pitch to come to, but he saw nothing to prevent them from dividing that step into two, which everyone in the abstract must consider it desirable to take. It might be too much to take the step altogether. From all he had heard it was the general opinion that it would be too great a fall in the pitch for them to make at once. It was with that view he had proposed that the matter be reconsidered, say twenty years hence. By dividing the step as he had suggested, they left the matter open for future consideration. and did not annihilate the hope of ultimately coming to the right standard of 512. If the resolution were to go forth as final, he thought it would be much to be regretted.

The Chairman then put the amendment, which was negatived.

Mr. Gruneisen then moved, by way of amendment, that the words "for the present" be inserted in the original resolution.

This was seconded by the Rev. E. Cox.

The amendment having been put and lost,

Mr. C. Wentworth Dilke said it was obvious that 512 was the proper mathematical number. That was admitted on both sides. Under these circumstances, he would suggest a resolution something to this effect—that although no doubt 512 was the more correct number, yet, looking at all the practical difficulties surrounding the question, this meeting recommends that the number of vibrations adopted be 528. That would be a positive announcement that 528 was adopted by this meeting, at the same time that it recognized that 512 was the proper number to be hereafter aimed at. He held that to put forth a resolu-

tion which was not positive would be doing no good. He would propose the following amendment:—

"That although this meeting is of opinion that the pitch of 512 vibrations for C is the more correct standard, yet, looking to all the practical difficulties that surround the question, it recommends that the number of vibrations to be adopted in this country shall be 528."

Mr. Henry Leslie had great pleasure in seconding that amendment, because it represented that though practical experience showed that 528 could be adopted, they might ultimately hope for a still further reduction.

Mr. Davison would ask the permission of the mover of the original resolution to modify it as follows:—"That looking to the practical difficulties attendant upon a lower pitch than 528 vibrations, this meeting recommends that pitch for general adoption."

Mr. C. Potter could not consent to this modification.

Sir John Herschell said, earnestly wishing that the number of 512 should be recognised in some authoritative manner, but, finding this hopeless, his next object was to leave the door open for ultimately arriving at that number. That might to a certain extent be done if the words "under existing circumstances" were introduced into the resolution; because, he thought, that in time the circumstances would change, and if the pitch were lowered, as proposed, it would be easy to introduce the final change afterwards.

Mr. Hullah had the less hesitation in urging the original resolution, seeing that it amounted only to a recommendation and not to the passing of a law. If that meeting were a parliament, and could force the country to adopt this view, the case would be different. After all, they merely passed a resolution; and to go before the world with a resolution upon which they were unresolved, would stultify their proceedings entirely.

Mr. Blagrove remarked that anything which left the matter in uncertainty would weaken the force of their proceedings. The reasons for recommending 528 as the standard were fully detailed in the report, which could always be referred to.

The Rev. W. Cazalet did not understand why 512 should be taken as more mathematically correct than 528. It was a practical and not a theoretical question which they had to deal with. He should object to a resolution which avowed that 512 was a more correct number than 528. It would open up the whole question afresh.

Mr. Chester remarked that the resolution would have no practical value unless it obtained acceptance out of doors; and that system would be accepted which was the simplest and offered the fewest points of difficulty. Looking to the probabilities of general acceptance out of doors, he thought 528 would meet with the largest amount of support. He was only in favour of the amendment upon the ground that it might be a means of obtaining unanimity, otherwise he should be inclined to fall back upon the original resolution.

The Chairman then put the amendment proposed by Mr. Dilke, which was negatived, and the original motion of Mr. Cipriani Potter, having been put to the meeting, was carried by a large majority.

The Rev. Dr. Whewell had great pleasure in proposing the following resolution, as one calculated to promote the object for which they had been called together:—

"That, in order to promote the acceptance of this pitch, and with the view to its general adoption in this country, the Society of Arts be requested to undertake the preparation of a standard tuning fork."

This was seconded by Mr. Henry Blagrove, and unanimously passed.

Mr. Hullah moved:—

"That a communication be made to the directors of orchestras, military bands, musical instrument makers, and others interested in music, calling their attention to the foregoing resolutions, and specially requesting their co-operation in carrying them out."

Mr. Nicholson seconded the resolution, which was supported by Mr. Griesbach, and carried unanimously.

The meeting concluded by passing a cordial vote of thanks to the Chairman.

EXAMINATIONS, 1860.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.*

PRIZES.

Arithmetic ...	1st Prize ...	£5	To No. 472—William Vaughan, aged 19, Sussex Hall Evening Classes—Clerk
	2nd Prize...	3	,, 531—Michael Shillito, aged 17, Leeds Young Men's Christian Institute—Mechanic
Book-keeping	1st Prize ...	5	,, 333—Francis Joseph Thomas Moore, aged 25, London Mechanics' Institution—Book-keeper
	2nd Prize...	3	,, 491—Robert Pearce, aged 20, Ipswich Mechanics' Institution—Accountant's Clerk
Algebra	1st Prize ..	5	,, 523—Thomas Hick, aged 19, Leeds Young Men's Christian Institute—Teacher
	2nd Prize ..	3	,, 378—Joseph William Mills, aged 17, Watt Institute, Portsea
Geometry ...	1st Prize ...	5	,, 557—Walter Robinson, aged 22, Leeds Young Men's Christian Institute—Mechanic
	2nd Prize ..	3	,, 656—Charles Herbert Ellerby, aged 18, Manchester Mechanics' Institution—Mechanical Draughtsman
Mensuration ..	...		*No Prizes awarded* ‡
Trigonometry	...		*No Prizes awarded.*‡
Conic Sections	1st Prize ...	5	,, 325—Hugh Battle, aged 39, Leicester Church of England Institute—Missionary
			No Second Prize Awarded.†
Navigation & Nautical Astronomy.....	...		*No Prizes Awarded.*‡

* The Prizes awarded to Institutions and Local Boards will be announced in a future number.
† The Candidate standing Second in this Subject did not obtain a First-class Certificate.
‡ No Candidate obtained a First-class Certificate in this Subject.

Principles of Mechanics ...	...		*No Prizes Awarded.*‡
Practical Mechanics	...		*No Prizes Awarded.*‡
Electricity, Magnetism, and Heat ...	1st Prize ...	5	,, 183—Archibald Simon Lang Macdonald, aged 20, Glasgow Mechanics' Institution—Mercantile Clerk
	2nd Prize ..	3	,, 328—William Scott, aged 26, London Mechanics' Institution—Inland Revenue
Astronomy ...	...		*No Prizes Awarded.*‡
Chemistry ...	1st Prize ...	5	,, 328—Wm. Scott, aged 26, London Mechanics' Institution—Inland Revenue
	2nd Prize ..	3	,, 443—William Croudson Barnish, aged 20, Wigan Mechanics' Institution—Clerk
Animal Physiology	...		*No Prizes Awarded.*‡
Botany	1st Prize ...	5	,, 185—Alexander McKinlay, aged 19, Glasgow Mechanics' Institution—Solicitor's Clerk
	2nd Prize ..	3	,, 143—John Gibbs, aged 37, Chelmsford Literary and Mechanics' Institution—Woolsorter
Political and Social Economy	...		*No Prizes Awarded.*‡
Geography ...	1st Prize ...	5	,, 357—John Dix Suggett, aged 17, Lynn Athenæum—Banker's Clerk
	2nd Prize ..	3	,, 454—Charles Walker, aged 18, York Institute—Telegraph Clerk
English History	1st Prize ...	5	,, 240—Robert Clark, aged 22, Glasgow Athenæum—Clerk
	2nd Prize ..	3	,, 115—Joseph Seed Roberts, aged 19, Bradford Mechanics' Institution—Cabinet-maker
English Literature	1st Prize ...	5	,, 68—Henry Simpson, aged 19, Birmingham and Midland Institute—Clerk
	2nd Prize ..	3	,, 73—Howard Shakespeare Pearson, aged 21, Birmingham and Midland Institute—Stationer
Logic	1st Prize ...	5	,, 408—Frederic Reeves, aged 19, Messrs. Chances' Library—Glass-cutter
	2nd Prize ..	3	,, 414—David Bailey, aged 25, Bilston Institution—Schoolmaster
Latin and Roman History.	1st Prize ...	5	,, 627—John Naismith Russell, aged 24, Glasgow Mechanics' Institution—Assistant teacher
	2nd Prize ..	3	,, 139—Charles Steer, aged 29, Croydon Literary Institute—Printer
French.....	1st Prize ...	5	,, 201—Abraham Shekelton, aged 33, Glasgow Mechanics' Institution—Book-keeper
	2nd Prize ..	3	,, 164—Andrew Farm, aged 29, Glasgow Mechanics' Institution—Pattern-drawer
German	1st Prize ...	5	,, 465—Walter Robert Clark, aged 20, Sussex Hall Evening Classes—Clerk
			No Second Prize Awarded.†
Music	1st Prize ...	5	,, 607—William Hugh Smith, aged 24, Glasgow Mechanics' Institution—Clerk
	2nd Prize ..	3	,, 429—John Walter Asquith, aged 31, Wakefield Mechanics' Institution—Teacher

‡ No Candidate obtained a First-class Certificate in this Subject.
† The Candidate standing Second in this Subject did not obtain a First-class Certificate.

CERTIFICATES.

The following is an Alphabetical List of the Candidates who have obtained Certificates :—

(1st) after a subject signifies a First-class Certificate.
(2nd) ,, ,, Second-class ,,
(3rd) ,, ,, Third-class ,,

(The occupations stated are either present or proposed.)

No.
636—Adams, John Henry, aged 18, Pembroke Dock M.I., Shipwright's Apprentice—Arithmetic (3d)
150—Allan, Michael, jun., aged 25, Glasgow M.I., Warehouseman—French (3rd)
151—Allan, Robert, aged 29, Glasgow M.I., Book-keeper—English Literature (3rd); Logic (3rd)
645—Allen, Edward, aged 28, Manchester M.I., Silkweaver—Arithmetic (3rd); Book-keeping (3rd)
235—Allison, David, aged 23, Glasgow Athenæum, Clerk—Book-keeping (3rd)
153—Anderson, James, aged 22, Glasgow M.I., Clerk—Algebra (2nd); Trigonometry (3rd)
581—Anderson, James, aged 38, People's College, Sheffield, Bootmaker—English History (2nd); Geography (2nd)
6—Anderson, William, aged 22, Aberdeen M.I., Bookseller—Arithmetic (3rd)
524—Andrew, John James, aged 17, Leeds Young Men's Christian I., Clerk—Book-keeping (2nd)
71—Aris, Robert Hamilton, aged 19, Birmingham and Midland I., Clerk—Arithmetic (2nd)
398—Armstrong, Matthew Watson, aged 19, Skipton M.I., Cabinetmaker—Arithmetic (3rd)
429—Asquith, John Walter, aged 31, Wakefield M.I., Teacher—Music (1st) with 2nd Prize
300—Atkinson, Henry, aged 22, Leeds M.I., Draper—Arithmetic (3rd)
331—Aumonier, Frederic, aged 22, London M.I., Salesman at Paperstainer's—Arithmetic (2nd)
390—Badger, William, aged 19, Rotherham Young Men's Christian I., Practical Engineer—Practical Mechanics (3rd)
414—Bailey, David, aged 25, Bilston Inst., Schoolmaster—Logic (1st) with 2nd Prize

459—Bailey, George, aged 16, York I., Railway Clerk—German (3rd)
385—Baker, John, aged 22, Kingston-on-Thames M.I., Carpenter—Arithmetic (2nd)
518—Balme, Henry, aged 20, Halifax W.M.Coll., Warehouseman—Arithmetic (3rd)
474—Banister, Albert, aged 17, Sussex-hall Evening Classes—English History (1st)
678—Barker, Mark, aged 20, Halifax M.I., Card Printer—Arithmetic (3rd)
327—Barlow, Thomas Kendall, aged 24, Leicester Church of England I., Solicitor's Clerk—Arithmetic (1st); Book-keeping (2nd); Algebra (3rd)
443—Barnish, William Croudson, aged 20, Wigan M.I., Druggist—Chemistry (1st) with 2nd Prize
157—Barr, Thomas Morrison, aged 25, Glasgow M.I., Land Surveyor—Electricity, Magnetism, and Heat (3rd)
488—Barrett, Edwin, aged 23, Ipswich M.I., Bookseller—English Literature (3rd)
483—Bateman, Francis, aged 16, Canterbury Church of England Young Men's Lit. I., Apothecary—English History (1st); Geography (2nd)
325—Battle, Hugh, aged 39, Leicester Church of England I., Missionary—Conic Sections (1st) with First Prize; Trigonometry (2nd)
145—Baty, John, aged 20, Darlington M.I., Railway Clerk—Animal Physiology (2nd)
504—Bayly, John, aged 23, Devonport M.I., Shipwright—Arithmetic (1st); Algebra (3rd); Mensuration (3rd)
106—Bearder, George, aged 26, Bradford M.I., Millwright—Arithmetic (2nd)
345—Bell, Joseph Carter, aged 20, Royal Polytechnic Inst. Classes, Clerk—Chemistry (3rd)
83—Beresford, William Freeman, aged 19, Birmingham and Midland I., Teacher—English History (1st)
614—Berry, Thomas, aged 22, Glasgow M.I., Warehouseman—Logic (1st)
314—Bew, John James, aged 22, Liverpool I., Commercial Cashkeeper—Logic (3rd)
576—Biggin, Isaac, aged 22, People's College, Sheffield, Warehouseman—Arithmetic (3rd)
416—Boden, George, aged 19, Stourbridge M. I., Reporter—French (3rd)
118—Bonny, Charles, aged 23, Brompton Ch. of Eng. Young Men's Inst., Ropemaker—Arithmetic (3rd)
307—Booth, John Burnett, aged 20. Leeds M.I., Bookseller—Arithmetic (3rd)
243—Bosworth, Thomas, aged 18, Glasgow Athenæum, Clerk—Book-keeping (3rd)
108—Bottomley, Robert, aged 16, Bradford M.I., Warehouseboy—Arithmetic (2nd); Mensuration (3rd)
532—Bradbury, David Addison, aged 17, Leeds Young Men's Christian Institute, Pupil Teacher—Geography (2nd); French (3rd)
99—Bradley, Oliver, aged 19, Bradford M.I., Warehouseman—English History (2nd)
589—Bramhall, John, aged 21, People's College, Sheffield, School Assistant—Arithmetic (2nd)
583—Bramwell, John Henry, aged 18, People's College, Sheffield, File Cutter—French (3rd)
506—Brear, William, aged 16, Halifax W. M. College, Warehouseman—Arithmetic (2nd)
657—Bridge, James, aged 16, Manchester M.I.—Arithmetic (3rd)
440—Bridge, Thomas, aged 16, West Bromwich Young Men's Christian Association, Chemist and Druggist's Apprentice—Arithmetic (3rd)
156—Brodie, William, aged 17, Glasgow M.I., Colour Maker—Chemistry (2nd)
533—Brooke, Henry, aged 19, Leeds Young Men's Christian Institute, Draper—Book-keeping (3rd); French (3rd)
546—Brooks, Joseph, aged 19, Leeds Young Men's Christian Institute, Mechanic—Arithmetic (3rd)
225—Brosnahan, William, aged 21, Glasgow Athenæum, Inland Revenue Officer—English History (3rd)
261—Brown, Ben, aged 19, Holmfirth M.I., Slubber—Arithmetic (3rd)
421—Brown, James, aged 19, Wolverhampton W. M. College, Railway Clerk—Bookkeeping (3rd)
359—Brown, Jeremiah, aged 21, Athenæum, King's Lynn, Clerk—Book-keeping (3rd)
74—Brown, Herbert, aged 22, Birmingham and Midland I., Manufacturer—English Literature (2nd)
155—Brown, John, aged 16, Glasgow, M.I., Clerk—French (3rd)
336—Brown, John James, aged 28, St. Stephen's Westminster I., Assistant-Master—Arithmetic (3rd)
154—Brown, Robert, aged 18, Glasgow M.I., Clerk—Arithmetic (1st); French (3rd)
120—Browne, Henry Edward, aged 19, Brompton Church of England Young Men's I., Shipwright (Apprentice)—Algebra (2nd); Trigonometry (2nd)
5—Bruce, Andrew, aged 16, Aberdeen M.I., Clerk—Arithmetic (3rd)
540—Bryer, Richard, aged 17, Leeds Young Men's Christian I., Apprentice in Cloth Warehouse—French (3rd)
445—Bucknall, Samuel George, aged 33, Wigan M.I., Bookseller and Stationer—Book-keeping (3rd)
55—Bulloc, Alexander, aged 18, People's Reading Room, Belfast, Clerk—Book-keeping (2nd)
457—Bulmer, Richard, aged 19, York Institute—Geography (3rd)
484—Bunce, John Friend, aged 26, Canterbury Church of Eng. Young Men's L.I., Turner—Arithmetic (2nd); French (2nd)
403—Burden, William Henry, aged 16, Messrs. Chances' Library, Clerk—Arithmetic (3rd)
597—Burdett, Thomas, aged 18, Bury Athenæum, Factory Operative—Arithmetic (3rd)
353—Burgess, Robert, aged 19, Louth M.I., Ironmonger—Algebra (2nd)
554—Burnell, William, aged 17, Leeds Young Men's Christian I., Clerk—Book-keeping (1st)
426—Butler, James Henry, aged 17, Wolverhampton Working Men's College, Presser and Stamper—Algebra (3rd); Book-keeping (3rd)
670—Butterworth, Joseph, aged 16, Selby M.I., Wheelwright—Arithmetic (2nd)
127—Buttifant, John George, aged 18, Darlington M.I., Clerk—Arithmetic (3rd)
146—Byers, George Steele, aged 18, Darlington M.I., Clerk—Arithmetic (3rd)
423—Caddick, James, aged 22, Wolverhampton Working Men's College, Clerk—Arithmetic (2nd); Book-keeping (2nd); French (3rd)
131—Cameron, John, jun.—aged 20, Carlisle Church of England Lit. I., Clerk—Arithmetic (1st); French (2nd); Book-keeping (2nd)
476—Carpenter, Joseph Marshall, aged 19, Sussex Hall Evening Classes, Clerk—English Literature (1st)
251—Casebourne, Henry, aged 25, West Hartlepool L. and M.I., Mechanical Engineer—Practical Mechanics (3rd)
7—Chalmers, Andrew, aged 19, Aberdeen M.I., Warehouseman—English Literature (2nd)
615—Chalmers, Thomas, aged 20, Glasgow M.I., Clerk—Book-keeping (2nd)
342—Chandler, Henry Parry, aged 18, Royal Polytechnic Inst. Classes, Clerk—Chemistry (2nd)
67—Chapman, James, aged 36, Birmingham and Midland I., Clerk—Algebra (3rd)
46—Chedzoy, Charles William, aged 16, Barnet L. and S. I.—Arithmetic (1st)

299—Child, Wallace, aged 18, Leeds M.I., Pupil-teacher—Arithmetic (2nd); Geography (3rd)
635—Christie, Charles Augustus, aged 19, Pembroke Dock M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
240—Clark, Robert, aged 22, Glasgow Athenæum, Clerk—English History (1st), with 1st Prize
503—Clark, Robert George, aged 21, Devonport M.I., Shipwright—Arithmetic (1st); Algebra (2nd); Geometry (3rd)
465—Clark, Walter Robert, aged 20, Sussex-hall Evening Classes, Clerk—German (1st) with 1st Prize
90—Clarkson, Elizabeth, aged 20, Blackburn M.I., Teacher—Geography (3rd)
471—Clementson, Alfred Bland, aged 19, Sussex-hall Evening Classes, Wholesale Stationer—Arithmetic (1st)
515—Cockroft, Henry, aged 18, Halifax Working Men's College, Clerk—Book-keeping (3rd)
258—Conder, James, aged 20, Hitchin M.I., Land Surveyor—Book-keeping (2nd); Astronomy (2nd); English History (2nd)
295—Cook, William, aged 17, Leeds Church of England I., Pupil Teacher—Arithmetic (2nd)
31—Cooper, Arthur, aged 29, Aberdeen M.I., Labourer—Electricity, Magnetism, and Heat (3rd)
84—Coote, Thomas, aged 16, Bishop's Stortford L.I., Merchant's Clerk—Arithmetic (3rd)
399—Cornthwaite, Robert, aged 23, Skipton M.I., Book-keeper—Arithmetic (3rd); Algebra (3rd)
406—Cotterell, John, aged 16, Messrs. Chances' Library, Glass Painter—Arithmetic (3rd)
566—Cowell, Charles, aged 20, Leeds Young Men's Christian I., Compositor—English Literature (3rd)
158—Craig, John, aged 18, Glasgow M.I., Clerk—Chemistry (2nd)
160—Crawford, John, jun., aged 19, Glasgow M.I., Clerk—Chemistry (1st)
289—Crawshaw, John William, aged 17, Leeds M.I., Clerk—German (2nd)
252—Crouch, John, jun., aged 19, Hertford L. and S. I., Attorney's Clerk—Arithmetic (1st)
413—Crowther, George, aged 18, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
159—Crum, John, aged 28, Glasgow M.I., Pay Clerk—Electricity, Magnetism, and Heat (2nd)
453—Crumbie, George, aged 17, York I., Attorney's Clerk—English History (2nd)
561—Curtis, Arthur, aged 16, Leeds Young Men's Christian I.,—German (3rd)
233—Cuthbertson, William Reid, aged 17, Glasgow Athenæum, Clerk—Book-keeping (3rd)
217—Cuthill, William, aged 20, Glasgow Athenæum, Engineer—Practical Mechanics (3rd)
287—Dalby, Edward, aged 17, Leeds M.I., Mechanic—Arithmetic (2nd); Algebra (2nd); Geometry (3rd)
227—Dansken, John, aged 24, Glasgow Athenæum, Measurer—Logic (2nd)
475—Dart, Richard Henry, aged 26, Sussex-hall Evening Classes, Draper—French (3rd)
313—Davidson, Andrew, aged 21, Liverpool I., Joiner—Arithmetic (3rd)
553—Dean, Thomas, aged 18, Leeds Young Men's Christian Institute, Clerk—Book-keeping (2nd)
442—Dean, William, aged 22, Wigan M.I., Clerk—Arithmetic (2nd)
550—Denny, Charles Edward, aged 18, Leeds Young Men's Christian Institute, Clerk—Bookkeeping (3rd)
498—Derrick, Thomas, aged 18, Bristol Young Men's Christian Institute, Clerk—Arithmetic (2nd); Geography (2nd)
114—Dibb, Charles Henry, aged 16, Bradford M.I., Wool sorter—Geography (2nd)
163—Dickson, James, aged 21, Glasgow M.I., Clerk—Algebra (2nd)
631—Dippy, Thomas, aged 18, Pembroke Dock M.I., Shipwright's Apprentice—Arithmetic (1st); Algebra (3rd); Geography (3rd)
8—Dow, James, aged 20, Aberdeen M.I., Engineer—English Literature (3rd)
1—Dow, Thomas, aged 18, Aberdeen M.I., Blacksmith—English Literature (2nd)
584—Dufty, Joseph, aged 17, People's College, Sheffield, Confectioner—French (3rd)
162—Dunn, William, aged 17, Glasgow M.I., Book-keeper—Arithmetic (1st)
123—Edgar, James, aged 17, Carlisle Church of Eng. I., Attorney's Clerk—Arithmetic (3rd); Book-keeping (3rd)
79—Edmonds, George, aged 18, Birmingham and Midland I., Clerk—English Literature (2nd)
315—Edmonds, Timothy Evan, aged 18, Liverpool I., Lithographer—Geometry (2nd)
656—Ellerby, Charles Herbert, aged 18, Manchester M.I., Mechanical Draughtsman—Geometry (1st) with 2nd Prize; Practical Mechanics (2nd)
405—England, George, aged 17, Messrs. Chances' Library, Birmingham, Chemist and Druggist—English History (3rd)
667—Entwistle, James, aged 18, Manchester M.I., Clerk—Arithmetic (3rd)
316—Evans, Rowland, aged 17, Liverpool I., Clerk—Political and Social Economy (3rd)
246—Ewart, William Routledge, aged 26, Stockton-on-Tees M.I., Draper's Assistant—Arithmetic (2nd); Book-keeping (3rd)
164—Farm, Andrew, aged 29, Glasgow M.I., Pattern Drawer—French (1st) with 2nd Prize
419—Farnworth, William, aged 33, Wolverhampton Working Man's College, Shingler—Arithmetic (3rd)
556—Farquhar, George, aged 23, Leeds Young Men's Christian I., Clerk—Geography (2nd)
626—Fimister, John, aged 24, Glasgow M.I., Stone Mason—Arithmetic (3rd)
17—Finlayson, Alexander, aged 18, Aberdeen M.I., Writer—English History (2nd)
243—Finn, Edward Cornelius, aged 19, S.E. Railway M.I., Railway Clerk—Arithmetic (2nd)
361—Firth, Caroline, aged 19, Macclesfield Useful Knowledge I.,—French (3rd)
464—Fisher, Benjamin, aged 17, Sussex-hall Evening Classes, Clerk—Arithmetic (2nd); Book-keeping (3rd)
51—Forsyth, Joseph, aged 30, People's Reading Rooms, Belfast, Assistant Draper—Astronomy (2nd)
599—Furness, John Thomas, aged 20, Bury Athenæum, Hatter—Arithmetic (2nd)
44—Garaway, Francis, aged 24, South Eastern Railway M.I., Schoolmaster (certificated)—Arithmetic (1st); Algebra (3rd); Chemistry (2nd); Geography (2nd)
231—Garner, George James, aged 18, Glasgow Athenæum, Clerk—Arithmetic (3rd); English Literature (3rd)
228—Gatheral, George, aged 20, Glasgow Athenæum, Warehouseman—French (2nd)
569—Gaunt, John, aged 23, People's College, Sheffield, File-cutter—Arithmetic (3rd)
412—Genner, Job, aged 20, Messrs. Chances' Library, Birmingham, Clerk—Book-keeping (3rd)
165—Gibb, Thomas, aged 20, Glasgow M.I., Mining Engineer—Arithmetic (1st); Algebra (2nd); Geometry (2nd)
143—Gibbs, John, aged 37, Chelmsford L. and M.I., Woolsorter—English History (1st); Botany (1st) with 2nd Prize
467—Gillingham, Alfred George, aged 26, Sussex Hall Evening Classes, Clerk—Book-keeping (1st)
326—Godfrey, Isaac, aged 18, Leicester Church of England I., Hosier—Arithmetic (2nd); Mensuration (3rd)
208—Govan, John, aged 16, Glasgow Athenæum, Clerk—French (2nd)
168—Govan, William Johnson, aged 17, Glasgow M.I., Clerk—French (2nd)
647—Gowan, James, aged 22, Manchester M.I., Clerk—Book-keeping (3rd)

297—Goyne, John, aged 25, Holbeck M.I., Teacher—Algebra (3rd); Geometry (3rd)
133—Graham, George, aged 25, Carlisle Church of England I., Grocer's Assistant—Arithmetic (3rd)
101—Greenhough, John Gershom, aged 17, Bradford M.I., Warehouseboy—English History (1st); Geography (1st)
166—Gregory, Jane Legendre, aged 26, Glasgow M.I., Governess—French (1st)
486—Greenstreet, Stephen Henry, aged 17, Canterbury Church of England Young Men's L.I., Pupil Teacher—Geography (2nd)
291—Greenwood, John William, aged 18, Leeds M.I., Pupil Teacher—Arithmetic (1st); Algebra (2nd); Geography (1st)
263—Greenwood, Pickles, aged 21, Ingrow cum Hainworth Young Men's Christian Improvement Society, Mechanic—Arithmetic (3rd)
514—Greenwood, Samuel, aged 20, Halifax Working Men's College, Card Writer—Book-keeping (3rd)
662—Gresty, Jonathan, aged 23, Manchester M.I., Warehouseman—Arithmetic (3rd); Book-keeping (3rd)
121—Griffith, John Joseph, aged 21, Brompton Church of England Young Men's I., Caulker—Arithmetic (2nd) Algebra (3rd)
65—Griffiths, Edwin, aged 35, Birmingham and Midland I., Dispensing Chemist—Chemistry (1st)
319—Griffiths, James, aged 19, Liverpool I., Teacher—Logic (3rd)
417—Griffiths, William, aged 20, Stourbridge M.I., Carpenter—Arithmetic (2nd); Algebra (3rd)
632—Griffiths, Henry, aged 18, Pembroke Dock M.I., Shipwright—Arithmetic (2nd); Algebra (3rd)
57—Hagan, Charles Henry, aged 17, People's Reading Room, Belfast, Engineer—Arithmetic (3rd)
562—Haigh, William Henry, aged 17, Leeds Young Men's Christian I., Cloth Finisher—German (3rd)
617—Hamilton, David, aged 16, Glasgow M.I., Pupil Teacher—Logic (2nd)
124—Hamilton, George, aged 19, Carlisle Church of England I., Tobacco Pipe Maker—Arithmetic (2nd); Geometry (2nd); Algebra (3rd)
609—Hamilton, James, aged 22, Glasgow M.I.—Latin and Roman History (1st)
460—Harding, James Staughton, aged 20, Evening Classes, Sussex-hall, Clerk—Arithmetic (2nd); French (2nd)
383—Hardwick, Joseph, aged 19, Kingston-on-Thames M.I., Bricklayer and Plasterer—Arithmetic (3rd)
218—Hargrave, Joseph James, aged 19, Glasgow Athenæum, Civil Engineer—Arithmetic (1st); Algebra (3rd)
216—Harper, James, aged 18, Glasgow Athenæum, Clerk—Latin and Roman History (2nd)
420—Harrington, Walter, aged 16, Wolverhampton Working Men's College—Arithmetic (3rd); Algebra (3rd)
232—Harris, James Reed, aged 22, Glasgow Athenæum, Ironmonger—Arithmetic (2nd); Book-keeping (3rd)
110—Harrison, Joseph, aged 18, Bradford M.I., Woolsorter—Astronomy (2nd); English Literature (2nd)
103—Harrison, William, aged 21, Bradford M.I., Compositor—Geography (2nd); English Literature (2nd)
573—Harrop, Alfred, aged 34, People's College, Sheffield, Bellows Manufacturer—Political and Social Economy (3rd)
66—Hart, Joseph, aged 33, Birmingham and Midland I., Dyer—Chemistry (3rd)
665—Hartley, Lewis, aged 19, Manchester M.I., Warehouseman—Political and Social Economy (2nd)
681—Hartley, Thomas, aged 18, Halifax M.I., Warehouseman—Book-keeping (3rd)
542—Hartley, William, aged 18, Leeds Young Men's Christian I., Clerk—Political and Social Economy (3rd); Logic (3rd)
463—Harvey, Joseph, aged 24, Evening Classes, Sussex-hall, Stationer—German (3rd)
571—Hasler, John, aged 27, People's College, Sheffield, Plane-maker—German (2nd)
377—Haves, John William, aged 17, Watt I., Portsea, Engineer Apprentice—Mensuration (2nd); Algebra (2nd); Trigonometry (3rd)
109—Hayward, Thomas, aged 19, Bradford M.I., Clerk—English History (1st)
558—Headland, Thomas, Jun., aged 17, Leeds Young Men's Christian Institute, Tailor and Draper—Arithmetic (3rd)
170—Henderson, Robert, aged 17, Glasgow M.I., Clerk to Commission Merchant—Arithmetic (1st)
172—Hennedy, David, aged 20, Glasgow M.I., Warehouseman—Music (3rd)
171—Hennedy, William, aged 22, Glasgow M.I., Manufacturer—Electricity, Magnetism, and Heat (3rd)
529—Heseldin, Francis Green, aged 16, Leeds Young Men's Christian I., Printer's Apprentice—Book-keeping (2nd)
523—Hick, Thomas, aged 19, Leeds Young Men's Christian I., Teacher—Algebra (1st) with 1st Prize; Geometry, (1st); Trigonometry (2nd); Conic Sections (2nd)
516—Highley, Matthew, aged 18, Halifax Working Men's College, Warehouseman—Book-keeping (3rd)
323—Highton, John, aged 17, Leicester Church of England I., School Assistant—Book-keeping (3rd); Geography (2nd); English History (3rd)
591—Hill, Charles, aged 21, People's College, Sheffield, Engraver's Tool Maker—Geography (3rd)
173—Hill, David, aged 16, Glasgow M.I., Clerk—Chemistry (1st)
519—Hill, Rowland, aged 19, Halifax Working Men's College, Woolstapler—Chemistry (3rd)
574—Hill, Thomas Vardy, aged 22, People's College, Sheffield, Clerk—Arithmetic (2nd)
253—Hills, Henry George, aged 17, Hertford L. and S.I., Printer—Arithmetic (1st)
340—Hind, Francis Henry Philip, aged 18, Royal Polytechnic, Banker's Clerk—Chemistry (2nd)
147—Hobson, William, aged 31, Darlington M.I., Railway Clerk—Animal Physiology (2nd)
85—Hodgson, James, aged 18, Blackburn M.I., Plasterer—Algebra (3rd)
81—Holdsworth, Matthew Henry, aged 19, Birmingham and Midland I., Mechanical Engineer—Arithmetic (2nd)
601—Holloway, William, aged 35, London M.I., Schoolmaster—English History (1st)
245—Holmes, John Emra, aged 20, West Hartlepool L. and M.I., Clerk H.M. Customs—English History (3rd)
649—Holmes, Peter, aged 16, Manchester M.I., Junior Clerk—Book-keeping (2nd)
209—Holmes, Robert Anderson, aged 17, Glasgow Athenæum, Clerk—English History (3rd)
38—Hood, James Wallace, aged 29, S. E. Railway M.I., Engine Fitter—Arithmetic (2nd); Book-keeping (3rd)
301—Hopwood, Herbert Jackson, aged 19, Leeds M.I., Clerk—Arithmetic (2nd)
473—Hoskins, Henry, aged 22, Sussex-hall Evening Classes, Clerk—Algebra (2nd)
169—Hunter, John, aged 23, Glasgow M.I., Clerk—Book-keeping (2nd)
229—Hunter, John, aged 19, Glasgow Athenæum, Warehouseman—English Literature (2nd)
219—Hutton, James, aged 20, Glasgow Athenæum, Accountant—English History (3rd)
580—Hutchinson, William Thomas, aged 30, People's College, Sheffield, Butcher—English History (1st)
673—Israel, Henry Ash, aged 19, Sussex-hall Evening Classes, Meat Salesman—Arithmetic (2nd)
341—Israel, Louis Ash, aged 21, Royal Polytechnic Inst. Classes, Commission Salesman—Chemistry (2nd)
148—Jackson, Henry, aged 26, Darlington Church of England I., Clerk—Arithmetic (1st); Algebra (3rd)

222—Jackson, John, aged 19, Glasgow Athenæum, Clerk—English History (1st)
444—Jackson, John, aged 19, Wigan M.I., Dispenser—Chemistry (3rd)
452—Jackson, Thomas, aged 20, York I., Attorney's Clerk—Book-keeping (3rd)
651—Jacob, Edward Westley, aged 20, Manchester M.I., Engineer—Arithmetic (2nd); Algebra (2nd); Chemistry (3rd); Principles of Mechanics (3rd)
259—Jeeves, Alfred, aged 24, Hitchin M.I., Solicitor's Clerk—Arithmetic (2nd); Book-keeping (2nd)
292—Jenkinson, Henry Irwin, aged 21, Leeds M.I., Clerk—Algebra (3rd)
634—Johns, Thomas Bowen, aged 20, Pembroke Dock M.I., Shipwright—Astronomy (2nd)
98—Johnson, Thomas, aged 21, Bradford M.I., Grocer's Assistant—Book-keeping (3rd)
100—Johnson, William, aged 21, Bradford M.I., Clerk—Arithmetic (1st); German (2nd); Algebra (3rd)
136—Johnston, Thomas B., aged 23, Carlisle Church of England Institute, Clerk—Arithmetic (3rd); Book-keeping (3rd)
330—Joseph, Isaac, aged 19, London M.I., Clerk—Arithmetic (1st); Book-keeping (2nd); Algebra (3rd)
102—Jowett, William Henry, aged 22, Bradford M.I., Letter-press Printer—English History (2nd)
397—Joy, Thomas Augustus, aged 19, Skipton M.I., Grocer—Arithmetic (3rd)
348—Keeble, Francis Henry, aged 20, Royal Polytechnic Inst. Classes, Cabinet Maker—Electricity, Magnetism, and Heat (2nd)
93—Kenyon, Thomas, aged 18, Blackburn M.I., Warehouseman—Arithmetic (3rd); Mensuration (3rd)
294—Kettlewell, John, aged 19, Leeds Church of England Institute, Pupil Teacher—Arithmetic (3rd); Geography (3rd)
72—Kidson, Samuel, aged 31, Birmingham and Midland I., Warehouseman—Botany (3rd)
62—King, John, aged 17, Berkhampstead M.I., Railway Clerk—English History (2nd)
620—Kinloch, David, aged 18, Glasgow M.I., Clerk—Book-keeping (2nd)
269—Knapton, William, aged 32, Leeds M.I., Mason—English History (2nd); German (3rd)
363—Kniveton, Charles, aged 21, Macclesfield Useful Knowledge Institution, Power-loom Weaver—Arithmetic (2nd)
175—Laidlaw, Robert, aged 18, Glasgow M.I., Clerk—Electricity, Magnetism, and Heat (3rd)
241—Laidlaw, Samuel, aged 20, Glasgow Athenæum, Clerk—English History (1st)
525—Lawrence, George Henry, aged 18, Leeds Young Men's Christian Institute, Clerk—Arithmetic (2nd); Book-keeping (2nd)
226—Lawson, John Yeaman, aged 22, Glasgow Athenæum, Draper—Arithmetic (2nd)
612—Leask, Thomas, aged 20, Glasgow M.I., Book-keeper—Book-keeping (3rd)
27—Ledingham, Alexander William, aged 29, Aberdeen M.I., Clerk—Chemistry (2nd)
389—Leonard, Edward, aged 16, Rotherham Young Men's Christian I., Pupil Teacher—Arithmetic (3rd); Geography (3rd)
674—Leslie, George Charles, aged 18, Sussex Hall Evening Classes, Clerk—Arithmetic (1st); Geography (3rd)
174—Lightbody, John, aged 21, Glasgow M.I., Clerk—Book-keeping (2nd); French (3rd)
425—Lilley, John, aged 19, Wolverhampton Working Men's College, Grocer—Arithmetic (3rd); Book-keeping (3rd)
132—Lindsley, William, aged 16, Carlisle Church of England I., Clerk—Arithmetic (2nd)
117—Lines, Francis, aged 17, Brompton Church of England Young Men's I., Shipwright Apprentice—Arithmetic (1st); Algebra (3rd)
221—Linn, William Campbell, aged 19, Glasgow Athenæum, Upholstery Trimming Manufacturer—Arithmetic (1st); Algebra (2nd); English Literature (1st)
644—Little, Charles, aged 18, Manchester M.I., Agent—Arithmetic (3rd)
427—Logan, Henry, aged 19, Wakefield M.I., Iron Moulder—Arithmetic (2nd)
76—Lucas, William, aged 33, Birmingham and Midland I., Clerk—Chemistry (2nd)
368—Lyall, William, aged 26, Newcastle-on-Tyne Church of England I., Letter-press Printer—Arithmetic (3rd)
183—Macdonald, Archibald Simon Lang, aged 20, Glasgow M.I., Mercantile Clerk—Principles of Mechanics (3rd); Practical Mechanics (2nd); Electricity, Magnetism, and Heat (1st) with 1st Prize
213—Macfadyen, James Ritchie, aged 17, Glasgow Athenæum, Merchant (proposed)—Arithmetic (1st); Book-keeping (3rd); French (3rd)
606—Macfarlane, David, aged 21, Glasgow, M.I., Clerk—Political and Social Economy (2nd)
180—MacGibbon, John Anderson, aged 17, Glasgow M.I., Architect's Apprentice (1st)
248—Mackenzie, John James, aged 19, West Hartlepool, L. & M.I., Clerk—English History (3rd); Geography (2nd)
30—MacKillican, John, aged 27, Aberdeen M.I., Watchmaker—Algebra (3rd)
622—Main, John, aged 18, Glasgow M.I., Clerk—Arithmetic (3rd)
179—Mann, James, aged 18, Glasgow M.I., Clerk—French (1st)
375—Marcus, John Augustus Henry, aged 19, Watt Inst., Portsea, Pattern-maker—Arithmetic (3rd)
446—Marsden, William James, aged 33, Wigan M.I., Book-keeper—Book-keeping (2nd)
633—Marshall, James, aged 28, Pembroke Dock M.I., Soldier—Arithmetic (2nd); Mensuration (3rd); Algebra, (3rd)
178—Martin, Daniel Gay, aged 24, Glasgow M.I., Clerk—French (2nd)
629—Mason, George, aged 19, Pembroke Dock M.I., Shipwrights' Apprentice—Arithmetic (3rd); Geometry (3rd)
302—May, Thomas, aged 31, Leeds M.I., Mechanic—Algebra (3rd); Geometry (2nd); Trigonometry (3rd)
351—McAlister, Samuel, aged 20, Louth M.I., Clerk in Civil Service—Algebra (3rd); Geometry (2nd)
237—McCondach, Kenneth, aged 22, Glasgow Athenæum, Book-keeper—Arithmetic (1st); English Literature (2nd); Logic (2nd)
530—McCully, Richard, aged 29, Leeds Young Men's Christian Institute, Clerk—French (1st); Latin and Roman History (3rd)
186—McDougall, John, aged 26, Glasgow M.I., Mercantile Clerk—Book-keeping (2nd)
182—McKechnie, William, aged 20, Glasgow M.I., Colour Maker—Chemistry (1st)
181—McKellar, David, aged 18, Glasgow M.I., Ship Draughtsman—Arithmetic (3rd)
185—McKinlay, Alexander, aged 19, Glasgow M.I., Solicitor's Clerk—Botany (1st) with 1st Prize
628—McMillan, Andrew, aged 17, Glasgow M.I., Ironmonger—Book-keeping (1st)
184—McPherson, Daniel, aged 23, Glasgow M.I., Clerk—French (3rd)
536—Meek, William Todd, aged 17, Leeds Young Men's Christian I., Cloth Finisher—Arithmetic (3rd)

23—Middleton, William, aged 27, Aberdeen M.I., Law Clerk—Arithmetic (2nd); Book-keeping (2nd)
111—Midgeley, John Whitworth, aged 32, Bradford M.I., House-agent—German (2nd); Book-keeping (2nd)
322—Miles, Alfred Ball, aged 20, Leicester Church of England I., Solicitor's Clerk—Book-keeping (1st)
176—Millen, Thomas Wilson, aged 21, Glasgow M.I., Book-keeper—Book-keeping (1st); Botany (3rd)
47—Miller, George William Neville, aged 30, Barnet I., Carpenter—Arithmetic (3rd)
378—Mills, Joseph William, aged 17, Watt I., Portsea—Algebra (1st) with 2nd Prize; Arithmetic (2nd); Navigation and Nautical Astronomy (2nd)
238—Mitchell, William, aged 24, Glasgow Athenæum, Pattern-maker—French (3rd)
333—Moore, Francis Joseph Thomas, aged 25, London M.I., Book-keeper—Book-keeping (1st) with 1st Prize
671—Moorshead, John Bayley, aged 19, Sussex-hall Evening Classes, Clerk—Arithmetic (1st)
672—Moorshead, William N. B., aged 16, Sussex-hall Evening Classes, Clerk—Arithmetic (2nd)
177—Morrison, Alexander, aged 20, Glasgow M.I., Book-keeper—Book-keeping (2nd)
97—Mort, Spencer, aged 20, Bradford M.I., Mechanic—Arithmetic (3rd)
603—Moses, Christopher, aged 29, Middlesbro' M.I., Brick and Tile Maker—Book-keeping (2nd)
528—Moss, Henry, aged 20, Leeds Young Men's Christian I., Stuff Salesman—Logic (3rd)
407—Mulcaster, George, aged 19, Messrs. Chance's Library, Glass Packer—Arithmetic (3rd)
210—Munro, John, aged 16, Glasgow Athenæum, Junior Clerk—English History (3rd)
355—Munson, Robert, aged 17, Athenæum, King's Lynn, Clerk—Book-keeping (3rd)
134—Murphy, Nicholas Bowman, aged 29, Carlisle Church of England Inst., Hairdresser—Latin and Roman History (2nd)
477—Nash, Robert George, aged 40, Sussex Hall Evening Classes; Clerk—Latin and Roman History (3rd)
534—Naylor, Edwin Rattenbury, aged 20, Leeds Young Men's Christian Institute, Clerk—Arithmetic (3rd); Book-keeping (3rd)
312—Neilson, George H., aged 26, Liverpool I., Letter Carrier—Arithmetic (2nd)
621—Nelson, Andrew, aged 18, Glasgow M.I., Draper—Arithmetic (3rd)
371—Norcross, John Jackson, aged 19, Oldham Lyceum, Piecer—French (3rd)
329—Norris, George M., aged 18, London M.I., Clerk—Arithmetic (2nd)
63—Norton, Philip, aged 19, Birmingham and Midland I., Sack Dealer—English Literature (2nd)
107—Nuttall, John, aged 19, Bradford M.I., Warehouseman—Algebra (2nd); Geometry (3rd)
39—Oliver, William, aged 23, S. E. Railway M.I., Railway Clerk—Arithmetic (2nd); Book-keeping (1st)
54—Parker, Alexander, aged 20, People's Reading Rooms, Belfast, Assistant in Warehouse—Book-keeping (3rd)
33—Parkin, Benjamin, aged 18, Ashbourne W. M. I., Organist—Music (2nd)
230—Parnie, James, aged 22, Glasgow Athenæum, Clerk—English Literature (2nd); Logic (2nd)
439—Partridge, Thomas, aged 16, West Bromwich Young Men's Christian Association, Brassfounder—Arithmetic (3rd)
494—Paterson, Hugh Wishart, aged 23, Glasgow Athenæum, Clerk—Book-keeping (3rd)
664—Patterson, James, aged 20, Manchester M.I., Assistant in Deaf and Dumb School—Arithmetic (3rd)
189—Paul, George Muir, aged 22, Glasgow M.I., Designer—French (2nd)
663—Payne, George, aged 21, Manchester M.I., Book-keeper—Book-keeping (3rd)
96—Payne, James, jun., aged 22, Blandford Institution, Attorney's Clerk—Arithmetic (1st); Geometry (3rd)
306—Payton, Joseph, aged 18, Leeds M.I., Clerk—Book-keeping (2nd); Algebra (3rd)
491—Pearce, Robert, aged 20, Ipswich M.I., Accountant's Clerk—Book-keeping (1st) with 2nd Prize
73—Pearson, Howard Shakespeare, aged 21, Birmingham and Midland I., Stationer—English Literature (1st) with 2nd Prize
257—Penn, William, aged 21, Hitchin M.I., Teacher—Arithmetic (2nd); Book-keeping (2nd); Geography (2nd); French (3rd)
436—Phelan, Edmond, aged 17, Waterford M.I., Accountant—Arithmetic (1st)
338—Phillips, John Foster, aged 20, St. Stephen's Westminster I., Compositor—Arithmetic (3rd)
526—Pickard, John Wood, aged 25, Leed's Young Men's Christian I., Cashier—Arithmetic (1st)
679—Pilling, Benjamin, aged 20, Halifax M.I., Tailor—Arithmetic (3rd)
544—Platt, James, aged 19, Leeds Young Men's Christian I., Clerk—Book-keeping (3rd)
441—Platt, James, aged 22, Wigan M.I., Attorney's Clerk—Arithmetic (3rd)
190—Potter, Lucy, aged 16, Glasgow M.I., Pupil Teacher—French (3rd)
344—Powers, Edward, aged 22, Royal Polytechnic Inst. Classes, Chemist and Druggist—Chemistry (1st)
431—Power, John, aged 16, Waterford M.I., Clerk—Arithmetic (2nd)
191—Prosser, Oswald, aged 19, Glasgow M.I., Law Clerk—Chemistry (2nd)
239—Purves, David Laing, aged 22, Glasgow Athenæum, Clerk—English History (1st)
195—Rae, Andrew Neill, aged 23, Glasgow M.I., Book-keeper—Botany (2nd)
660—Ratcliffe, Henry, aged 16, Manchester M.I.—Arithmetic (2nd); Geometry (3rd); Algebra (3rd)
335—Ravenscroft, Frances, aged 30, London M. I., Clerk—Arithmetic (3rd)
116—Redman, Edward, aged 23, Brompton Church of England Young Men's I., Shipwright—Arithmetic (2nd); Algebra (3rd)
505—Reed, Charles Frederick, aged 20, Devonport M.I., Bootmaker—Arithmetic (3rd)
244—Reed, John, jun., aged 25, West Hartlepool L. and M.I., Clerk—Book-keeping (3rd)
408—Reeves, Frederick, aged 19, Messrs. Chances' Library, Birmingham, Glass Cutter—Logic (1st) with 1st Prize
610—Reid, William, aged 17, Glasgow M.I., Joiner—Book-keeping (3rd)
308—Richardson, George Frederick, aged 17, Leeds M.I., Telegraph Clerk—Arithmetic (2nd)
192—Riley, Alexander, aged 20, Glasgow M.I., Mercantile Clerk—Book-keeping (3rd)
197—Rintoul, Robert, aged 21, Glasgow M.I., Clerk—French (2nd)
104—Rishworth, William, aged 19, Bradford M.I., Woolsorter—Arithmetic (3rd)
64—Robbins, Thomas, aged 20, Birmingham and Midland I., Clerk—Geography (2nd)
115—Roberts, Joseph Seed, aged 19, Bradford M.I., Cabinetmaker—English History (1st) with 2nd Prize; Book-keeping (3rd)
260—Roberts, William, aged 27, Holmfirth M.I., Woollen Cloth Weaver—Arithmetic (2nd); Music (2nd)
77—Robertson, John, aged 33, Birmingham and Midland I., Teacher—Chemistry (1st)
625—Robertson, William, aged 27, Glasgow M.I., Warper—Book-keeping (3rd)

552—Robinson, Charles, aged 23, Leeds Young Men's Christian I., Warehouseman—English History (1st); English Literature (2nd)
404—Robinson, James, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
557—Robinson, Walter, aged 22, Leeds Young Men's Christian I., Mechanic—Geometry (1st) with 1st Prize
352—Roney, John, aged 18, Louth M.I., Attorney's Clerk—English History (3rd)
485—Roots, William, aged 26, Canterbury Church of England L.I., Forage Contractor—English History (3rd)
646—Rowland, Robert, aged 23, Manchester M.I., Warehouseman—Arithmetic (3rd).
347—Rudler, Frederick William, aged 19, Royal Polytechnic Inst. Classes, Solicitor's Clerk—Principles of Mechanics (3rd)
223—Runciman, William Aitcheson, aged 19, Glasgow Athenæum, Clerk—German (2nd).
334—Rundell, Joseph Benjamin, aged 26, London M.I., Clerk, Conic Sections (2nd).
198—Russell, George, aged 20, Glasgow M.I., Mechanical Engineer—Practical Mechanics (2nd).
214—Russell, John Lindsay, aged 18, Glasgow Athenæum, Book-keeper—Book-keeping (3rd).
627—Russell, John Naismith, aged 24, Glasgow M.I., Assistant Reader—Latin and Roman History (1st), with 1st Prize.
45—Samuels, Thomas, aged 24, Barnet I., Clerk, Chancery Registrar's Office—Arithmetic (2nd).
605—Sanders, Albert John, aged 20, Newbury I., Chemist's Assistant—Arithmetic (2nd); Chemistry (3rd).
428—Sanderson, John, aged 22, Wakefield M.I., Labourer—Arithmetic (3rd).
593—Savage, George, aged 21, Clerkenwell Working Man's I., Brass Finisher—Arithmetic (3rd).
138—Scott, James, aged 20, Carlisle Church of England I., Clerk—Book-keeping (3rd).
543—Scott, Thomas John, aged 18, Leeds Young Men's Christian I., Clerk—Arithmetic (2nd); Algebra (3rd).
328—Scott, William, aged 26, London M.I., Inland Revenue—Chemistry (1st), with 1st prize; Electricity, Magnetism, and Heat (1st), with 2nd prize.
387—Scrimgeour, Daniel, aged 20, Kingston-on-Thames M.I., Clerk—Geometry (1st); Algebra (2nd); Trigonometry (2nd); Conic Sections (3rd).
3—Shanks, William Henderson, aged 21, Aberdeen M.I., Clerk—Book-keeping (2nd)
501—Shapland, Catherine Elizabeth, aged 22, Bristol Athenæum—German (2nd)
203—Shaw, Alexander, aged 21, Glasgow M.I., Clerk—French (1st)
356—Shaw, Samuel William, aged 19, Athenæum, King's Lynn, Clerk—French (3rd); German (2nd)
447—Shaw, Thomas, aged 21, Wigan M.I., Banker's Clerk—Book-keeping (2nd)
479—Shaw, Walter Henry, aged 18, Sussex-hall Evening Classes, Clerk—English History (3rd)
201—Shekelton, Abraham, aged 33, Glasgow M.I., Book-keeper—Book-keeping (2nd); French (1st) with 1st Prize
286—Sherwin, Hugh, aged 30, Leeds M.I., Clerk—Book-keeping (2nd)
531—Shillito, Michael, aged 17, Leeds Young Men's Christian I., Mechanic—Arithmetic (1st) with 2nd Prize; Geometry (1st)
388—Shillitoe, Wilson, aged 17, Rotherham Young Men's Christian I., Pupil Teacher—English History (3rd)
40—Shingleton, William Henry, aged 29, S.E. Railway M.I., Railway Clerk, Book-keeping (3rd)
332—Shinn, Thomas, aged 18, London M.I., Clerk—Chemistry (1st)
590—Shutt, Richard, aged 37, People's College, Sheffield, Saddler—Algebra (3rd); Latin and Roman History (3rd)
438—Silvester, William, aged 20, West Bromwich Young Men's Christian Association, Clerk—Arithmetic (3rd)
68—Simpson, Henry, aged 19, Birmingham and Midland Institute, Clerk—English Literature (1st) with 1st Prize
200—Simpson, William, aged 16, Glasgow M.I., Junior Clerk—Arithmetic (1st)
41—Skelton, John Henry, aged 16, S. E. Railway M.I., Railway Clerk—Arithmetic (1st)
126—Skinner, John, aged 35, Carlisle Church of England Inst., Shopman—Arithmetic (3rd)
199—Sloan, Samuel, aged 17, Glasgow, M.I.—Arithmetic (2nd); Geometry (2nd)
311—Small, John McMillan, aged 22, Liverpool I., Clerk—Arithmetic (2nd); Geography (2nd)
410—Smith, Charles, aged 16, Messrs. Chances' Library, Birmingham, Accountant—Arithmetic (3rd)
608—Smith, David, aged 19, Glasgow M.I., Mechanic—Algebra (3rd); Geometry (3rd); Trigonometry (3rd)
602—Smith, David, aged 19, Middlesbro' M.I., Engine Fitter—Arithmetic (2nd)
480—Smith, Edmond Wm., aged 35, Shaw Farm Inst., Attendant on Machinery—Arithmetic (3rd); Geography (3rd)
320—Smith, Frederick, aged 16, Liverpool I., Estate Agent—Geography (3rd); English History (3rd); English Literature (3rd)
510—Smith, Henry, aged 19, Halifax W. M. College, Warehouseman—English Literature (3rd)
358—Smith, Henry William Faux, aged 18, Athenæum, King's Lynn, School Assistant—Arithmetic (2nd); Algebra (3rd); Chemistry (2nd)
624—Smith, John Henry, aged 19, Glasgow M.I., Compositor—English History (2nd)
613—Smith, John Stewart, aged 19, Glasgow M.I., Clerk—Arithmetic (2nd); Book-keeping (3rd)
648—Smith, Samuel, aged 16, Manchester M.I., Junior Clerk—Arithmetic (3rd)
466—Smith, Thomas, aged 18, Sussex Hall Evening Classes, Clerk—Arithmetic (2nd); Book-keeping (3rd)
12—Smith, William, aged 18, Aberdeen M.I., Iron Turner—Algebra (3rd)
49—Smith, William, aged 17, People's Reading Rooms, Belfast—Algebra (1st)
607—Smyth, William Hugh, aged 24, Glasgow M.I., Clerk—Music (1st) with 1st Prize.
324—Sneath, George, aged 18, Leicester Church of England I., Clerk—Arithmetic (2nd); Book-keeping (1st)
343—Solomons, Albert Elias, aged 20, Royal Polytechnic Inst. Classes, Colonial Merchant—Chemistry (2nd)
669—Southern, James William, aged 20, Manchester M.I., Book-keeper—English Literature (3rd)
455—Sowden, Thomas Henry, aged 19, York I., Railway Clerk—Book-keeping (3rd); Mensuration (3rd)
517—Spencer, Norcliffe Blakey, aged 18, Halifax Working Men's College, Clerk—Book-keeping (1st)
369—Stanger, John, aged 29, Newcastle-on-Tyne Church of England I., Butler—Book-keeping (3rd)
59—Steele, William, aged 19, People's Reading Room, Belfast, Clerk—Arithmetic (3rd); Geometry (3rd); Political and Social Economy (3rd)
139—Steer, Charles, aged 29, Croydon Lit. I., Printer—Latin and Roman History (1st) with 2nd Prize.
202—Stewart, John, aged 22, Glasgow M.I., Clerk—French (3rd)
596—Stewart, William, aged 16, Clerkenwell Working Men's I., Solicitor's Clerk—Arithmetic (3rd)
604—Stillman, Augustus Octavius, aged 19, Newbury I.—Music (3rd)
129—Stoker, George Naylor, aged 21, Carlisle Church of England Lit. I., Clerk—Arithmetic (2nd); Geography (2nd)

357—Suggett, John Dix, aged 17, Athenæum, King's Lynn, Banker's Clerk—Geography (1st) with 1st Prize
512—Sutcliffe, William, aged 19, Halifax W.M. College, Damask-weaver—Arithmetic (2nd)
511—Sutton, James, aged 19, Halifax, W.M. College, Overlooker—Arithmetic (3rd); English Literature (3rd)
112—Swaine, Sidney, aged 17, Bradford M.I. Clerk—Arithmetic (2nd)
422—Sweetman, Edward John, aged 19, Wolverhampton, W.M. College, Tailor—French (3rd)
668—Taylor, James Crowther, aged 18, Manchester M.I., Clerk—Arithmetic (2nd)
650—Taylor, Joseph, aged 17, Manchester M.I., Junior Clerk—Arithmetic (3rd)
250—Taylor, William Henry, aged 20, West Hartlepool L. and M.I., Apprentice Draughtsman—Algebra (2nd); Music (3rd)
618—Tennant, George, aged 17, Glasgow M.I., Pupil teacher—Latin and Roman History (1st)
204—Tennent, James Binnie, aged 19, Glasgow M.I., Clerk—Algebra (3rd)
500—Thomas, Richard Coupland Fleming, aged 18, Bristol Young Men's Christian I., Architect's Pupil—Algebra (3rd)
495—Thomas, William, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
430—Thompson, William S., aged 21, Waterford M.I., Lithographer—Arithmetic (3rd)
560—Thorp, Joseph, aged 18, Leeds Young Men's Christian I., Mechanic—Arithmetic (3rd); Algebra (3rd)
402—Tisley, Samuel Charles, aged 30, London M.I., Clerk—Arithmetic (2nd); Book-keeping (2nd); Practical Mechanics (3rd)
75—Tonks, Zephaniah, aged 17, Birmingham and Midland I., Pupil teacher—English History (3rd)
508—Toothill, Abel, aged 16, Halifax W. M. College, Designer—Arithmetic (3rd)
677—Toothill, James Arnold, aged 22, Halifax M.I., Assistant Teacher—Geography (2nd); English History (3rd)
555—Trant, William, jun., aged 16, Leeds Young Men's Christian I., Apprentice—Arithmetic (3rd); Geometry (3rd); Astronomy (3rd)
630—Trevena, Henry Albert, aged 20, Pembroke Dock M.I., Shipwright—Trigonometry (3rd)
545—Turner, Andrew, aged 19, Leeds Young Men's Christian I., Letter-press Printer—Arithmetic (2nd)
215—Turner, John, aged 23, Glasgow Athenæum, Warehouseman—English Literature (2nd)
303—Turner, Thomas Burton, aged 20, Leeds M.I., Solicitor's Clerk—Book-keeping (2nd); Algebra (2nd); Geometry (2nd)
409—Underhill, Charles, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
598—Unsworth, William, aged 32, Bury Athenæum, Boot and Shoe Maker—Music (3rd)
19—Urquhart, John, aged 19, Aberdeen M.I., Clerk—Arithmetic (2nd)
21—Valentine, John Sutherland, aged 17, Aberdeen M.I., Clerk—Algebra (3rd)
655—Varley, Henry, aged 26, Manchester M.I., Warehouseman—Algebra (3rd)
478—Vaughan, George, aged 16, Sussex Hall Evening Classes, Clerk—Arithmetic (1st)
472—Vaughan, William, aged 19, Sussex Hall Evening Classes, Book-keeper—Arithmetic (1st) with 1st Prize
535—Wainwright, Henry, aged 16, Leeds Young Men's Christian I., Engineer—Arithmetic (3rd)
256—Wakenell, James Frederick, aged 17, Hitchin M.I., Coal Merchants' Clerk—Book-keeping (2nd); Arithmetic (3rd)
454—Walker, Charles, aged 18, York I., Telegraph Clerk—Geography (1st), with 2nd prize; English Literature, (2nd)
509—Walker, John, aged 20, Halifax W.M. Coll., Warehouseman—English Literature (2nd)
113—Walker, Richard Felvus, aged 17, Bradford M.I., Clerk—Arithmetic (3rd)
293—Walker, William, aged 19, Leeds M.I., Painter—Arithmetic (3rd)
305—Ward, George, aged 26, Leeds M.I., Chemist and Druggist—Chemistry (1st)
310—Warden, Henry, aged 16, Liverpool I., Shopman—Geography (3rd); English Literature (3rd)
105—Webster, John, aged 17, Bradford M.I., Civil Engineer—Arithmetic (3rd)
492—Weetman, John, aged 21, Ipswich M.I., Clerk—French (1st); German (2nd)
122—Wildish, James, aged 18, Brompton Church of England Young Men's I., Shipwright's Apprentice—Algebra (3rd)
653—Williams, Thomas, aged 18, Manchester M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
502—Wills, Sophia Ann, aged 41, Bristol Athenæum, Governess—French (2nd); English Literature (2nd); German (3rd)
458—Wilson, Albert William, aged 16, York I., Arithmetic (1st)
572—Wilson, John, aged 38, People's Coll., Sheffield, Penblade Grinder—Political and Social Economy (2nd)
565—Wilson, John William, aged 18, Leeds Young Men's Christian I., Solicitor's Clerk—Book-keeping (2nd)
588—Wing, John Unwin, aged 20, People's Coll., Sheffield, Accountants' Clerk—Arithmetic (2nd); Book-keeping (2nd)
449—Wood, James Lee, aged 17, Wigan M.I., Clerk—Arithmetic (3rd)
654—Wood, Joseph, aged 18, Manchester M.I., Clerk—Arithmetic (2nd); Book-keeping (1st)
513—Wood, Ralph, aged 17, Halifax Working Men's College, Reedmaker—Arithmetic (2nd)
521—Wood, William Hanson, aged 26, Halifax Working Men's College, Warehouseman—Geography (3rd)
587—Wood, William Martin, aged 31, People's College, Sheffield, Grocer—English Literature (1st)
42—Woodland, Richard, aged 17, S.E. Railway M.I., Railway Clerk—Arithmetic (1st)
376—Woodman, Samuel James, aged 17, Watt Institute, Portsea, Engineer's Apprentice—Mensuration (2nd); Trigonometry (3rd)
82—Woodward, Charles Josiah, aged 21, Birmingham and Midland I., Chemical Teacher's Assistant—Principles of Mechanics (3rd)
149—Woodward, Robert, aged 17, Darlington M.I., Railway Clerk—English History (2nd)
141—Wren, William, aged 40, Carlshalton Mutual Improvement Society, Gardener—Arithmetic (3rd); Botany (2nd)
541—Wright, John, aged 25, Leeds Young Men's Christian I., Teacher—Geometry (3rd)
522—Wright, Murrell, aged 17, Leeds Young Men's Christian I., Attendant in Cloth Warehouse—Book-keeping (2nd)
537—Yeadon, Oliver, aged 17, Leeds Young Men's Christian I., Mechanic—Astronomy (3rd)
236—Young, Robert, aged 17, Glasgow Athenæum, Stationer's Assistant—English History (3rd); Book-keeping (3rd)

THE FEMALE SCHOOL OF ART, GOWER-STREET.

A Conversazione will be held at the South Kensington Museum, by permission of the Lord President of the Council, on Thursday evening, the 21st June, 1860, at 9 o'clock, in aid of the funds now being raised for erecting a building for this School of Art.

By the gracious permission of the Queen, the Koh-i-noor Diamond, which has been re-cut since the Exhibition of 1851, will be exhibited; together with a collection of ancient and modern jewellery, which the Council of the Fine Arts Club has kindly consented to provide for this occasion.

The Marquis of Salisbury will liberally contribute the services of the band of the Hertfordshire Militia for the night.

The admission will be by tickets only, which may be obtained of any member of the Committee of the Female School of Art; or of Miss Gann, the Superintendent of the School, 37, Gower-street; or of Mr. Philip Cunliffe Owen, at the South Kensington Museum; all of whom will also receive donations.

Gentlemen's tickets 5s. each; Ladies' 2s. 6d. each.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....London Inst., 7. Mr. G. W. Hastings, "On Commercial Law, in connection with the Travers Testimonial Fund."
Geographical, 8½. 1. Sir R. Schomburgk, "Boat Excursion from Bangkok to Pechaburri, with General Report on the Trade of Siam." 2. "Late Explorations in Western Africa," by Coloured Gentlemen, Dr. M. R. Delany and Mr. R. M. Campbell."

Tues. .....Syro-Egyptian, 7½. Mr. Sharpe, "On the Alexandrian Translation of the Bible, and the Bias of its Translators."
Medical and Chirurg., 8½.
Zoological, 9.

Wed. .....Literary Fund, 3.
Geological, 8. 1. Continuation of Dr. Falconer's paper, "On the Bone Caves of Gower, Glamorganshire, with the Appendix, by Mr. Prestwich, on the Raised Beach of Newslade Bay, and the existence of Boulder Clay in Cefa-y-Cryn." 2. Mr. Jamieson, "On the Occurrence of Crag Shells beneath the Boulder Clay of Aberdeenshire."
Microscopical, 8.
Archæological Assoc., 8½.

Thurs. ...Roy. Soc. Club, 6.
Antiquaries, 8.
Royal, 8½.

Sat. .....Asiatic, 2.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 4th May, 1860.

245. Friendly Society—Return.
247. Savings' Banks (Number of Depositors, &c.)—Accounts.
247 (1). Savings' Banks (Sums paid or withdrawn, &c.)—Return.
263. Army—Copy of Memorandum dated 25 March, 1826.
268. London Water Companies—Return.
268. Boroughs (England and Wales)—Return.
102. Bills—Anstruther Union Harbour.
121. ,, Stock Jobbing.
123. ,, Census (Ireland).
124. ,, Fisheries (Scotland)—(Amended).

Delivered on 5th and 7th May, 1860.

211. Registrars, &c. (Ireland)—Returns.
251. Navy (Retirement and Promotion)—Return.
257. Population, &c.—Return.
262. Army (Officers and Men in Depot Battalions)—Return.
269. Metropolitan Police—Returns.
248. Friendly Societies—Return.
272. Queen's Printers' Patent—Return.
273. Army (Number of General Officers, Field Officers, &c.)—Returns.
219. East India (Nawaub of the Carnatic)—Return.
232. Pauper children—Return.
125. Bills—Nuisances Removal and Diseases Prevention.
122. ,, Metropolis Local Management Act Amendment.

Delivered on 8th May, 1860.

196. Grand Jury Presentments (Ireland)—Abstract of Accounts.
279. Dock and Victualling Yards—Returns.
280. Aldershot Barracks—Return.
281. Enfield Factory—Return.
199. East India (Madras)—Return.
127. Bill—Marriages (Extra Parochial Places).

Delivered on 9th May, 1860.

234. Treasury Chest—Account.
236. Elections—Return.
237. Coroner's Inquests—Returns.
274. Excise Traders—Return.
276. Pauper Lunatics (Scotland)—Return.
284. Criminal Justice (Middlesex)—Returns.

Delivered on 10th May, 1860.

255. East India (Settlement and Cultivation of Land)—Returns.
278. Edinburgh City—Return.
285. Bankruptcy—Return.
286. Thames Conservancy—General Report and Account.
119 Cambridge University (St. Catherine's College and Christ's College)—Copies of Statutes.
130. Bill—Labourers' Cottages (Scotland).

Delivered on 12th and 14th May, 1860.

282. Military Defences (Colonies)—Return.
283. National Vaccine Board—Copy of Report.
293. Sale of Gas Act—Return.
128. Bills—Spirits.
131. ,, Registration of Births, &c. (Ireland).
132. ,, Locomotive.

Delivered on 16th May, 1860.

241. Coroners' Inquests—Return.
289. School of Arts, &c.—Return.
135. Bill—Municipal Corporations (Ireland) Act Amendment.
Greece (Financial Conditions)—General Report of the Commissioner.
Statistical Abstract for the United Kingdom, from 1845 to 1859.
275. National Gallery—Return.
288. Magistrates (Ireland)—Return.
290. Poor Law (Medical Relief)—Return,
291. Medical Act (1858)—Return.
292. Universities and Durham University—Returns.
296. Sale of Gas Act (1859)—Return.
134. Bill—Registration of Births, &c. (Ireland), (No. 2.)

Delivered on 17th May, 1860.

270. Exchequer—Account.
271. Whitby Rectory—Return.
308. Civil Services—Estimate for Votes "on Account."
137. Bill—Local Boards of Health, &c.

Delivered on 18th, 19th, and 21st May, 1860.

236. Elections—Return (Amended Copy.
248. (1) Friendly Societies—Return.
299. County Treasurers (Ireland)—Account.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 1st*, 1860.]

Dated 11th April, 1860.

910. J. F. Hillel, Mark-lane—Imp. in the apparatus and in the mode of treating Spanish grass and other fibrous materials, to be used in the manufacture of paper.

Dated 24th April, 1860.

1018. L. Orlard, Cheviré Lerouge, Maine-et-Loire, France—Imp. in breech loading fire-arms, and in their cartridges.
1031. R. Atkinson, Southampton-court, Tottenham court-road—An apparatus to give warning to the inmates of a house or apartment of the attempted entry of thieves or burglars, which may be called a "burglar and thief detector."

Dated 27th April, 1860.

1058. J. White, G. White, and J. White, Manchester—An imp. or imps. in machinery for pressing and cutting tobacco and other substances.
1059. L. D'Aubreville, 60, Boulevard de Strasbourg, Paris—Imp. in the manufacture of metallic boxes or vessels used to contain preserved alimentary provisions or other substances, and in the apparatus or machinery employed therein. (A com.)

Dated 3rd May, 1860.

1114. M. Henry, Fleet-street—Imp. in the mode of, and apparatus for, propelling, turning, and changing the direction of ships, balloons, and other bodies.

Dated 4th May, 1860.

1118. T. Railton, Manchester—Imp. in the apparatus employed in the manufacture of cap or bonnet fronts.

Dated 5th May, 1860.

1120. C. Stevens, 1n, Welbeck street, Cavendish square—An improved means and apparatus for transporting and preserving live fish, and keeping water fresh for a long period. (A com.)

Dated 9th May, 1860.

1150. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of threads and yarns, and in the preparation of fibrous materials for such manufacture. (A com.)

Dated 10th May, 1860.

1154. H. Wildsmith, J. Carter, and James Carter, Batley, Yorkshire Imp. in extracting wool or other animal fibres from combinations of wool and cotton, or mixtures of other animal and vegetable fibrous substances or fabrics, and in the machinery or apparatus employed therein.

Dated 12th May, 1860.

1174. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved machine for raising water. (A com.)
1176. R. Young, Glasgow, N.B.—Imp. in apparatus for cleaning grain.
1178. J. Chatterton, Highbury-terrace, and W. Smith, Pownall-road, Dalston—Imp. in electric telegraph conductors.

Dated 14th May, 1860.

1182. E. Lord, Todmorden, Yorkshire—Certain imp. in machinery for opening, blowing, and cleaning cotton and other fibrous materials.
1184. W. E. Newton, 66, Chancery-lane—An imp. in iron pavements. (A com.)
1186. T. Haworth, Preston, Lancashire—Imp. in machinery or apparatus applicable to looms for weaving, and the tools employed therein.

Dated 15th May, 1860.

1188. R. Read, Havelock-street, Leicester—Imp. in the process of waterproofing fabrics for garments so as to allow perspiration to pass through the same.
1189. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved centrifugal turbine. (A com.)
1190. A. Sax, Paris—A new mode of obtaining motive power by the effect of weights and springs, or by springs only, in combination with proper connecting parts.
1191. B. Samuelson, Banbury, Oxon—Imp. in reaping and mowing machines.
1192. S. Smithard, Nottingham, and H. Wheatcroft, 27, Fore-street, London—Imp. in the construction of machines for uniting portions of lace, blond edging, net, and other fabrics, usually called "running-on machines."
1193. G. H. Barth, 217, Piccadilly—Imp. in processes for aerating or super-saturating water and other fluids with oxygen, or compounds of oxygen or other gas or gases.
1194. B. Hooper, 43, King William-street—Imp. in the manufacture of a paper suitable for preventing forgery.
1195. J. Higgins, and T. S Whitworth, Salford, Lancashire—Imp. in machinery or apparatus for preparing and spinning cotton and other fibrous materials.
1196. W. E. Newton, 66, Chancery-lane.—Imp. in valves and valve gear, for the induction and eduction of steam to and from cylinders of steam engines, part of which is applicable to other purposes. (A com.)
1197. S. C. Salisbury, Essex-street—An improved mode of and apparatus for churning butter. (A com.)
1198. J. Denis, Queenhithe—Imp. in the preparation of vegetable matters, as a pulp, for the manufacture of paper. (A com.)
1199. S. N. Larkins, Dover—Improved bathing apparatus.
1200. R. J. Jordan, Berner's-street, Oxford street—Imp. in pills.

Dated 16th May, 1860.

1203. J. Grant, Glen Grant, Moray—Imp. in breakwaters.
1204. P. Chrimes, 175, Collyhurst-road, Manchester—Imp. in stoppering bottles, jars, and other like vessels.
1205. J. Ambler, Little Horton, Yorkshire—A new kind of cloth or woven fabric.
1206. C. Cowper, 20, Southampton-buildings, Chancery-lane—The manufacture and application to fibres and fabrics of a new blue colour, and compounds of the same with other colours. (A com.)
1207. A. V. Newton, 66, Chancery-lane—An improved mode of treating oils, for the production of gas and volatile oils. (A com.)
1208. W. E. Newton, 66, Chancery-lane. Imp. in locks for safes, doors, and other purposes.
1209. C. M. Guiellemin, 7, Rue Madame, Paris, M.D.—Imp. in submarine electric telegraphs.

Dated 17th May, 1860.

1211. C. Lowenstein, 37, Crutched Friars—Imp. in arrangements for paying out submarine cables.
1213. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the cylinders and pistons of steam and other engines, or machines propelled by aeriform fluids. (A com.)
1215. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved railway brake. (A com.)
1217. G. Davis, 1, Serjeant-street, Lincoln's-inn, and 28, St. Enoch-square, Glasgow—A system of chromato topo-chronographic charts intended to facilitate the study of universal history and chronology. (A com.)
1219. S. C. Salisbury, Essex-street—Imp. in machinery and apparatus to be employed in weaving.
1221. A. B. Ibbotson, Sheffield—Imp. in vices, part of which imp. is applicable to screw wrenches, spanners, turning lathes, and other tools and machines. (A com.)
1223. S. Holdsworth, J. Henderson, W. Henderson, and T. Bagley, Durham—Imp. in looms for weaving.
1225. J. D. Dunicliffe and S. Bates, Nottingham—Imp. in bobbin net, or twist lace machines.
1227. N. Clayton and J. Shuttleworth, Lincoln—Imp. in portable and traction engines.

Dated 19th May, 1860.

1229. S. Fielden and A. Fielden, Todmorden, Lancashire—Imp. in self-acting mules for spinning.
1231. C. Stevens, 1B, Welbeck-street, Cavendish-square—Imp. in striking clocks. (A com.)
1233. W. Ambler, Keighley, Yorkshire—Imp. in means or apparatus to facilitate the consumption of smoke in furnaces.
1235. J. Lees, Birmingham—Imp. in the manufacture of swivels, hooks, and rings for attaching and securing watches, chains, or jewellery, parts of which imp. are applicable to key-rings, ear-rings, and other similar articles.
1237. W. E. Newton, 66, Chancery-lane—Imp. in looms for weaving carpets and other looped and pile fabrics. (A com.)
1239. J. Longmaid, Inver, Galway—Imp. in treating iron pyrites and other ores containing copper, silver, and tin, or either of them, and sulphur.

Dated 22nd May, 1860.

1253. G. Moulton, Manchester—Imp. in machinery for transferring to or tracing upon printing rollers or cylinders copies of designs or patterns intended to be etched or engraved thereon.
1255. J. Green, Newtown, Worcestershire—Imp. in the construction of ploughs, cultivators, and similar agricultural implements.
1257. J. Hinks, Birmingham—Imp. in lamps for burning petroline and other liquid hydro-carbons, and in supports for the said lamps.
1259. J. Marland, Southport, Lancashire—Imp. in preparing for and warping and sizing woollen and worsted and other yarns and threads.
1261. J. Bottomley, Laister Dyke, Yorkshire—Imp. in means or apparatus employed in spinning wool and other fibrous substances.
1263. J. Goldie, Glasgow—Imp. in furnaces and in the consumption or prevention of smoke.
1265. J. H. Johnson, 47, Lincoln's Inn-fields—Imp. in machinery or apparatus employed in spinning. (A com.)
1267. W. Clissold, Dudbridge, Gloucestershire—An imp. in the construction of gearing wheels.

Invention With Complete Specification Filed.

1318. E. Dufossé, 1, Place Valenciennes, Paris—A system of skeleton or frame-work with continuous free air currents, applicable to the construction and improvement of seats of any description, mattresses, saddles, and upholstery generally, with a view to render them hygienic.

Patents Sealed.

[*From Gazette, June 1st*, 1860.]

June 1st.

2728. J. Moore.
2744. J. Rudkin.
2745. E. A. Curley.
2748. J. Hawkins and C. Hawkins.
2751. C. Short, T. B. Smeeton, and W. Bowler.
2754. W. Hutton.
2802. G. Davies.
2807. J. Chatterton.
2809. J. Chatterton and W. Smith.
2362. E. P. Holden.
2959. C. J. Rooney and D. Renshaw.
2963. W. A. Gilbee.
2969. J. S. Crosland.
2971. H. B. Barlow.
39. O. J. T. Gossell.
223. J. H. Johnson.
335. J. H. Johnson.
385. W. Readman.
386. J. Green.
749. H. Vigurs.
859 A. N. Jensen.

[*From Gazette, June 5th*, 1868.]

June 5th.

2764. F. Potts.
2771. R. H. Collyer.
2773. T. R. Harding.
2776. J. Mabbott.
2785. W. Prosser and J. Hogg.
2787. F. H. Elliott and C. A Elliott.
2789. J. Macintosh.
2791. J. Macintosh.
2824. W. Teall.
2831. W. Robinson.
2838. G. Bedson.
2852. C. Reeves.
2856. H. Martin.
2860. W. H. Harfield.
2895. M. Turnor.
2920. G. F. Stidolph.
103. T. Wilson.
119. D. F. L. R. J. Vonwiller and F. Seiler.
685. T. Wilson.
863. E. H. Ashcroft.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, June 1st*, 1860.]

May 30th.

1527. M. Clark, H. Oldfield, and W. Salmon.
1707. G. W. Charlwood.

[*From Gazette, June 5th*, 1860.]

May 31st.

1540. W. H. Walenn.
1587. W. E. Newton.
1634. A. V. Newton.
1681. W. E. Newton.
1735. W. E. Newton.

June 2nd.

1577. T. L. Boote and R. Boote.
1578. R. H. Collyer, M.D.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, June 1st*, 1860.]

June 1st.

1351. J. R. Johnson.
1391. C. Nickels.

June 2nd.

1366. I. Kendrick.
1381. B. Biram.

Journal of the Society of Arts.

FRIDAY, JUNE 15, 1860.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council, at their meeting on Wednesday last, the 13th inst., that the amount of the Guarantee Fund promised up to that date, was £312,950.

NINTH ANNUAL CONFERENCE.

A circular letter has been addressed to the Institutions and Local Boards, informing them that the Ninth Annual Conference with the Representatives of the Institutions in Union and of the Local Boards will be held at the Society's House, on Friday, the 22nd inst, at half-past ten o'clock precisely. Sir Thomas Phillips, F.G.S., Chairman of Council, will preside.

The Council hope that the Managers of each Institution will not fail to appoint and send its Representative to the Conference, and that the Local Boards will be represented by the chairman, or some other member of the Board.

The Secretaries of Institutions and Local Boards are requested to forward to the Secretary of the Society of Arts the names of these Representatives, *as soon as they are appointed,* stating also, at the same time, whether they will be present at the Society's Annual Dinner, which will take place on the same day, and of which particulars are given below.

The Council will lay before the Conference the Secretary's Report of the proceedings of the Union for the past year, and a Programme of the Examinations for 1861.

In connection with that Programme, the Conference will have an opportunity of considering the following points:—

1. What further steps can be taken to increase the importance and utility of the Local Boards, and whether they might not advantageously hold Annual Examinations of children between 13 and 16 years of age, and grant to them, on their own authority, Certificates and Prizes?
2. Whether the List of subjects for the Final Examinations can be advantageously extended, or otherwise improved?
3. Whether the Government Examinations in Drawing (both Freehand and Mechanical) are such that no further provision for Examination in that subject is required by the Institutions?
4. Would it be well to make special arrangements for Women in the Examinations; or are the arrangements of the present programme suitable and sufficient for them?
5. Whether any change can advantageously be made in the days and hours fixed for the Final Examinations?

Among the other questions which the Council will submit to the Conference for discussion are the following:—

6. Are the Institutions of opinion that the principle of competitive Examinations for Government appointments, already partially introduced into the public service, should receive further extension?
7. Wherever large District Educational Boards, or Local Unions of Institutions, can be established, is it not desirable that organising masters should be appointed to promote the establishment of Adult Classes, and to assist in teaching?
8. Is the opinion of the Conference favourable to Discussion Classes; and, if so, under what conditions should they be held?
9. Without losing sight of the educational character which it is desirable that Institutions should always maintain, how far can they judiciously promote such outdoor and in-door recreation as may be beneficial to the physical and mental health of their members?
10. Should the Conference express its opinion in favour of Early-closing and Holidays, with reference to the moral, intellectual, and physical health of the members of the Institutions?
11. Would the Institutions like arrangements to be made for fixing certain days on which excursion parties of their members and friends might assemble at the Crystal Palace, or elsewhere?
12. Should any further efforts be made by the Union to procure the opening of the National Museums and Galleries to the public of an evening?
13. Can the Institutions, with advantage, make arrangements for their members to visit the proposed International Exhibition of 1862.
14. How far can the system of book-hawking be made useful to the libraries of Institutions?
15. Whether the Institutions should promote the formation of local museums; and, if so, whether these museums might not easily and with advantage be made to represent the productions of the locality, instead of being of the heterogeneous character often given to them?

Notice of any other subjects which any of the Representatives may wish to submit to the Conference, should be given to the Secretary.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Friday, the 22nd June, at six o'clock punctually. The Right Honourable Benjamin Disraeli, M.P., will preside.

Members and their friends are invited to be present, and tickets (price 10s. 6d. each) may be obtained at the Society's House.

ANNUAL GENERAL MEETING.

The One Hundred and Sixth Annual General Meeting, for the purpose of receiving the Council's Report, and the Treasurer's Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held (in accordance with the Bye Laws) on Wednesday, the 27th inst., at 4 o'clock, p.m.

The Council give notice that at this meeting they will propose to repeal that portion of Bye-Law No. 9 referring to the election of the chairman of the Council, which declares that "the Chairman of the preceding year shall not be re-elected to that office."

The Council hereby convene a Special General Meeting of the Members of this Society, to ballot

for the election of Members, such meeting to take place at the close of the Annual General Meeting.

By order of the Council,
P. LE NEVE FOSTER, *Secretary.*

EXAMINATIONS, 1860.

The following Prizes have been awarded to Institutions and Local Boards, in accordance with the conditions* set forth in the Examination Programme for this year:—

PRIZES TO INSTITUTIONS.

One Prize of £5 to the Sussex Hall Evening Classes, in respect of Candidate No. 472, William Vaughan, who obtained the First Prize in Arithmetic.

One Prize of £5 to the Leeds Young Men's Christian Institute, in respect of Candidate No. 523, Thomas Hick, who obtained the First Prize in Algebra.

One Prize of £5 to the Leeds Young Men's Christian Institute, in respect of Candidate No. 557, Walter Robinson, who obtained the First Prize in Geometry.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 183, Archibald Simon Lang Macdonald, who obtained the First Prize in Electricity, Magnetism, and Heat.

One Prize of £5 to the London Mechanics' Institution, in respect of Candidate No. 328, William Scott, who obtained the First Prize in Chemistry.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 185, Alexander McKinlay, who obtained the First Prize in Botany.

One Prize of £5 to the Glasgow Athenæum, in respect of Candidate No. 240, Robert Clark, who obtained the First Prize in English History.

One Prize of £5 to the Birmingham and Midland Institute, in respect of Candidate No. 68, Henry Simpson, who obtained the First Prize in English Literature.

One Prize of £5 to the Glasgow Institution, in respect of Candidate No. 627, John Naismith Russell, who obtained the First Prize in Latin and Roman History.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 201, Abraham Shekelton, who obtained the First Prize in French.

One Prize of £5 to the Sussex Hall Evening Classes, in respect of Candidate No. 465, Walter Robert Clark, who obtained the First Prize in German.

One Prize of £5 to the Glasgow Institution, in respect of Candidate No. 607, William Hugh Smith, who obtained the First Prize in Music.

No Prizes are awarded to Institutions in respect of the Candidates who obtained First Prizes in Book-keeping, Conic Sections, Geography, and Logic, it having been ascertained that these Candidates had not received "systematic instruction" in these subjects at their respective Institutions "for a period of not less than three months," as required by the conditions.

PRIZES TO LOCAL BOARDS.

The Prize of £10 to the Local Board at the Glasgow Mechanics' Institution.

The Prize of £8 to the Local Board at Bradford.

The Prize of £6 to the Local Board at the Glasgow Institution.

The Prize of £4 to the Local Board at the London Mechanics' Institution.

The names of the following Candidates, belonging to the Glasgow *Institution*, were erroneously inserted in the list in last week's *Journal* as belonging to the Glasgow *Mechanics'* Institution:—

614—Berry, Thomas, aged 22, Warehouseman—Logic (1st).

615—Chalmers, Thomas, aged 20, Clerk—Book-keeping (2nd).

626—Fimister, John, aged 24, Stone Mason—Arithmetic (3rd).

617—Hamilton, David, aged 16, Pupil-teacher—Logic (2nd).

609—Hamilton, James, aged 22—Latin and Roman History (1st).

620—Kinloch, David, aged 18, Clerk—Book-keeping (2nd).

612—Leask, Thomas, aged 20, Book-keeper—Book-keeping (3rd).

606—Macfarlane, David, aged 21, Clerk—Political and Social Economy (2nd).

622—Main, John, aged 18, Clerk—Arithmetic (3rd).

628—McMillan, Andrew, aged 17, Ironmonger—Book-keeping (1st).

621—Nelson, Andrew, aged 18, Draper—Arithmetic (3rd).

610—Reid, William, aged 17, Joiner—Book-keeping (3rd).

625—Robertson, Wm., aged 27, Warper—Book-keeping (3rd).

627—Russell, John Naismith, aged 24, Assistant Reader—Latin and Roman History (1st), with 1st Prize.

608—Smith, David, aged 19, Mechanic—Algebra (3rd); Geometry (3rd); Trigonometry (3rd).

624—Smith, John Henry, aged 19, Compositor—English History (2nd).

613—Smith, John Stewart, aged 19, Clerk—Arithmetic (2nd); Book-keeping (3rd).

607—Smyth, William Hugh, aged 24, Clerk—Music (1st), with 1st Prize.

618—Tennant, George, aged 17, Pupil-teacher—Latin and Roman History (1st).

Also, for

127—Buttifant, John George, aged 18, Darlington M.I., Clerk—Arithmetic (3rd).

Read—

127—Buttifant, John George, aged 18, Carlisle Church of England Inst., Organist—Music (3rd).

For

180—Mac Gibbon, John Anderson, aged 17, Glasgow M.I., Architect's Apprentice—(1st).

Read—

180—Mac Gibbon, John Manderson, aged 17, Glasgow M.I., Architect's Apprentice—Arithmetic (1st).

For 55—Bulloe, read 55—Bulloch.

And for 335—Ravenscroft, Frances, read 335—Ravenscroft, Francis.

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* The conditions were as follows:—

"The following Prizes are offered to the Institutions, viz.:—To the Institution whose Candidate obtains the First Prize of £5 in any of the 25 Subjects, one Prize of £5. An Institution can take more than one such Prize; but no such Prize can be taken by an Institution unless the Council of the Society of Arts are satisfied that the Candidate, in respect of whom the Prize is claimed, has received in a class at the Institution systematic instruction in the subject for a period of not less than three months.

"The following Prizes are offered to the Local Boards, viz.:—To the Local Board whose Candidates (not fewer than twenty) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £10. To the Local Board whose Candidates (not fewer than sixteen) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £8. To the Local Boards whose Candidates (not fewer than twelve) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £6. To the Local Board whose candidates (not fewer than eight) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £4. No Local Board can receive more than one of these prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted. No Prize of any kind can be awarded to, or in respect of, any of the persons referred to in the second and third paragraphs of the Preliminary Notice."

ON DECIMALISING BRITISH MEASURES, WEIGHTS, AND COINS.

By Charles Atherton.

The following paper, "On Decimalising British Coins, and obtaining a Uniform Decimal System of Measures and Weights," was read at a meeting of the British Branch of the International Association, on the 7th of February last:—

As a member of the Committee of the British branch of the Association for obtaining an international system of measures, weights, and coins, I conceive that the present occasion affords a suitable opportunity for the diffusion of such views as may be entertained individually by the members of this Committee. The circumstances of my professional duties afford me, perhaps, unusual opportunities of appreciating the objects of this Association, and of forming some opinion as to the obstacles which, in a popular point of view, beset our path, and my daily avocations in engineering pursuits for many years having been such as necessitate the use of figures, not merely in their ordinary application, but also involving calculations of a somewhat abstruse character in connexion with scientific inquiries, thus enabling me to base my opinions on my own experience; under these circumstances, I deem it to be an obligation that I should briefly submit my views, but with great deference, to the distinguished authorities who are devoting attention to the introduction of some one general international system of measures, weights, and coins, and from whom, in some respects, I differ.

It must be admitted that the reformation which this Association has in view is of the most formidable character; for in consequence of our present system of British measures, weights, and coins having been devised without observing any constant ratio of progression whatever, it follows that the introduction of a decimal progression can not now be effected without disturbing established usages, lopping off our engrafted habits of calculation and of thought, and embarrassing mutual intercourse in every department of wholesale transactions, retail dealings, day pay wages, science, and art; in short, in superseding our tables of weights, measures, and coins, we are imposing upon ourselves the necessity of abandoning our earliest impressions of the mutual relations of things, and giving up a knowledge which has been acquired during childhood and youth, by irksome mental labour, and at a penance which no one can forget, and surely it is not easy to reconcile oneself to the idea that all these labours have been misdirected. In the face of such admitted physical obstacles and mental discouragements, I ask myself the question, Why do I now advocate the objects of this Association? My answer is simply this; that in my own individual experience, the educational toils and penances of my youth in respect of figures have not met the practical requirements of my life. I have been obliged to acquire in after life (and I must say that I found it easily done) that knowledge of figures which ought to have been a primary matter of rudimentary education in youth, and the vehicle of my thoughts in matters of calculation, namely, a knowledge of decimal numeration; and I now desire to popularise the knowledge of decimal arithmetic as a matter of elementary teaching, because I am satisfied, on my own part, that without this knowledge, I should have been utterly incapable of elaborating, or even of conceiving, those pursuits which I regard as the specialities of my life, and such I boldly assert has been the experience of every man in Britain, whose pursuits in life have not been restricted to one object, but have placed him under the obligation of prosecuting investigations and calculations dependent on the use of figures generally. Moreover, in a public point of view, I conceive that, for the want of the readiness of perception derivable from the facility of calculation which is imparted by the aid of decimal arithmetic, the general intelligence of the country remains, for the most part, so far as dependent on the use of figures, in a state of comparatively passive obduracy; for, under present circumstances, it is only one mental unit in a thousand that, by its own exertions, gets liberated from the irrational network of our vicious system of figures. The national intellect being thus generally spell-bound by the deficiencies of our present educational system in the use of figures, the fruition thereof, as compared with what it might become under proper cultivation, may be likened to the chance production of corn sown upon a pavement as compared with the production of cultivated ground. I may further observe that it is generally those who are ignorant of decimals, or those whose special avocations, not having necessarily exacted the daily use of decimals, have managed to get on without them, and who are, therefore, incapable of appreciating the advantages of decimal progression, as compared with our present national system of measures, weights, and coins, who are callous to the benefits, both personal and in a national point of view, which the reformation sought by this association would undoubtedly bring about. Hence, the admitted want of popular co-operation and sympathy with which it must be acknowledged that our cause has been received. But, to view this matter in its true light, only let us suppose the use of decimals to be suppressed, what would be the result? What, for example, would our actuaries and statists do? Why, we at once paralyse the whole progress of intellectual research, so far as based on the application of figures; and the inquiring faculties of man, in scientific deduction, become at once rendered destitute as is the woodman when deprived of his axe; and can it be supposed that this implement, so indispensable to the prosecution of the higher orders of intellectual inquiry, in which the use of figures is involved, would not produce a wonderful development of popular intelligence in connection with matters of every-day life when wielded by the masses, now mentally dead for want of the spark which would give vitality to thought, and which may be so easily struck?

This consideration, namely, the popular liberation of thought, and the extension of its range, is of no mean importance in a public point of view, seeing that the destinies of Britain demand the full energies of the nation, and that progressive national intelligence affords the only security for the progressive development of national power. The considerations of political economy involved in this matter are important, but I confine myself to its practical bearings on daily life. Such are the grounds on which I beg to express the conviction—that any system of measures, weights, and coins, whether national or international, ought to be based on decimal progression. Now, as regards the preference to be given to any special unit of measurement as the basis of an international system of measures and weights, the fact of the French metre having been established and already more generally received, internationally, than any other unit of length, and admitted, after being once determined, to be as capable of being preserved as a standard of reference, and as capable of being multiplied into exact duplicate as any other standard of length that can be devised, and, moreover, as the invention of Whitworth's machine for reproducing exact material duplicates of length, within given limits, is well adapted for, and greatly facilitates the material reproduction of, the metrical length in exact counterpart, for these reasons I concur in the decision already arrived at by this Association, that the metre should be regarded as the international standard, with which, *par excellence*, it is desirable that the measures and weights of all nations should have some *definite relation*, if not an absolute identity.

I imagine that no question will be raised as to the metre being internationally recognised as being, under all existing circumstances, the most available international standard unit of length, and that, any unit of length being established, the units of capacity and of weight admit of being based thereon, as exemplified by the French metrical system. The great question, therefore, is how

shall the metre and its decimal subdivisions be incorporated into the system of measurement adopted in each country respectively, so as to constitute an international standard of reference whereby the details of national measures and weights generally, if not absolutely metrical, may have a definite connection therewith and with each other. The obvious, though, I fear, humanly visionary solution of this problem, is simply that each nation abandon its established system, and adopt the metrical decimal system of length, capacity, and weight, complete as it is in all its details. This, if internationally resolved upon, would, I believe, be the easiest mode of effecting the desired object. The resulting chaos would be at first severe; it would, however, be rapidly transient, and order, conducive to the general good of all civilized nations, would gradually and quickly supervene; but the realization of this Utopian climax is beyond any precedent involving present sacrifice for prospective good which the order of human events affords; and I am under the conviction that in consequence of decimals having hitherto taken no part in the affairs of common life in Britain, and not having been hitherto recognised by the Legislature in connection with measurements, weights, or coins, the present population of Britain, as a mass, are utterly unprepared to appreciate, or fully to avail themselves of the benefits of the decimal system if suddenly introduced at the present time; and although at present a large per centage of the masses, and I may say even of classes above the masses, are not masters of calculation in connection with our present anomalous system of weights and measures, and are, therefore, as respects the use of figures, passive; nevertheless, if a new, though improved, and greatly simplified system were introduced, the difficulties consequent on the change would be attributed to the new system, and not to the prevalent unpreparedness of the people to receive it. National prepossessions, moreover, may not be abruptly outraged, even for the public good, nor, in my opinion, do the necessities of the case at all demand the compulsory legislative suppression of our existing system of measures, weights and coins. I am of opinion as hereinafter shown, that by simple modifications of our British system, such improvements may be engrafted thereon as will of themselves constitute a complete decimal system, and that such improved tables of measures, weights, and coins, being recognised in our national education, would be exclusively adopted by the rising generation, the decimal progressions of our new tables would come into use, and the non-decimalised portion would quietly and gradually die out. In the meantime, however, the attainment of internationality, as contemplated by this Association, will demand co-operation and decision on the part of the respective States, in adopting such legislative measures as will prepare the respective nations for the reception and fruition of so beneficent an object. These views on the general aspect of the work which this International Association has undertaken to prosecute, lead me to express my opinions more specifically on the course of procedure most conducive, in my opinion, to the realisation of the objects of this Association in Britain.

In the first place, I would begin with schools. All manufacturing establishments, such as cotton-mills, which employ children, are subject in some degree to legislative regulation for the due personal protection and health of the children so employed. Why not let all schools be subject in some degree to legislative regulation for the due cultivation of the minds of children, and of youths under scholastic discipline? I see no objection to legislative regulation demanding that in the progress of education the reading and meaning of decimals be taught as an element of arithmetical numeration; in fact, numeration is incomplete without it. Tables of decimal equivalents may be prepared to facilitate the expression decimally of our present subdivisions of weights and measures, and the whole course of arithmetical education may have especial reference to the prospective introduction of the contemplated decimal system of weights, measures, and coins. The rising generation, being thus mentally prepared, should have every opportunity of putting their acquirements into practical operation, by such decimal modifications being introduced by the legislature into our tables of measures, weights, and coins, as will constitute a decimal system, admitting, if not absolutely metrical, of direct reference to the metrical system; for, although the metre itself should be adopted in Britain to supersede, for example, the statute yard, I am of opinion that it alone would not, even eventually, be exclusively adopted as the sole implement or unit of length with which the various requirements of different trades will be prosecuted, nor is it at all necessary that it should be so, provided that the units of length and of capacity and weight adopted in different trades respectively have, each of them, an easily expressed and *definite ratio* to the metrical system, and be each of them subdivided decimally; for example, the metre (39·37097 inches) decimally divided, may be substituted for the yard as a suitable unit for the generality of purposes for which the yard is now adopted, but, in my opinion, the metre alone will not be sufficient; it will also, I believe, be popularly necessary, in order to meet the convenience of those trades in which the foot and the inch are chiefly used as units of lineal measurement, that the aliquot parts of the metre most closely approximate to the foot and the inch be adopted as substitutes for those units, such, for example, as the fourth part of the metre to be called a foot, such foot being divided into 10 in., each such new inch being $\frac{39 \cdot 37}{40} = \cdot 984$, being a close approximation to (only $\frac{16}{1000}$ shorter than) the present inch, and this would be a carrying out of the international principle, seeing that our sub-units have a definite ratio to the great international unit of reference, the metre. Before, however, going into the subject of the adaptation of our national tables of length, capacity, and weight to the metrical system, I desire to express the opinion (an opinion based on conviction in proportion to the deference with which I esteem the opinions of others, from whom, apparently, I differ on this point) that the decimalization of our coins should, next to rudimentary education, be the first practical step in our national preparation for decimal weights and measures. I do not admit the doctrine that there will be no use in decimalizing our coins unless we also at the same time decimalize our tables of length, capacity, and weight. On the contrary, I know from my own experience, and therefore I cannot, in deference to others, divest myself of the conviction that the decimalization of our coins would, in a very short time, vastly facilitate all calculations which involve money reckonings; for example, if our coins, a matter of everyday experience with everybody, were arranged in decimal progression, such decimal subdivision would, at once, become popularised, by reason of the coincidence that ten hours is the general expression for a day's work. The rate of wages per day would thus, without any calculation, express by the same figures in the next lower denomination, the rate per hour, an application of greater popular utility to the uneducated than any other that I can think of, as one exemplification of the results of the decimal system. Then again, if our coins were thus decimalized, there would be a great practical inducement for every person engaged in calculating the pecuniary values of quantities to express his quantities not in mixed terms, as at present, such, for example, as tons, cwts., qrs., lbs., or acres, roods, perches, yards, but such mixed quantities would at once, by most people, be arbitrarily expressed in tons and decimals of a ton, acres and decimals of an acre, the value of which at so much per ton, or so much per acre, expressed in decimal coinage, would be calculated and expressed in money with the greatest facility. In short, my conviction is, that if our coins were decimalized, the public generally, as above exemplified, would take the decimalization of weights and measures into their own hands for their own individual convenience

in calculation, thus paving the way for the introduction of such metrical and decimal modifications of our present system as the Government may hereafter be induced to adopt, with a view to internationality.

Although, for the reasons above stated, it would, in my opinion, be politic to advance, at the present time, no further than taking up the educational movement and decimalising our coins, I would beg to offer a few observations on the coinage which appears to me best adapted to meet the transition from our present system into that of decimal progression, and also to notice a few fortuitous coincidences which will, as I conceive, greatly facilitate the adaptation of British tables of measures and weights to the metrical system, without any material violation of our present ideas of quantity, with reference to the principal units now in use, namely, the yard, the inch, the ton weight, the tun measure, and the acre; premising, however, that I totally object to the French nomenclature, because it presumes on there being only one unit in measures of length, capacity, and weight respectively, whereas one of the great utilities of the decimal scale of progression consists in this, that any one of its denominations may be made available as the unit of the system, with reference to its lower denominations.

As to coins, I imagine that it will be futile, in Britain, to talk of doing away with the pound sterling as the leading British monetary unit; but inasmuch as the dollar is probably the monetary unit most generally recognised by the world at large, it may be worthy of consideration whether the intrinsic value of the pound sterling is as nearly that of five dollars as the variable value of different metals in different countries will admit; if not, it seems desirable, with a view to internationality, to establish such an equalisation, in order that the florin may also be equal to half-a-dollar. The value of the pound sterling being so adjusted, the British monetary table might be decimalised as follows, the nomenclature being arbitrarily assumed:—

Decimal Coins of Account.

10 cops = 1 bit.
10 bits = 1 florin.
10 florins = £1 sterling.

Tokens.

Present Coinage.
1 shilling = 5 bits, or 50 cops.
Sixpence = 2½ bits, or 25 cops.
1 penny, to pass for 4 cops.
1 halt-penny ,, 2 cops.
1 farthing ,, 1 cop.

It is to be observed that the introduction of the decimal progression, which is thus completed by the "bit" and the "cop," does not necessarily require the knowledge of working figures decimally. Account books for the £, florin, bit, and cop system, may have a separate column for each denomination of coin, as at present for the £, shillings, pence, and farthing system, and the working of figures may be carried on as at present. A very little practice will show the advantage of decimal progression, even to those unacquainted with the working of decimals. At any rate the introduction of the "bit" and the "cop" will render our coinage decimal for the convenience of those who choose to use it decimally; and if the daily wages of workmen should become based on the florin and the bit, in lieu of the shilling and the penny, the decimalised coins would soon become popular, they would also become the coins of account, and the shilling, the sixpence, and the penny, would be regarded merely as tokens of convenience, and gradually become obsolete, excepting as tokens of the value of 50 cops, 25 cops, and 4 cops respectively. The farthing is so nearly the value of the proposed "cop," that our present copper coinage would be available as current tokens, and no new coinage would be necessarily demanded for the immediate purpose of putting this decimal system into operation. With this system the pound sterling would be the leading unit of account for all wholesale dealings, but for wages and retail dealings the florin would be used as the unit.

Having before observed that, in my opinion, it will be politic to advance no further at the present time than decimalising our coins, I will now conclude this paper by merely showing with what very trifling alterations of our present leading units, our British system of measures and weights may be made to harmonise with the leading units of the metrical system, thus, fortunately enabling us, as respects our leading units, to retain our present nomenclature.

1st. As regards the ton weight of 2,240 lbs.

It so happens that the cubic metre contains 220·4 gallons, British imperial measure of 10 lbs. water per gallon, equal to 2204 lbs. Consequently, if the metrical ton weight, namely, a cubic metre of water, be adopted as the British unit of weight, 100 tons would by the new standard weigh 101·4 tons.

2nd. As respects measures of capacity.

The cubic metre contains 220·4 gallons imperial measure, which is so near the measure termed the tun, that it may be adopted as the leading unit of capacity without any violence to our present ideas of this leading unit, for liquid measures.

3rd. As respects land measure.

If the chain be made 20 metres in length, each square chain of land would contain 400 metres, and 10 such square chains would be 4,000 square metres, which are equal to 4,784 square yards (very nearly), being only 56 square yards less then the English acre of 4,840 square yards, consequently 100 acres of land, present British measure, would, by this metrical measurement, contain 101 acres. This change, based on the metre, may therefore be adopted without any violence to our present ideas of the acre as the leading unit of land measure.

4th. As respects the inch, so generally referred to as the unit in the precise measurements of machinery.

The metre being 39·37079 ins. in length, a 40th part of the metre will be ·984 inches, consequently, if this portion of the metre be taken as our new inch, 100 ins. present measure would be 101·6 ins. by the new standard. Such measurements could be easily transferred to the French metrical system, and the change from the present inch is so minute that it may be adopted without violence to our present ideas of lineal measurements.

5th. As respects cloth measure.

The metre being 39·37079 inches, or only $3\frac{37}{100}$ inches longer than our yard, may be adopted for the purposes of cloth measure without manual inconvenience, seeing that it is so used in France, where the general national stature is, I believe, admitted to be somewhat less than the general British stature.

These exemplifications of the adaptation of the metrical system to all the principal denominations of quantities which are regarded as our leading units of British measurements, sufficiently show that our British tables of weights and measures may be rendered international with reference to the metrical system with so little departure from our present leading units of quantity, as will scarcely disturb our ideas of such quantities, and therefore without necessitating any departure from our accustomed nomenclature of such leading units, a result so encouraging as, in my opinion, to dispel the apprehension of practical difficulty which has hitherto prevented the cause of internationality, in the matters of measures, weights, and coins, from receiving that general public support which is merited by reason of its intrinsic worth as a reformation tending to universal good, and so worthy of, and consonant with, the spirit of our times, in matters affecting our international commercial policy.

CROUPEE OIL.

A specimen of this oil has been deposited at the Society's House, for the inspection of members, by Mr. Robert Clarke, Colonial Surgeon, Gold Coast, who thus describes it in the *Pharmaceutical Journal* for May last:—

"This oil is commonly called 'Croupee' on the Gold Coast, 'Touloucouna' at the Gambia and Senegal, and 'Kundah' at Sierra Leone; and the tree which produces the seeds from which it is made is a Meliaceous plant, the *Carapa Touloucouna* of the *Flore de Senegambia*.* It flowers in January and the early part of February, and ripens in March or April, when the fruit is gathered, and shortly after the manufacture of the oil is commenced. The fruit, a large, somewhat globular five-celled capsule, contains in each cell eighteen to thirty seeds, varying in size from a chestnut to a small hen's egg. They are three-cornered, convex on the dorsal surface, of a brownish or blackish red colour, and rugose. On the Gold Coast, the tree grows abundantly in Assin, Tueful, Dinkarra, and Western Wassaw, the Braff Country, Essicoomah, Akim, and Aquapim, and in several of the other districts of the protected territory. Strictly speaking, it might be extensively grown over large tracts of land, both at Sierra Leone and the Gold Coast, which are at present a wilderness of jungle; the land under cultivation bearing so small a proportion to that lying waste, which prevails to such an extent, that the former is the exception and the latter the rule. In the vicinity of Freetown, and the villages and hamlets of the former colony, and in the suburbs of Cape Coast, and forts on the seaboard of the latter settlements, nearly all the magnificent forest trees have been cleared away, the ground being covered with copsewood, densely matted by climbing plants. Everywhere almost in these luxuriant copsewoods the Carapa forms part of them, and is readily distinguished by the rich reddish-brown colour of the bunch of soft leaves which adorn the points of the upper branches, attracting the notice of the most casual observer by the beautifully variegated appearance imparted to the darker leaved brushwood around them. Its presence also is a sure indication of the fertility of the soil on which it grows.

"At present, Cape Coast market is chiefly supplied with Croupee oil from Assin, Accra obtaining its supplies from Akim and Aquapim. Small quantities are brought to Wimebah from Essicoomah, the other regions before named furnishing enough of it for home use.

"The manufacture of Croupee oil is conducted by the natives much in the same way as they make palm oil. In Assin the seeds are dried for a short time, they are then boiled, and the oil skimmed off as it rises to the surface. The boiling is done in large clay pots, made in the country, which are ingeniously ranged upon furnaces built of clay; large quantities of the seeds being boiled in them with little trouble and small expense, fuel being abundantly at hand in the rural districts of the country, which is not the case in some of the Coast towns, where it is scarce and extremely high priced. For domestic use and for sale the natives preserve the oil in large wooden troughs, hewn out of a part of the trunk of the Pullom or wild cotton tree. They fit these reservoirs with covers of the same material, and thus keep the oil safe from impurities falling into it.

"In the village of Kent, situated in the western district of the colony of Sierra Leone, the mode of obtaining Croupee, there known as Kundah oil, is somewhat different. There the seeds, after being sun-dried, are hung up in wicker hurdles for some weeks in their huts, and exposed to the heat and smoke from the fire, are subsequently slightly roasted, and reduced to a pulp in large wooden mortars, which is boiled, the supernatant oil being removed by skimming.

"The economical uses of Croupee oil are varied. It burns well, and the finer qualities give a pleasant and good light, but more frequently the bulk of it brought to market burns rather smokily; but that defect might, in my opinion, be removed by greater care in preparing the oil, the present methods being rude and imperfect. As a paint oil, it answers well and admirably for lubricating iron tools and utensils, and I am satisfied will be found a valuable addition to the oils used in the manufacture of soap.

"Croupee oil is taken to market in pots, holding from two to four gallons each, the average market value paid by the traders in Manchester or Birmingham goods being about 1s. 9d. sterling a gallon on the Gold Coast. At Sierra Leone it is carried to market in calabashes, the average market price being about 2s. per gallon. As an article of commerce it is alleged to be deficient in stearine, but I am not aware whether this statement is correct. It should, however, be kept in view that there is almost invariably the greatest difficulty at first experienced in attempting to introduce any new product to market. Few of the regular purchasers will buy it, as they want that kind of oil to which they have been accustomed either for machinery or manufacture, and it is only by sending it for years to market that it at length attracts attention. Gradually, however, it works its way up, and being found useful, inquiries are made for it and its real value determined. Much labour and time might be saved, and the process shortened, by employing brokers who pay special attention to particular articles, and by giving them every information on the subject. This method, I would suggest, should be tried with Croupee oil, and I feel satisfied would be ultimately rewarded by its becoming a valuable export from the Gold Coast, more particularly when it is known that a very large quantity could be procured, and double or treble that quantity if encouragement is given to the growers; and there is good reason for believing that these expectations are capable of being practically realised, and a vast benefit thereby conferred on the settlements of the Gold Coast. For some years past several puncheons of the oil have been shipped from Cape Coast to the United States, by an enterprising merchant there, the samples sent fetching the current price of palm-oil; and I may here mention that it is generally used in the Wesleyan chapels on the Gold Coast for lighting purposes, and is found to answer well.

"Several years ago I brought from Sierra Leone to England specimens of the root, stem, leaves, and fruit of the Touloucouna tree, with the oil, and these were at the time deposited in the Museum of the Pharmaceutical Society, where, doubtless, they have been carefully preserved. Before, however, leaving the Gold Coast, I supplied myself with some of the oil from Assin, a sample of which accompanies this paper. An analysis of the oil I took from Sierra Leone in 1842 was made by Mr. Redwood, which showed that it is entirely soluble in ether. In alcohol it is separable into two parts, a concrete substance which was dissolved, and an oil fluid at ordinary temperatures, on which the alcohol has no effect. The former contained the bitter principle and the nauseous odour of the oil, the latter being nearly colourless and tasteless. According to MM. Pelroz and Robinet, the oil owes its bitterness to an alkaloid principle, which is also found in the bark of the tree.

"The natives of the gold coast, and some of the mixed races at Sierra Leone, with the Soosoos, Timmanees, and Sherbros, inhabiting the country in the neighbourhood of the latter colony, greatly value Touloucouna oil for its anthelmintic virtues, as they, and indeed all ranks and classes of people living in West Africa, are apt to become infested with one or other of the Tœnia, or with lumbricus, suffering more especially from the former varieties of worm. Some of the negroes use it as a rubefacient, to relieve rheumatic and fugitive pains, and they freely apply it to cure the inveterate itch, known on the coast by the term Kra-Kra, and also in other skin diseases, to which they are very liable.

"Having heard a good deal of its effects as an anthel-

* In my former paper on Touloucouna oil, which appeared in vol. ii., page 341, of the *Pharmaceutical Journal*, the carapa tree, it was stated, would be found figured in Sweet's *British Flower Garden*; but this is not the case, as I had an opportunity of ascertaining, through the kindness of Mr. Bennett, of the Botanical Department, British Museum.—R. C.

mintic, I was induced to give it a fair trial, which I had ample opportunity of doing, as I was then in charge of the large Liberated African hospitals at Sierra Leone. In the numerous cases I tried it I can speak favourably, as I found it to expel and destroy both varieties of tape and also lumbrici. I must, however, candidly admit that its nauseous and extremely bitter taste, in my opinion, will prevent its more general employment, unless it may turn out that its valuable and undoubtedly powerful anthelmintic properties depend upon (as in all probability they do) the bitter alkaloid principle, which could, no doubt, by careful manipulation, be freed from its nauseous odour. At least, it is well worth a patient trial to ascertain whether so desirable an object cannot be accomplished, because I feel satisfied it would be found a remedy of no mean importance, from the fact of the negroes being accurate observers in matters relating to their own comfort and happiness.

"I was in the habit of giving the oil internally in doses of one or two ounces, but this, of course, was regulated by the age and strength of the patient. In weakly persons, I consider its administration unwarrantable, while it may safely be given to the robust. Its action as a purgative resembled castor oil, both in the length of time it takes to operate and in the bulky nature of the evacuations. Over doses induce the most dangerous consequences, as hypercatharsis, vomiting, cold sweats, and death, if relief was not soon obtained.

"Should the patient labour under ascarides, it may be used as an enema, and with the greatest benefit. An ounce or two of the oil may be dissolved in a pint of warm water and thrown into the bowels, and will be found to dislodge and bring away great numbers of these parasites."

KEW GARDENS.

The tender of Messrs. Cubitt and Co., for the erection of the great Conservatory and Winter Garden in the pleasure-grounds and arboretum adjoining the Botanic Gardens, at Kew, has been accepted by the First Commissioner of Her Majesty's Office of Works, and the structure commenced. It will be a trifle short of 700 feet in length, covering somewhat about the same space as the *Great Eastern* steam-ship, and will probably be the grandest purely horticultural building in the world. It will occupy an extensive area on the right-hand side of the grand lawn avenue, leading from the Palm House to the Pagoda.

Home Correspondence.

THE DECAY OF TIMBER, AND ITS PREVENTION.

Sir,—I regret that I was not able to be present at the Society of Arts on the 30th May, during the reading of Mr. Burnell's very valuable paper on the causes of decay in building woods, and the means of preventing it; for, as I have directed much attention to the subject, and especially to the *modus operandi* of creosote, or dead-oil, in preserving timber, I should have taken part in the discussion.

Mr. Burnell does not attach too much importance to the process of creosoting timber, when he regards it as the most effective of all the processes known for the prevention of decay; for, in truth, the dead-oil of common coal-tar contains all the elements which are necessary for giving permanent stability to organic compounds, by checking decomposition, by opposing the processes of oxidation, and by destroying the vitality of the lower forms of animal and vegetable life. If, indeed, the application of creosote to timber has ever failed in preventing decay, it has been because of the improper use of it, or the use of an oil which has not contained a due proportion of its most effective constituent—carbolic acid. This it is which is chiefly concerned in strengthening the weak affinities of the young or immature constituents of wood. It coagulates the albumen and gives firmness to the cellulose matters that are so prone to decay, and which communicate by a sort of catalytic influence, their decomposition to the neighbouring and more mature tissues. So powerful is the antiseptic property of this acid that, when separated from coal tar, it will at once arrest the decomposition of every kind of organic matter. I have seen it stop the putrefactive changes of sewage and cess-pool matter instantly, and it will even stay the more active decomposition of putrefying animal flesh. It is to be regretted that all samples of dead-oil do not contain a like proportion of this valuable constituent. I have found that it ranges from 0·05 per cent. to rather more than 6 per cent. of the oil; and as the value of the oil is dependent on the proportion of this acid, it is a matter of some importance to know how its presence can be discovered. A rough estimate may easily be made by shaking up about half a pint of dead-oil with its own bulk of a rather weak solution of caustic potash. After standing for a little while, the oil will separate, and the potash solution of the carbolic acid may be poured off. On acidulating this with sulphuric acid, the carbolic acid will separate, like an oil, and it may be known by its creosote-like odour.

Another important constituent of dead-oil is the hydrocarbon, which gradually discolours the oil and thickens it by absorbing atmospheric oxygen and forming a solid pitch. This operates in preserving wood by appropriating the oxygen which may be within its pores, and so checking ligneous eremacausis. The resinoid body which is formed shuts up the pores of the wood and effectually protects it from the action of air and moisture. The presence of this hydrocarbon may be known by the darkening, and, as it were, drying of the oil when it is put upon white filter paper and exposed to the air. In the distillation of the oil this compound comes over most freely at the time when the naphthaline distils; and as far as my experiments have gone, I am led to think that the best dead-oil (that charged with most carbolic acid, and the resinafiable hydrocarbon) comes over at from 360° to 490° Fahrenheit. The carbolic acid is most abundant in the runnings at or near to the first temperature, and the media for holding them in solution and applying them to the timber at the last. Naphthaline, and paranaphthaline, or salts, as they are sometimes termed, will of course come over at these temperatures; but as these substances are of no value whatever in preserving timber, they should be separated as far as possible by submitting the oil to cold and to the action of time. Dead-oil should not be exposed to the air more than is necessary, in order that oxygen may not be absorbed and the oil thickened and discoloured. Lastly, I may say that carbolic acid and the hydrocarbons of dead-oil are among the most powerful poisons to fungi, and acori, and all the lower forms of organic life. The oil, therefore, acts as a physiological preservative of timber. In point of fact its preservative action is of four kinds:

1st. It coagulates albuminous substances, and gives stability to the constituents of the cambium and cellulose of the young wood.

2nd. It absorbs and appropriates the oxygen which is within the pores of the wood, and so checks, or rather prevents, the eremacausis of the ligneous tissue.

3rd. It resinifies within the pores of the wood, and in this way shut out both air and moisture.

4th. It acts as a positive poison to the lower forms of animal and vegetable life, and so protects the wood from the attacks of fungi, acori, and other parasites.

No doubt the action of the oil is injurious to higher forms of animal life. It is even offensive to ourselves, and hence the objection to its use in the interior of buildings. But I am led to think that this objection may be overcome by the use of agents, which, like nitric acid in its action on the benzole of the lighter oil of coal tar, may give to the dead oil a less offensive, if not a positively pleasant odour. When this is accomplished there can be no objec-

tion to its use in the interior of buildings, or for the preservation of ships.

I am, &c,
H. LETHEBY, M.B., M.A., &c.,
Professor of Chemistry in the College of the London Hospital.

Proceedings of Institutions.

Darlington Mechanics' Institution.—The report of the Committee for the year 1859, presented at the annual general meeting, held on the 9th March last, says:—That the institution may be said rather to have maintained its efficiency than to have made any progress during the past year. The importance and beneficial effects of Mechanics' Institutions, both on society at large and on their individual members, are now fully acknowledged; yet the committee, in spite of their most earnest efforts, have to lament that the Institution does not receive the support that they could wish from those whose name it bears, and for whose especial benefit it was established. Among a population of 15,000 there are only between 400 or 500 members, and of these scarcely more than half are artizans. This seems to indicate a considerable amount of indifference to the many advantages obtainable at a cost merely nominal. The present number of members is 461, being 63 less than last year. Three are life members; 74 news room; 102 yearly, and the remainder half-yearly and quarterly. The number entered on the books during the year has been 661. After speaking of the Society of Arts Examinations, and giving the names of the local Board appointed for Darlington, the report goes on to say that an encouraging and stimulating prospect is thus placed before the studious youth of the town, the certificates given by the Society of Arts being regarded as especial recommendations, not only by a large number of the great mercantile firms in this country, but also by the Government with respect to some departments of the Civil Service. Besides this, the principle of competitive examination is now being adopted in many departments of the state, and successful candidates with the Society of Arts would certainly find the difficulty of obtaining a government appointment materially diminished by their previous training. The evening class for general instruction, conducted by Mr. Bartlett to the close of 1859, and since conducted by Mr. Adam Clarke, successor to M. De Baste, has been well attended, the average number of scholars being 20. The committee have to record their grateful sense of the services rendered by their secretaries, Messrs. Forster and Smith, and other gentlemen connected with the Penny Bank, which continues to be appreciated and used by the youth of the town. The gain on the transactions of the bank for the past year is £5 12s. 7d. The following lectures have been delivered during the year:—"Popular Proverbs," by G. Dawson, Esq., Birmingham; "Macbeth," by the Rev. M. Miller, Manchester; "The Poetry of Byron, Moore, and others," by Mr. Jeffreys, Stockton; "The Uncrowned Monarchs of Europe," and "The Genius and Writings of Lord Macaulay," by the Rev. E. P. Hood, London; "Electricity," (two lectures), by Mr. E. Wheeler; "Charles the 1st," "Charles the 2nd," "The Romance of the Bourbon Family," and "Cardinal Wolsey," by Mr. Daniel, London; "Foreign Travel, St. Petersburgh," by Mr. W. Taylor, Middlesborough. The statement of accounts shows that this has been done at an ultimate cost to the institution of £13 0s. 5d.; this loss being caused entirely by non-attendance at the delivery of lectures, the merit of some of which it would be scarcely possible to exceed. Various donations to the library have been made. The sum of £28 17s. 2d. has been expended on the library in binding and the purchase of new books, which, with the volumes presented, has increased the number from 2,613 to 2,737. The issue has been 9,890, against 9,951 in the preceding year, showing a decrease of 61. Efforts are in contemplation to extend the building, so as to comprise the formation of a museum, more especially of geology, and the committee, recognising the importance and value of such a collection in the centre of so great a mining district as that of South Durham, have received with much pleasure from the owners of adjoining property, a very liberal offer of a site, on which a suitable building could be erected; but, as it is uncertain how far this project would meet with the required support, they cannot at present do more than recommend it to the careful consideration of their successors. In the Penny Savings Bank in connection with the Institution, the total number of transactions during the year has been 9,569, viz., 8,797 sums received, and 772 paid; or an average of 184 weekly. The largest number in one evening has been 394, and the smallest 96. The number of accounts opened during the year has been 345; making a total of 1,855 accounts opened since the commencement of the bank. The number of accounts having balances on the 25th February last was 879, and the average amount at the credit of each account, 16s. 6½d.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Brit. Architects, 8. Mr. M. Digby Wyatt, "On Illuminated Manuscripts, as illustrative of the history of the Art of Design."

Tues. .....Statistical, 8.

Wed. .....Royal Soc. Literature, 4½.
Ethnological, 8½.

Thurs. ...Philosophical Club, 6.
Numismatic, 7. Anniversary.
Chemical, 8. 1. Dr. Lyon Playfair, "On Baudrimont's protosulphide of carbon." 2. Dr. Roscoe, "On the composition of diluted acids of constant boiling points."
Linnæan, 8. 1. Dr. Anderson, "Systematic account of all the plants hitherto found at Aden." 2. Mr. Bradford, "On Orchidaceous plants from Trinidad." 3. Mr. B. Clarke, "On a new arrangement of Phænogamous plants." 4. Prof. Greene, "On the mutual relations of the cold-blooded *Vertebrata*." 5. Dr. Hooker, "On Arctic Vegetation." 6. Ditto, "On the plants collected in Sir J. McClintock's Voyage of the Fox." 7. Ditto, "Præcursores ad Floram Indicam.—*Cruciferæ*." 8. Ditto, "New genera of plants from Borneo." 9. Mr. F. Walker, "On New Guinea *Diptera*."
Philosophical, 8.

Sat.....Asiatic, 2.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 18th, 19th, and 21st May, 1860.

302. Newspaper Postage—Return.
311. British Museum—Account and Estimate.
314. Cadetships—Returns.
315. Navy—Supplementary Estimate.
15. Railway and Canal Bills (152 Waterford and Limerick Railway (No. 2)—Board of Trade Report.
139. Bills—Highways (South Wales).
141. ,, Masters and Operatives (as amended by the Select Committee.)
96. ,, Husband and Wife Relation Law Amendment (Scotland).
129. ,, Titles to Land (Scotland) Act 1858 Amendment (amended).
140. ,, Tramways (Scotland).
142. ,, Refreshment Houses and Wine Licences (amended).
Greenwich Hospital—Report of the Commissioners.
Public General Acts—Cap. 16, 17, 18, 19, 20, 21, and 22.

Delivered on 22nd May, 1860.

294. Poor Relief (Ireland)—Returns.

Delivered on 23rd and 24th May, 1860.

300. Income Tax—Return.
312. East India (Military Despatch)—Return.
316. Railway and Canal Bills Committee—5th Report.
317. South Exeter Railway Company—Return.
318. Belfast Borough—Return.
319. Committee of Selection—6th Report.
315. (1) Navy (Supplementary Estimate)—Plan of Malta Harbour.
298. Grand Juries (Ireland)—Return.
108. Bill—Fisheries (Ireland).
136. ,, Registration of Births, &c. (Scotland)—Amended.
146. ,, Councillors of Burghs and Burgesses (Scotland).
Political Refugees—Correspondence.
Military and Naval Exhibition (Genoa and the Two Sicilies)—Despatch.

First Session, 1859.

208. (AXI.) Poor Rates and Pauperism—Return (A).

Delivered on May 25th, 1860.

309. Houses of Parliament (External Stonework)—Return.
155. Bill—Divorce Court.
Sicily (Landing of General Garibaldi)—Correspondence.

Delivered May 26th, 30th, and 31st, 1860.

15. Railway and Canal Bills (153. Denbigh, Ruthin, and Corwen Railway)—Board of Trade Supplemental Report.
236. (1). Elections—Return.
306. East India—Home Accounts.
320. Prince's Chamber (House of Lords)—Return.
322. Liverpool and Manchester District County Courts—Return.
324. National Education (Ireland)—Return.
335. Navy (Steam Vessels)—Return.
254. East India (Coinage)—Return.
84. (4). Trade and Navigation Accounts (30th April 1860.)
313. East India (Hindoo Temples)—Correspondence.
327. East India (Public Debt)—Account.
328. Packet and Telegraphic Contracts—1st Report from Committee.
333. Metropolis Turnpike Roads—34th Report of the Commissioners.
336. Reform of Parliament (England) Act, &c.—Return.
138. Bills—Local Government Supplemental.
145. „ Registration of Births (Ireland) (No. 2) (amended).
148. „ Offences against the Person.
149. „ Malicious Injuries to Property.
150. „ Coinage Offences.
151. „ Accessories and Abettors.
152. „ Forgery.
153. „ Larceny, &c.
154. „ Criminal Statutes Repeal.
143. „ Roman Catholic Charities (amended).
144. „ Landlord and Tenant (Ireland) (No. 2).
158. „ Smithfield Markets, Streets, and Improvements.
159. „ Coroners (No. 3).
160. „ Savings Banks and Friendly Societies Investments (amended).
162. „ Universities and College Estates.
Japan—Correspondence respecting Trade.
Public General Acts—Cap. 23, 24, 25, and 26.

Delivered June 1st, 1860.

277. Parliamentary Voters—Return.
322. Parliamentary Cities and Boroughs—Return.
307. Masters and Operatives—Report from the Committee.
133. Bill—Herring Fisheries (Scotland) (amended).
China—Further Correspondence with Mr. Bruce.
Education—Report of the Committee of Council.

Delivered June 2nd and 4th, 1860.

39. Turnpike Trusts—Return.
310. Stockton and Stokesley County Courts—Returns.
326. Langstone Harbour—Copy of Memorial.
334. Shipping—Returns.
301. Augmentation of Livings—Return.
323. Voters, &c.—Return.
325. Statute Book—Return.
336. (1). Reform of Parliament (England) Act, &c.—Further Return.
337. Church Leaseholds—Further Return.
342. Navy (Number of Men entered, &c.)—Return.
343. Ecclesiastical Commissioners (Metropolis)—Return.
345. National Collections—Return.
348. Coals (Navy)—Return.
259. Electoral Division (Ireland)—Return.
163. Bill—Lands Clauses Consolidation Act (1845) Amendment.
Railways in India—Report of Juland Danvers, Esq.

Delivered June 5th, 1860.

330. East India (Army)—Return.
340. National Portrait Gallery—3rd Report of the Trustees.
349. Navy (Gun Boats)—Return.
147. Bills—Caledonian and Crinan Canals.
157. „ County Rates and Expenditure.
165. „ Leasing and Improving Lands (Ireland).

Delivered on 5th June, 1860.

161. Bill—Annuity Tax Abolition (Edinburgh) (amended).

Delivered on 7th June, 1860.

305. East India—Finance and Revenue Accounts,
329. Corrupt Practices Prevention Act, 1854, &c.—Report from Committee.
161. Bills—Friendly Societies Act Amendment.
166. „ Tithe Commutation.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 8th*, 1860.]

Dated 8th February, 1860.

342. G. A. Huddart, Brynkir, Caernarvon—Imp. in apparatus for obtaining motive power.

Dated 14th April, 1860.

938. L. M. Boulard, 39, Rue de l'Echiquier, Paris—An improved apparatus for preventing or destroying incrustations in steam boilers.

Dated 23rd April, 1860.

1010. J. A. Philippe, 14, Rue du Ponceau, Paris—A new process and apparatus for bleaching fabrics and substances that can be bleached, such as thread, textile plants, and paper pulp.

Dated 2nd May, 1860.

1106. W. S. Jackson, Milton-street, Dorset-square, Middlesex—Imp. in the manufacture of soap.

Dated 9th May, 1860.

1141. G. Scott, 15, Ashburnham-terrace, Greenwich, Kent—Imp. in furnace or grate bars.

Dated 11th May, 1860.

1172. W. Brown and C. N. May, Devizes—Imp. in brick-making machines.

Dated 16th May, 1860.

1202. C. H. Simpson, Bexhill, Sussex—Imp. in propelling vessels through the water, and apparatus connected therewith.

Dated 17th May, 1860.

1210. W. Krutzsch, Chamber-street, Goodman's-fields—Imp. in mortars.
1212. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved handle or holdfast for files, chisels, and similar tools. (A com.)
1216. J. Nicholson, Chaple-house, Hensingham, Whitehaven, Cumberland—Imp. in reaping machines.
1218. A. Robertson, Neilston, Renfrew, and A. Ritchie, Glasgow—Imp. in steam boiler and other furnaces, and in the prevention of smoke.
1220. J. Cole, Coventry—Imp. in looms for weaving.
1222. R. A. Brooman, 166, Fleet-street—An improved mowing machine. (A com.)
1226. W. Geeves, Caledonian Mills, New Wharf-road, Battle-bridge—Imp. in saw mills.

Dated 19th May, 1860.

1228. H. N. Nissen, Mark-lane—Imp. in the preparation of paper, in order to prevent the extraction or alteration of writings thereon without detection.
1230. J. Ferguson, Paisley—Imp. in and connected with looms for weaving.
1234. S. Davey, 32, Hatton Garden, Middlesex—Imp. in fastenings for attaching buttons, studs, brooches, or other ornaments and fastenings, to articles of dress, and for other uses.
1236. A. V. Newton, 66, Chancery-lane—An improved liquid preparation of tobacco. (A com.)
1238. W. E. Newton, 66, Chancery-lane—Imp. in printing blocks for printing fibrous and textile fabrics. (A com.)
1240. C. Binks, Parliament-street, Westminster, and J. Macqueen, Old Jewry—Imp. in treating certain manganese compounds for obtaining oxides of manganese and other products therefrom.

Dated 21st May, 1860.

1243. T. Blakeley, Liverpool—Imp. in rotary engines.
1245. T. W. Teulon, Euston-road, Middlesex—Imp. in chimney tops.
1246. W. Barker, jun., Huyton Brewery, near Liverpool—Improved apparatus for regulating the temperature of ale, beer, porter, and other liquids during the process of fermentation.
1247. J. Craig, Paisley—Imp. in cropping and clipping machines, for the treatment of woven fabrics.
1248. S. R. Samuels, Nottingham—Imp. in machinery used in weaving.
1249. G. Nimmo, Glasgow—Imp. in the manufacture of iron.
1251. W. E. Newton, 66, Chancery-lane—Imp. in the mode of, and apparatus for, winding clocks and other time-keepers. (A com.)
1252. A. Holland, Queen-street, Oxford-street—An imp. in the construction of roller blinds. (A com.)

Dated 22nd May, 1860.

1254. J. W. Wilson, Buckingham-street, Strand, and J. Harris, Gresham-street, London—A new method of constructing and forming boxes or cases, for containing and enclosing different articles, more especially during their transmission by post or other conveyance.
1256. S. Hood, 68, Upper Thames-street, London—The manufacture of improved wrought iron sash-frames and casements, and all kinds of wrought iron framing.
1258. B. Blackburn, Clapham-common, Surrey, and H. Carr, Victoria-street, Westminster—Imp. in railway axle-boxes and axles.
1262. J. Hickisson, Maria-street, Kingsland road, Middlesex—Imp. in means or apparatus for ascertaining the character of metals, particularly applicable to the detection of counterfeit coin.
1264. J. Paton, Glasgow—Imp. in machinery or apparatus for winding, lifting, and boring for mining purposes.
1266. W. Cilssold, Dudbridge, Gloucester—An imp. in the manufacture of driving belts.

Dated 23rd May, 1860.

1269. G. Paul, Glasgow—Imp. in machinery for winding yarn or thread.
1270. T. Cope, Liverpool—Imp. in the treatment and preparation of tobacco.
1271. W. H. Burnett, Margaret-street, Middlesex—Imp. in electric telegraphs, and in apparatuses employed therewith, a part of which improvements is applicable to the winding of clock-work.
1272. M. Cavanagh, Kensington, Middlesex—Imp. in lock spindles.

1273. P. E. Chevalier, 22, Boulevart St. Martin, Paris—An improved table stand for the support of glasses and other articles.
1274. G. Bartholomew, Linlithgow, N.B.—Imp. in shoes for the feet of horses and other animals.
1275. R. H. Collyer, Alpha-road, Regent's-park—Imp. in the manufacture of tubes and other vessels and other articles, and in the machinery and apparatus connected therewith.
1276. C. F. Atkinson, Sheffield—Certain imp. in the manufacture of chains.
1277. J. Summerscales and J. Sagar, Keighley, Yorkshire—Imp. in washing, wringing, mangling, squeezing, and crushing machines.
1278. T. Heppleston, Manchester—An imp. or imps. in breach loading fire arms, and in projectiles to be used therewith.
1279. W. Howard, 24, Great Russell-street, Middlesex—An improved window blind.
1280. D. Mulkay, 69, Rue Rasière, Brussels—Imp. in springs for supporting or distending ladies' dresses.
1281. W. H. Barker, Kingston-upon-Hull—Imp. in moulds for candles.
1282. F. J. E. Duclos de Boussois, 16, Place Vendome, Paris—Imp. in the manufacture of tubes, hollow axles, shafts, gun-barrels, masts, and other tubular metal articles.
1283. F. J. E. Duclos de Boussois, 16, Place Vendome, Paris—Imp. in the treatment of bituminous rocks, for the extraction of bitumen therefrom, and in the application of the residuum to various useful purposes.

Dated 24th May, 1860.

1284. J. Sharp, Bradford—Imp. in looms for weaving.
1285. R. H. Heighway, Strand—An improved cooking apparatus.
1286. T. Johnson, Plumstead, Kent—Imp. in machines for washing bottles and jars.
1287. R. C. Clapham, Walker, Northumberland, and R. Cail, Gateshead, Durham—Improved deodorising agents.
1288. W. Baker, Sheffield—Imp. in the manufacture or production of white lead.
1289. W. E. Newton, 66, Chancery lane—Improved machinery or apparatus for mixing and moulding materials for the manufacture of fuel, part of which machinery or apparatus is applicable to moulding bricks and other analogous articles. (A com.)
1290. J. Paddon, Swansea, and W. Lowther, Briton Ferry, near Neath, South Wales—Imp. in coke ovens. (A com.)
1291. F. W. Prince, 15, Wellington-street, London Bridge—Imp. in fire arms and ordnance.

Dated 25th May, 1860.

1293. Captain C. D. Waddell, Queen's-terrace, Bayswater—Imp. in ordnance or fire arms, and in the application and arrangement of the propelling agents with which they are charged.
1294. J. Hingham, Halifax, and G. Collier—Imp. in the manufacture of fabric of the character of that technically called "camlet."
1295. J. Mackintosh, North Bank, Regent's-park, Middlesex—Imp. in breach-loading fire arms, ordnance, cartridges, and projectiles.
1297. B. Finch, Beaufort square, Chepstow—An imp. in the arrangement of the rudders of ships and vessels.
1298. T. Dickins, Middleton, Lancashire, and G. McCulloch, Manchester—Imp. in machinery or apparatus for spinning and doubling silk, cotton, and other fibrous materials.
1299. G. Wallis, 16, Victoria-grove, Fulham-road, West Brompton—New or improved methods of preparing drawings, writings, designs, prints, or impressions of engravings and photographs for the purpose of impressing or engraving the same in or upon metallic substances, and thereby producing printing or embossing surfaces or ornamental metallic surfaces for such purposes as the same are or may be applicable to, also new or improved machinery to be employed in the said impressing or engraving.

Dated 26th May, 1860.

1300. G. De Laire and C. Girard, Paris—A new process for manufacturing red and violet colouring matter.
1301. E. T. Hughes, 123, Chancery lane—Improved methods of obtaining artificial light, and in the apparatus and burners connected therewith. (A com.)
1303. G. Elliot, Houghton-le-Spring, Fence Houses, Durham—Imp. in weighing coals at the screen, and in the apparatus for the same.
1304. G. D. Jones, Pentonville—Imp. in the manufacture of sand, emery, and glass papers and cloths, and in the machinery employed therein.
1305. R. A. Brooman, 166, Fleet-street—Treating certain animal substances in order to obtain albuminous, gummy, glutinous, and glairy products and fat. (A com.)
1306. G. Dowler, and G. J. Farmer, Birmingham—Imp. in machinery for the manufacture of boot-heels and tips, coins, medals, tokens, checks, and such like articles.
1307. J. Dale, and H. Caro, Manchester—Imp. in obtaining colouring matters for dyeing and printing.

Dated May 28th, 1860.

1309. G. Robinson, Newcastle-upon-Tyne—Imp. in the manufacture of salts and preparations of ammonia.
1311. W. J. Murphy, Cork—An improved motive power engine.
1313. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in ruffles or gathered fabrics, and in the apparatus employed in their manufacture. (A com.)
1315. H. Ditchfield, Calceth, near Manchester—Imp. in machinery or apparatus for folding woven fabrics.

Dated 29th May, 1860.

1317. C. Schiele, Bebbington, Cheshire—Imp. in the manufacture of lubricants. (A com.)
1319. C. Berck, Herve, Belgium—Imp. in the manufacture of the selvages of woollen cloths and other stuffs.
1321. J. Dugdale, jun., and E. Dugdale, Blackburn—Imp. in the construction of journals and bearings for shafts, spindles, and other similar articles.
1323. W. S. Nosworthy, Coleman-street, London—Imp. in pianofortes.
1325. A. Samuelson, Scott-street Foundry, Hull—Imp. in gun boats.
1327. H. Hughes, Homerton, Middlesex—Imp. in machinery for goffering, fluting, shaping, embossing, and connecting together, lace, ribbons, and other like materials, parts of which improvements are also applicable to the shaping and corrugating of metals.
1329. R. H. Collyer, Alpha road, Regent's-park—Imp. in telegraphic cables, also applicable to other similar purposes.

Dated 30th May, 1860.

1331. E. A. L. D'Argy, 29, Boulevart St. Martin, Paris—An improved candlestick.
1333. W. Pickstone, Radcliffe, and W. Bacon, Southport, Lancashire—Imp. in machinery for dyeing, washing, and sizing.
1335. E. Carless, Bow-common, Middlesex—Imp. in the manufacture of all kinds of candles, for the purpose of rendering them free from guttering.

Dated 31st May, 1860.

1337. W. R. Bowditch, St. Andrews, Wakefield—Imp. in the purification of coal gas, and of coal oils.
1339. S. Rowbotham, Putney—Imp. in the composition and manufacture of soap.
1341. C. Aldin, Clapham park—An imp. in the construction of paving-tiles.
1343. J. A. Manning, Inner-temple, Middlesex—Imp. in the treatment, application, and use of sewerage matters and the general wastes of towns and factories.
1345. G. Mackenzie, Paisley, and J. Hamilton, Glasgow—Imp. in bobbins or holders for textile materials.
1347. W. H. Harfield, Royal Exchange-buildings, London—Imp. in capstans and windlasses, and in shackling-chains.

Patents Sealed.

[*From Gazette, June 1st*, 1860.]

June 8th.

2793. J. Lawson.
2795. J. Tenwick.
2799. J. Thomson, R. Thomson, and H. Thomson.
2813. R. Emery.
2815. P. G. Gennerich.
2817. P. Stirling.
2818. G. C. Watson.
2833. J. H. Dickson.
2835. W. Clark.
2843. J. Rhodes.
2867. R. Morrison.
2879. W. Clark.
2903. A. Welch.
2918. A. V. Newton.
2940. H. B. Barlow.
9. J. H. Johnson,
78. A. V. Newton.
148. T. K. Callard.
222. J. H. Johnson.
431. J. H. Johnson.
733. T. Richardson.
799. J. A. de Maniquet.
818. J. Buchanan.
845. T. Gamble and E. Ellis.
890. J. H. Johnson.

[*From Gazette, June 12th*, 1868.]

June 12th.

2830. J. Barling.
2836. T. Bolton, J. Bertenshaw, and J. McConnell.
2837. J. Champion.
2844. A. B. Ibbotson.
2845. W. Watson.
2848. G. Leslie.
2854. E. Cormier.
2857. C. Hancock.
2863. W. Mosley, jun.
2866. H. Stokes.
2874. T. W. Plum.
2994. J. Braggins.
333. W. Wain.
631. G. H. Birkbeck.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, June 8th*, 1860.]

June 4th.

1579. R. Roberts, W. Shaw, and S. Shaw.

June 5th.

1598. A. F. Sheridan.

June 6th.

1645. J. Whitworth.

[*From Gazette, June 12th*, 1860.]

June 7th.

1605. W. Wright.
1629. G. Sampson, J. Sampson, and E. Ledger.
1639. J. Robertson.
1641. J. L. Clark.
1646. J. Buchanan.

June 8th.

1655. E. Barsanti & F. Matteucci.
1665. A. V. Newton.

June 9th.

1623. J. Brown.
1635. W. E. Newton.
1671. W. E. Newton.
1672. R. Levick, jun., and J. James.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, June 8th*, 1860.]

June 4th.

1404. J. Horrocks, jun., and J. D. Horrocks.

[*From Gazette, June 12th*, 1860.]

June 9th.

1423. J. Westwood and R. Baillie.

Journal of the Society of Arts.

FRIDAY, JUNE 22, 1860.

FINANCIAL STATEMENT.

The following Statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye Laws, which provides that at the Annual General Meeting "the Council shall render to the Society a full account of all their proceedings, and of the Receipts, Payments, and Expenditure during the past year; and a copy of such Statement shall be published in the *Journal* of the Society on the Friday before such General Meeting."

ANNUAL STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31st MAY, 1860.

Dr.

			£ s. d.
To Subscriptions for the year ending 31st May, 1860:—			
From Members and Institutions in Union with the Society			3,522 8 11
Outstanding		£1,459 18 0	
Due on former years	£337 1 0		
Estimated not recoverable	182 7 3—	519 8 3	
,, available arrears of the year		940 9 9	
Life Contributions			84 0 0
To Dividends on Stock:—			
£5,136 3s. 10d. Consols		148 6 2	
£388 1s. 4d. New Three per Cents		11 4 2	
			159 10 4
Interest on Deposit Account			2 9 0
To Sale of Microscopes		9 7 6	
,, Transactions, Books, Papers, &c.		10 10 11	
,, Catalogues of Exhibitions		18 16 6	
Admissions to the Ross Exhibition		19 17 0	
			58 11 11
To Payment in aid of Expenses of the Artistic Copyright Committee by the Royal Academy		40 0 0	
,, ,, Society of Painters in Water Colours		20 0 0	
			60 0 0
To Special Subscriptions held in trust:—			
Balance of Examination Prize Fund, at the London and Westminster Bank		40 2 0	
Subscriptions to the Fund received during the present year		84 12 0	
Ditto outstanding	£14 14 0		
			124 14 0
Marine Algæ Prize	70 0 0		
			£4,011 14 2
By Excess of expenditure over income			495 17 10
			£4,507 12 0

Cr.

		£ s. d.	£ s. d.
By General Establishment Expenses:—			
Rent, Rates, and Taxes		196 14 11	
Insurance, Gas, Coals, and House Charges		136 18 9	
Salaries, Wages, and Commissions		956 16 3	
Postage Stamps and Carriage of Parcels		99 15 6	
Stationery and Printing (not including Journal)		118 15 0	
Advertising		13 0 6	
			1,522 0 11
By General Expenditure:—			
Working Classes Museum		0 16 0	
Female School of Art		10 10 0	
Library		92 2 7	
Journal	£983 8 3		
Less charged to Union of Institutions	196 13 8		
		786 14 7	
Union of Institutions, including Journal, Examinations, List of Lecturers, Postage, Stationery, Printing, and other charges		787 14 11	
Examination Prizes awarded		210 0 0	
Medals		21 0 0	
Exhibition of 1862		552 5 4	
Exhibition of the Works of the late Sir W. C. Ross, R.A.		49 10 9	
Exhibition of Inventions		73 14 0	
Exhibition of Italian Furniture		0 9 0	
Artistic Copyright Committee, during the present year		27 3 10	
Musical Pitch Committee		9 9 0	
Surgical Instrument Committee		3 6 6	
Dinner		33 10 0	
Two Conversazioni		161 14 6	
Repairs, Alterations, and Furniture		165 10 1	
			2,985 11 1
			£4,507 12 0

BALANCE SHEET, 31st MAY, 1860.

Dr.

To Sundry Creditors, viz:—			
To Tradesmen's Bills	577 11 8		
Exhibition of 1862	334 11 10		
Fees to Examiners	151 4 0		
Examination Prizes	210 0 0		
Salaries and Commissions	21 17 9		
		1,295 5 3	
To Economic Museum		212 15 2	
Examination Prize Fund		124 14 0	
Do. Outstanding	14 14 0		
Marine Algæ Prize	70 0 0		
To Trust Liability in respect of Government Stock (Consols) held for specific purposes, as per contra, viz., Set apart to answer:—			
Swiney Prize	1,333 6 8		
Stock Trust	100 0 0		
To Government Stock New 3 per Cents., set apart to answer Fothergill Trust	388 1 4		
		£1,632 14 5	
By Excess of Assets over Liabilities		4,259 5 10	
		£5,892 0 3	

Cr.

By Cash in hand:—			
At Messrs. Coutts and Co.	251 0 11		
At Commercial Bank on Deposit	111 18 3		
,, ,, ,, on General Account	84 0 0		
At London and Westminster Bank, available for Examination Prizes.	127 3 0		
At London and Westminster Bank, held in trust to be awarded as a Prize for an Essay on Marine Algæ, £70.			
		574 2 2	
By Consols, £3702 17s. 2d., at 95¼.		3,526 19 0	
By Subscriptions in arrear	1,459 18 0		
Estimated not recoverable to the amount of	400 0 0		
		1,059 18 0	
By advance on Account of the Exhibition of 1862		731 1 1	
By Government Stock held in trust applicable to specific purposes, viz.:—			
Consols	1,433 6 8		
New 3 per Cents.	388 1 4		
		£5,892 0 3	

Society's House, Adelphi,
June 15, 1860.

(Signed) SAMUEL REDGRAVE, ARTHUR J. LEWIS, } *Auditors.*
P. LE NEVE FOSTER, *Secretary.*

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council, at their meeting on Wednesday last, the 20th inst., that the amount of the Guarantee Fund promised up to that date, was £319,300.

The following has been received from the Secretary to the Royal Agricultural Society:—

June 7th, 1860.

Sir,—I had the pleasure of submitting your letter of the 5th inst. to the Council of this Society at their meeting yesterday, and am instructed to inform you that, though unable as a body to contribute to the Guarantee Fund which is being raised by the Council of the Society of Arts towards the International Exhibition of 1862, they are fully sensible of the advantages to science and art likely to be derived from the Exhibition.

The papers you were good enough to enclose, were distributed amongst the members of Council, from some of whom you will no doubt hear in their individual capacity.

The success of the International Exhibition will so materially affect the interests of this Society in holding their meeting in the metropolis, that the Council desire me to express their sense of the cordial feeling entertained by the Council of the Society of Arts, and their hope that, as in 1851, success will crown the efforts of both Societies.

I am, &c., H. HALL DARE, Secretary.

P. Le Neve Foster, Secretary, Society of Arts.

NINTH ANNUAL CONFERENCE.

The Ninth Annual Conference with the Representatives of the Institutions in Union and of the Local Boards, takes place at the Society's House this day (Friday), at half-past ten o'clock. Sir Thomas Philips, F.G.S., Chairman of the Council, in the chair.

ANNUAL DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society takes place at St. James's Hall, Piccadilly, this day (Friday), at six o'clock punctually, the Right Honourable Benjamin Disraeli, M.P., in the chair.

ANNUAL GENERAL MEETING.

The One Hundred and Sixth Annual General Meeting, for the purpose of receiving the Council's Report, and the Treasurer's Statement of Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held (in accordance with the Bye Laws) on Wednesday, the 27th inst., at 4 o'clock, p.m.

The Council give notice that at this meeting they will propose to repeal that portion of Bye-Law No. 9 referring to the election of the chairman of the Council, which declares that "the Chairman of the preceding year shall not be re-elected to that office."

The Council hereby convene a Special General Meeting of the Members of this Society, to ballot for the election of Members, such meeting to take place at the close of the Annual General Meeting. By order of the Council,

P. LE NEVE FOSTER, *Secretary.*

ON THE DECAY AND PRESERVATION OF BUILDING MATERIALS.

By Professor D. T. Ansted, M.A., F.R.S.

The following lecture was delivered at the Royal Institution on the 24th May, 1860:—

The subject of my present lecture is eminently practical, and hardly admits of much variety of illustration; but I am sure that none of you can have examined, or even glanced at the numerous specimens of architectural construction in the older and more picturesque cities of England and the Continent—you cannot have admired the graceful tracery of Westminster Abbey,—you cannot even have looked at the rich detail of the noble building recently erected so near it, by one whose genius will, perhaps, be willingly acknowledged, now that he has departed from amongst us, without noticing the facts I am about to refer to.

You will there see, at every turn, fresh proof of apparently capricious and unaccountable decay. You will find many old stones unaltered, while many new ones are mouldering fast into rottenness; and you will, I believe, be interested, in spite of the apparent dryness of the subject, in anything that will inform you about a result so painful, so irregular, and so desirable to check, if in any way its prevention is possible.

Our building materials are of several kinds. Let me point out to you the principal varieties—their peculiar uses—their relative value for special purposes—and the special causes of decay in each. I shall then endeavour to put before you the modes by which such materials may be, at least in some measure, preserved from decay.

There is one thing which I may say with regard to all building materials of the nature of stone,—namely, that wherever it is found forming part of the earth's crust as a mass of rock, it is invariably,—if it comes to the surface at all—injured and altered near the surface. In a granite district, for example, where there is scarcely any soil lying over the granite, it scarcely ever happens that the upper portion of the granite does not, to a certain extent, exhibit marks of alteration. In all the common absorbent stones which are ordinarily used for building purposes, this is much more remarkably the case. And, to a certain extent, the rate at which the stone would be injured may be estimated by its appearance where it has been thus exposed for a long time to the action of the atmosphere. But that can only be taken as a partial measure of the injury likely to occur, because in some cases it will happen that stone will stand exposure perfectly well in its own atmosphere, and when the surface only is exposed, without having been removed from the bed, although that same stone, when it is removed from the bed, particularly when it is placed in a different position from that which it occupied in the bed, will decay much more rapidly. Still, as I have said, it is an indication, and you will generally find that in a granite district, a surface of good granite is exceedingly hard close to the top, and a decomposing granite worn and rotten. In a sandstone district there will also be a certain amount of decomposition dependent on the value of the stone. And in a limestone district there will generally be considerable decomposition; in fact, the whole of the upper bed of limestone will be converted into vegetable soil.

Let us now take the building materials in regular order. First of all there is the group of which granite is the representative. A very remarkable group of stones is this, which are perfectly familiar to everyone. With respect to it, therefore, I shall not waste your time in definitions, and merely remark that as it is one of the hardest, and, in some respects, one of the most valuable stones we have, yet in many respects, although very useful, it is almost impracticable for delicate ornamentation. Granite consists of a number of crystals embedded in a crystalline base. In other words, it is a mass of crystalline minerals crystallised altogether. That is the essential nature of granite, and the point in which it differs from most other stones. This explains at once its value,

and the nature of its decay. Its value, because granite, being composed entirely of crystallised matter, is non-absorbent, and very little exposed to injury, so that there is no opportunity for decomposing agencies to get to it, without the lapse of a very long period of time. But it is also necessary to observe that granite consists of various kinds of crystals, and these not being always composed in the same manner, some are more liable to decay than others. Among the crystals that form granite are crystals of quartz, a material so durable that one hardly expects it to fail at all. But quartz, under certain circumstances, is capable of assuming a state in which, by the action of the weather, it will decay. This very peculiar state I shall speak of afterwards, when I have to ask your attention to some means of preventing decay. It is a fact—and I allude to it now as one of the ways in which granite appears subject to decay. A portion of quartz seems to be liable, in some states, to combine with water; and it then can be acted upon by alkalies and alkaline carbonates. More frequently it is the crystals of felspar, of which granite also consists in a large measure, that decay. These consist of compound silicates, and the alkali among them is generally potash, but occasionally soda. When the alkali is soda, the stone is more likely to decay than when it is potash. Mica or talc, the other constituent of granite, is in a similar way liable to decomposition. Thus, although granite, as a stone, seems scarcely liable to injury, yet all the different parts of it are really capable of decay. With regard to the prevention of granite from decay, I do not know that it has ever been attempted. The only thing to be done is to select the better kinds, and you have only to go to the British Museum, and look at those wonderful specimens which have been delicately sculptured by the Egyptians, and afterwards exposed for so many centuries to a dry atmosphere, and now for some years to our own moist atmosphere, to observe how totally untouched they are. You have only to look at the various specimens of granite in our own metropolis, or in other parts of our island, and you cannot fail of being convinced how well it stands generally, although you may occasionally find unfavourable specimens.

Granite is a material which, owing to its great hardness, requires to be worked by pick and wedge; it cannot be worked merely by chisel and mallet. Owing to that it is expensive, and, generally speaking, cannot be used for ordinary purposes.

Next we come to the group of freestones. Freestones are either sandstones or limestones. The sandstones form a large group, but they are not very extensively used for the more decorative parts of buildings. They are at any rate little used in London, and there are many reasons for this. Sandstone consists for the most part of quartz sand, and I have told you that quartz forms a larger part of granite. But the particles of quartz in sandstone are cemented together by some foreign combining substance; sometimes this substance is silica, and in that case the stone will be almost unchangeable. Such is the sandstone that is worked in Edinburgh, and obtained at Craigleith. It is a stone which scarcely injures by exposure. Most of the sandstones, however, are cemented together, either by carbonate of lime, which has been filtered in by the action of water, by a mixture of clay and carbonate of lime introduced in the same manner, or by the presence of oxide of iron. All these cementing media are of course liable to the action of foreign substances upon them, according to their nature. And if these give way it is clear that the stone itself must give way. For an example of this kind of stone, that scarcely changes at all, I may direct your attention to a few specimens of the Yorkshire stones on the table before you. Although very excellent, however, these stones are not very manageable. They are difficult to work, and very hard. Although very durable they vary, and are not quite free from the ordinary faults of sandstone. There is also before you a specimen of red stone (Mansfield) in which there is a considerable quantity of iron. The others are silica, with some mica, and are cemented by calcareous and argillaceous matter. They are thus liable to the ordinary action of weather and foreign substances upon them. In these stones the particles of silica rarely, if ever, give way, but they are liable to fall away from each other by the decomposition of their cementing medium. But I was going to speak of the several kinds of sandstone before going into the causes of decay. The Yorkshire stones are the next in value after Craigleith, and are very good. Some of the dark-coloured Scotch stones are also excellent. The stones from the coal measures are better than these red ones, which are not by any means advisable, and require to be used with care. There are a number of varieties of these red sandstones. All the sandstones used may be grouped in these three ways:—Those that are very hard, very compact, very fine in grain, and, generally speaking, of a pale colour; these are durable, but costly. Next, there are those that are hard and laminated. That is the character which belongs to almost all rocks that have been found in water, but in some it shows itself more markedly than in others. In stones which are completely laminated, the appearance is like sheets of paper placed one over the other, and you can almost separate them. Those stones are easily perishable. There are, however, laminated stones, such as those I am now referring to, of good quality. These are generally not of very fine grain, although they may be so. They are most frequently of a mixed grain, made up of particles of sand and small pebbles of different sizes. Very often they have reddish tints of colour, owing to the presence of iron, and they are often very irregular in their character. Lastly, there are some soft stones which are laminated, and generally red, but soft and bad. These are the three kinds of stone.

All these stones are subject to decay in this way:—First, from the lamination. Having been formed in water, they have been deposited in beds one over the other, and never become entirely free from water, and when exposed to the air are liable to give off the water by evaporation, and take it in again by absorption when rain comes, or when the atmosphere is damp. After this, if a change of temperature follows, and a severe cold sets in, the temperature of the stone passing below the point of the extreme density of water, the water begins to expand. That expansion, before and whilst freezing, is one of the properties of water with which you are probably acquainted. You all know that if you leave water in a jug with a narrow neck, and frost sets in, the water will expand and break the jug. In the same way laminated and absorbent stones will break. The water gets in but cannot get out freely. It expands, and the stone breaks. Secondly, water entering in the manner I have described contains foreign substances. The water in the atmosphere that falls in the shape of rain is absorbed into the stone, and necessarily contains those foreign substances floating in the atmosphere which are soluble in water. These substances include a large number of gases, —acid gases for the most part—but some others. For example, they include carbonic acid gas, and carbonic acid dissolves in water; they include, also, sulphurous acid passing into sulphuric acid, and this is taken up by the water. They include, also, ammonia. All these substances are abundantly produced in the atmosphere of large towns. These substances entering into the body of the stone, begin to act upon the cementing medium. If the cementing medium is easily acted on chemically by these substances, it is of course very soon removed. If it is not easily affected by them, then the stone remains unaltered; but, generally speaking, it is the case that sandstones that have either lime or clay as their cementing medium, are more or less affected by foreign substances entering into them through the atmosphere. There is then a cause of decay in the sandstones, and the sandstones, when they are very absorbent, generally become readily disintegrated in this manner. Sandstones are not very extensively used in London for building, but they are very much employed in many parts of the country.

The next group includes what we call limestones. Limestones differ more in their nature than sandstones do, and include different kinds of material. For example, there are the carbonates of lime pure and the carbonates of lime and magnesia. First of all, I will take the carbonates of lime. Some of these are perfectly crystalline, such as marble. Marble has a very close texture; it does not absorb water, and it is, therefore, little acted upon by it unless it contains acids. When sound it lasts a long time, but if cracked, decay will enter in where the crack occurs. Marble is a very expensive stone, and the quantity of it compared with the other kinds of limestone is small, but there is a good deal of a sort of limestone intermediate between marble and common oolites. This is generally hard, and not unfrequently contains thin strings of foreign substances, as silica, which interfere with its working. Such stones are found in Derbyshire, and belong to what geologists call the carboniferous or mountain limestone series. They are crystalline, but irregular, being partially cracked and containing many fossils. A large majority of the limestones used in this country, are oolites, so called because they appear to be made up of a number of eggs. These oolites are of various qualities. They are found in many parts of the country, and are commonly used for building, being, in fact, our common materials. There are several varieties of them which are of different value. One of the best is the Portland stone. There is a specimen upon the table, and a very good specimen it is. These stones are made up of a number of little particles, which are themselves groups of smaller particles. These little particles are cemented together by carbonate of lime, and the whole stone is nearly pure carbonate of lime. Portland is probably the best building stone we have in England, but is dear, being hard and expensive to work. St. Paul's Cathedral is built of Portland stone, and so is Greenwich Hospital, both being excellent examples. It is impossible, perhaps, to find better specimens of this stone than the Hospital. A few days before his death, I was with Sir Charles Barry at Greenwich Hospital, and he was pointing out to me the beautiful condition of the stone on the east face. It is, indeed, worth looking at as a specimen of the material, and is almost, if not quite, equal to the marble of which Milan Cathedral is built. There are many other good specimens of this stone in London, and of these the Reform Club is as good as any. If you look at these specimens of the better kind, you will hardly recognise the decay that takes place. You must look at stones which have been a long time exposed, or else at an inferior quality of material. Bath stones offer a wonderful contrast to Portland. Bath stone is almost as soft as cheese in the quarry, and it can then be cut with an ordinary knife. I speak now of the stones in the quarry, where all stones are softer and more easily worked than when they have been exposed for some time to the air. Bath stone, being exceedingly soft, is therefore cheap. It is easily got and easily cut, but it is not a stone that wears well. Some specimens of Bath stone are to be seen in the recent restorations of Westminster Abbey that have failed so completely as to be already a great deal worse than much of the stone that has been there for centuries. Within the few years that have elapsed since this stone was put up, it has decayed entirely. And yet stones of the same kind, from nearly the same quarry—indeed some from the identical quarries—have been used in the City of Bath, and are not much the worse after a century's wear. There is a difference in the quality of the stone, but there is also a great difference in the quality of the air to which stones are exposed. The rapid decay may, however, be partly attributed to the fact that the stones for Westminster Abbey had not been well-selected, and perhaps the stones used at Bath had been for some time exposed to the air before use. Bath stone is, as I have said, an exact opposite to Portland. But we have other stones that are bad. I do not know that I can mention a more remarkable instance than the stone which is obtained at Heddington, in the neighbourhood of Oxford. There are some specimens of the different oolites on the table, and the Heddington is in some respects the worst of all. No one, I think, can have looked at some of the older buildings in Oxford without seeing what a bad state they are in, and how bad the stone itself must be. I have here a specimen of Heddington stone, that has been exposed for a short time to the action of acids, and it shows the way in which such stones will decay. Besides these there are a number of stones of intermediate quality in England, known by various names—the names of the quarries in which they are found. There is the Ancaster stone, the Ketton stone, the Barnack stone, and the Purbeck stone. There is another limestone to which I wish to direct your attention—that is the Caen stone. A vast quantity of stone has been obtained, from time immemorial, from some of the quarries in the neighbourhood of Caen, and some other places near. This stone has been brought over to England almost from the time of the Norman conquest. Part of Canterbury Cathedral is built of it, and it has stood very well. But other stones from the same or from adjacent quarries have gone entirely. They have failed so thoroughly that it is impossible to conceive anything worse. They are even worse than the Heddington stone in the worst cases in Oxford. There is a specimen before me of Caen stone showing decay; it shows the quality of the stone, and it shows the way in which decay takes place. This, however, although a decayed stone, is not a bad specimen. I could not get the sort of specimen I should have been glad of, to show how badly some Caen stone decays. But there have been some buildings erected lately in London, and I am sorry to say that one of them is Buckingham Palace, that show the decay as clearly as can be. Soon after the palace was completed, the stone became in so bad a state that it was positively dangerous for the sentinels to walk underneath it, and it was necessary to remove large portions of it and to substitute stucco; and there it remains to this day painted over. This case, with regard to a common limestone, will show what sort of material we have to deal with. All the cheaper kinds of stone are exceedingly liable to decay.

How does limestone decay? It decays in a very simple way, and from the same causes that I alluded to in speaking of sandstones. First there is an exposure to changing temperature, all the limestones being absorbent, and taking in a certain quantity of water. The water is driven in by rain, particularly in what appear to be the sheltered parts of the stone, beneath projections. Then cold comes, and even if the stone has been placed in the building as it lays in the bed, there will still be a tendency to throw off successive laminæ, but if put carelessly in the building, or fixed at right angles to the position it was in the bed, so that what was originally the plane of the bed has now become vertical, the effect will be that the whole face of the stone will peal off, and if the stone is cut into delicate ornaments, it is almost inevitable that some of the planes of the bed would interfere, so that when expansion takes place, the outer laminæ of the ornament would break off and fall away. The moment that is done in any one place, absorption becomes more rapid than it was before, and it goes on with increasing rapidity. If, however, the stone lasts for a certain time without injury, the surface hardens. All stone is much harder after it has been exposed to the air for some time than it is in the quarry; and, therefore, if it once gets into this state it may last, but if it is attacked early it will go. There is an instance of this to be seen in Mr. Hope's house, in Piccadilly, which is built of a soft stone. It has been sheltered by putting leads over the tops of the exposed parts; and I have Mr. Charles Smith's authority for saying that, in consequence of that the stone has been preserved. The water has been prevented from draining down into the stone, and in that way it has had time to harden. The water that is absorbed when limestone is exposed to the air is charged with acids, as I have already mentioned, and under these circumstances the stone acts as a kind of filter. A porous

stone acts also in another way, decomposing the gases that pass into it. A certain, though slow, decomposition thus goes on, and the stone becomes actually destroyed. Very often this will take place even when it is not very apparent outside. That is the case especially in some of the Heddington stones. At Oxford you will often see large scales breaking off from the surface of the building, although the outside is apparently pretty good. This is the result of that amount of decomposition and alteration that goes on within the substance of the stone itself.

There is another kind of limestone which I must mention. It is magnesian limestone. The magnesian limestone is carbonate of lime and magnesia; common limestone is simply carbonate of lime. Just as the common limestone when crystallised is very durable, so magnesian limestone when crystallised (in which case it is composed of equal parts of carbonate of lime and carbonate of magnesia), is in a more compact state than when earthy, and then seems to stand exceedingly well. In the places where these stones are obtained, the churches built of them centuries ago are quite unaltered. But when these same stones are brought into our London atmosphere, although they appear to be just as good, and are exposed to very much the same influences, they begin at once to decay. It was owing to a neglect of the consideration of this matter that the stone used for the construction of the Houses of Parliament has suffered so much. The stone for this purpose was selected with the greatest possible consideration. A commission was appointed of the fittest men of the time—the best geologist, the architect, competent practical men, and the best chemists. All those employed were men of the highest reputation, and no one has hinted for a moment that they did not do their duty. This commission examined the different limestones in the country, and they recommended the magnesian limestone of Bolsover, because they believed it to be the best. They found buildings constructed of it many centuries ago entirely unaltered, and they naturally recommended that it should be employed. Then came a difficulty which had not been considered sufficiently, and that was that the particular quarries which had supplied the stone to the churches in the neighhourhood were by no means large enough to supply the quantity required for the Houses of Parliament; and not only that, but it was not at all certain that other stones could be got in the immediate neighbourhood of precisely the same kind. Other quarries adjacent were selected, and the stone which was used was certainly from the neighbourhood, and nominally the same stone, but really it was exceedingly imperfect. Magnesian limestone differs from common limestone in the way in which it decays. Under the action of those causes that I have already mentioned, it decays whenever the two minerals are not perfectly crystallised together, and then it becomes disintegrated and powdery, so that in one block you will find portions which are perfectly hard, and other portions near them, which are also hard, whilst between these two you will find portions which are perfectly soft, and so disintegrated that the particles might almost be blown away by the wind. This has arisen from the way in which the material was originally crystallised, and from the difficulty that there is in producing a perfect crystallisation in a mass on a large scale in nature. Generally speaking there is a considerable amount of variety both in the composition and subsequent metamorphosis of rocks, so that bedded materials almost always vary a great deal even in a short distance. This is the case with magnesian limestone, but it also appears that neglect was incurred by the want of sufficient superintendence in selecting the best kinds of stone, and rejecting bad samples either at the quarry or in London. There was no sufficient superintendence, and the poor and inferior specimens of stone were not rejected. They were all put into this great building, and the result is that some of the stones are very good, some very indifferent, and some exceedingly bad. The same kind of stone was used in the new building of Lincoln's-inn, and it is even worse. The same kind of stone, however, is used in the construction of the Museum of Practical Geology in Jermyn-street, and there there is not a stone faulty. It would appear then that the selection of stone is a very important matter. So much I may say with regard to the materials and the nature of the causes that produce their decay.

Practically, then, the causes of decay of absorbent stones are connected with exposure to damp atmosphere, rendered impure by various acids and alkaline gases, and also with changes of temperature, especially above and below the temperature of about 38 degrees, at which water attains its greatest density. It is quite clear that where there is a large amount of injurious gases present in the air, in other words in and near large cities, where there are a great number of people breathing and giving off carbonic acid gas, and where a large number of fires are burning, which always yield a large quantity of sulphurous acid, and also where there is much ammonia; in these places, and owing to the state of the atmosphere, stones which in the open country would stand perfectly well, will stand very badly. In addition to this must be taken into account the exposure to certain winds, and the action of the weather to a greater or less extent for a limited time.

The question then arises how these things are to be overcome in our climate. Generally speaking, one would be apt to suppose that non-absorbency was a most desirable thing; and that if we could render stones non-absorbent—that is, if we could prevent them from sucking in the moisture and these dangerous gases—we should be able to answer our purpose and prevent the decay of the stone. I need not inform you that it is no new thing to preserve in this way—not, indeed, stone—but other substances, such as stucco and terra cotta. You can scarcely go into a good modern street in London without seeing a large number of houses covered over with cement, and that cement covered over with paint. Now, what is paint? It is a mixture of oil and oxide of lead. The paint coats the surface in such a way that water cannot get into it. We all know the result; the paint, indeed, never looks well; it is not an ornamental thing under ordinary circumstances, and much less so when applied to stones. But how far is it successful? Why the moment it is put on, it begins to decay. Decay must take place, because oil begins to decompose the moment it is exposed to the action of the air; and the result is, that after a very short time the oil separates from the oxide of lead, and the surface first blackens and soon begins to peel off. You have a thin film of oil and white lead put on a surface; it adheres slightly for a time, but the moment it is left alone it begins to decompose and rot, and in the course of a year or two you must do all the work over again. Numerous plans have been patented for coating and choking the pores of absorbent stones with preparations of various kinds. The almost invariable idea has been, to render the stones as far as possible non-absorbent. This has been done by combining a certain proportion of mineral substance with oil or fatty matters. There is but one observation with regard to these; they all inevitably tend to decomposition except perhaps those that are of a pitchy or bituminous nature.

Bitumen is of a nature that does not decompose by exposure, and is permanent, but it is of so dark and disagreeable a colour that it completely destroys the appearance of stone, and renders it so unsightly that no one could venture to recommend it. Oil and fatty substances therefore are the only ones that have been used. One cannot help feeling, that if our stone buildings are to be painted till their character as stone is lost, it would be better to build them of a cheaper material, and use bricks and stucco at once. I may say with regard to the patents that have been taken out within the last 20 years on subjects of this kind, that I have had no less than 17 before me, and out of these 17, eleven are simply mixtures of various substances with oils and resins, and are therefore essentially of the same nature. Some of the others use mixtures of mineral matters in oil, but none of them appear to have

answered the purpose, and none of them are now employed at all. There is another point I ought to mention, and that is that a mere mixture of things, not involving chemical combination, must fail. We must then either have some invention by which the pores of stones are permanently choked by a bituminous substance, not unsightly, and not in any way subject to decomposition, or we must find some mineral deposit which we can answer for which will adhere firmly and which will also be permanent; in other words, we must put something into or upon the stone which shall be a mineral substance, closely adhering and not subject to ordinary atmospheric influences.

It is now many years since a suggestion was made by a French chemist, of the name of Kuhlman, which was apparently very ingenious, and which, to a certain extent, answered the purpose. It was a suggestion to coat the surface of absorbent stones with silica. Now, I have already spoken to you of silica, as forming the great mass of sandstones, and also, to a great extent the base of granite. Common flint is the form in which we all know it. In that form it appears to be rather an unpromising suggestion to apply it to a surface in such a way that it shall adhere and be permanent. Silica, which is in fact a combination of a base which is called *silicon* with oxygen, is also called by chemists *silicic acid*, but the acid properties are so weak that they cannot be recognised by the senses, and its affinities for alkaline bases are very feeble. Silicic acid, or silica, is capable of existing in combination with water, and in combination with some alkalies is soluble; is found in nature, combined with water, in some minerals, and when in that state is passed into a state of insolubility by the action of alkaline carbonates, among the rest carbonate of lime.

As a natural hydrate, or combined with a small quantity of water (about 3 or 4 per cent.), it forms part of some particular kinds of sandstone. It is also found in natural hot springs, and even in common spring water, —no doubt by the action of carbonic acid. I have said that it is soluble in caustic alkali. It is soluble for example in caustic potash and caustic soda, not under ordinary temperature and pressure, but at a temperature of 300 or 400 degrees Farenheit, and under steam pressure. Under these circumstances there is no difficulty in dissolving it. You get a solution in this way, a mixture of silica and potash combined with water, and a tenacious though soluble fluid. I have a specimen of it before me. You see it is perfectly fluid; it is as much a fluid as water would be; but if in this state you expose it to the action of ordinary air for a time, it hardens, becoming first sticky and gelatinous. It is then a hydrate of silica. To become this it undergoes a certain kind of decomposition, parting with its potash to carbonic acid in the air. Before the lecture, I placed a drop of the fluid solution on a piece of glass, and those who take an interest in it may see what the effect has been. It was perfectly fluid; it is now quite gelatinous and sticky, and in a short time it will become perfectly hard. It has attached itself, also, firmly to the surface of the glass, and could not now be removed. In this form it was proposed to use the liquid silicate of potash or water-glass by M. Kuhlman, whose process consists in the coating of absorbent stone with the solution in question, and he believed that after this treatment the stone would become coated with silica. Since it is known that silica laid on and dried is insoluble, he believed he had secured a useful result; but he forgot that insoluble silica that has been deposited in that way is still capable of being acted upon by the alkaline carbonates. Therefore, even when thus deposited, still in the course of time the alkaline carbonates of the atmosphere would act upon it, and it would be a failure. But that is not all; for, if at the time I put this drop on the glass I had not taken care that the glass was dry, or if I had dashed water on it it would have been washed away. Now that is exactly what would happen if you put some of it on a stone, and a shower of rain were to fall. In that case the effect would be destroyed, the preparation being washed away. So much for the process which Kuhlman invented. It is right to say that M. Kuhlman himself believed that when used in limestone a double decomposition would take place, the silicate of potash being not only decomposed by the carbonic acid of the air, but a part of the silicic acid combining with the lime to form silicate of lime. This would, however, be a work of time, which the weather in a damp climate would not permit.

Another process has been introduced by Mr. Ransome. His plan was to decompose the silicate of potash and to produce a deposit of mineral upon it, which would adhere to the stone by a process of double decomposition. He considered that if a mineral deposit could be absorbed into the stone, I mean if, after a solution was absorbed into the stone, it could afterwards, by a chemical combination, caused by another solution subsequently absorbed, be decomposed so that a solid film would be everywhere deposited, and if this could be done in a very brief space of time, so that damp, air, and rain should have no effect upon it, then the object required would be attained. It suggested itself to him in this way:—He was in the habit of manufacturing the soluble silicate on a large scale, and he thought that by combining it with the chloride of calcium (muriate of lime) he would get this double decomposition. This is the case, because soda and potash have but a weak affinity for silica, and lime a very strong one. Silica, therefore, parts very readily, indeed, with soda or potash, to lime, whilst the chlorine would, with great readiness, pass to the soda. He therefore attempted the process; and I think you will say he attempted with some success, at any rate so far as the experiment went. There is, however, no obscurity about the general result, as it is simply a matter of experiment. The first thing he did was to satisfy himself that he could get a rapid deposit. In the two glasses before me, one contains a certain proportion of silicate, and the other contains a corresponding proportion of the chloride of calcium, so that the two shall combine and form solids. In mixing these together, I put the chloride of calcium into the silicate of soda. The result is that the affinity of the chlorine for sodium being greater than that for calcium, while the affinity of the silica for soda is weak, a double decomposition takes place, the chlorine leaving the calcium to pass to the sodium, thereby forming soluble chloride of sodium or common salt, and the silica and lime set free, also combine to form silicate of lime, an insoluble salt, which is immediately thrown down in a solid state. The proportions being properly taken, the whole of the water is taken up and made use of as water of solidification, and the salt can be subsequently removed by washing.

[The lecturer, while performing the experiment, stated that by the time the lecture was over the whole of the contents of the glasses then liquid would be in a solid state, and added that unless it was removed before long, the solid silicate of lime formed would adhere to the glass so firmly that it would be very difficult to get it off.]

We thus have silicate of lime rapidly formed, and being obtained in this way it is necessary to consider what the result would be in the solution of the problem before us. I need not say it is by no means sufficient to have an insoluble mineral deposit placed on the surface of a mineral, whether calcareous or silicious. It is not only necessary to have that, since there must also be cohesion, and this cohesion must be sufficiently powerful to render the mineral coating preservative. It is absolutely necessary that the silicate of lime should be a material which, when put on a surface of stone, should not only remain there, but become permanently adherent. Experience, however, has long ago shown that a very thin deposit of this peculiar mineral, silicate of lime, does adhere with singular rapidity, and with the most remarkable tenacity, to particles of sand and stone with which it comes in contact. It is the film which, produced gradually, gives all its value to mortar, and which cements together the stones of which are formed what builders call concrete, on the very existence of which as a firm solid mass, half our buildings

depend. Immediately on the deposit of the minute particles produced by the double decomposition of two minerals and formation of two others, this strong tendency to adhere comes into operation. The particles of silicate of lime newly set free, immediately and firmly attach themselves to the particles or grains of which the stone is made up, not only surrounding them, but binding them to each other, just as when mortar has long been left to harden it is as difficult to separate the parts cemented as it is the solid brick or stone; this it is which gives its principal value to the method suggested.

I have laid on the table several specimens of different materials which have been treated in this way, and also some of the results after they have been exposed to decomposing agencies. Near me are two specimens of terra cotta. One has not been treated in any way, and it is exceedingly absorbent, and we know from experience that terra cotta soon becomes injured on exposure to the weather. The other has been treated by the processes that I have mentioned, and if any one will take the trouble to scratch the surface, he will at once see the nature of the change. The surface has become excessively hard, and although when treated this way it is not necessarily non-absorbent, it can be made so by repeating the process often enough. If not made non-absorbent, however, it has become less capable of injury by exposure. These specimens were prepared at the Museum at South Kensington.

There is also before me a specimen of Heddington stone exposed to Ransome's process, and another specimen of the same stone not exposed to that process. Both of them have been dipped in acid, and the result is as you see. The surface of one is entirely gone; the surface of the other is not touched. There are also two specimens of Caen stone, one exposed to the process and the other not. Both have been subjected to the same amount of acid, and the result is that one stone is entirely destroyed and the other is not injured. There are several other specimens of Mr. Ransome's stones on the table, and the hardness of them will be at once recognised by anyone who will compare them with similar stones not so treated.

There is another process which I ought to mention, which has been partly carried into operation in the Houses of Parliament. It was introduced by a Hungarian gentleman, of the name of Szerelmey.* I can hardly with propriety say anything about it. I know too much and too little about it to be able to express an opinion. At the same time, if I did not mention it, it might seem as if I had not been aware of it. Mr. Szerelmey, at the suggestion I believe, of the late Sir Charles Barry, asked me to look at his process, but he did not inform me what its preservative power consisted of, and although he intimated its nature, he evidently intended me to regard what I observed as confidential. All I can say is, that regarding it as a secret process, it is quite impossible for anyone to express an unqualified opinion of its value until time shall have tested its capabilities. It is, therefore, best not to speak of it at all until it has been exposed for a number of years to the action of the weather. Time alone can show what its value is, if the materials employed are not stated, and certainly an experience of not less than several years can be regarded as of any value, since ordinary paint or drying oil will preserve absorbent stones for that period.

In returning now to the original subject, let me remind you that if, as seems to be the case, we are forced to make use of soft perishable material for purposes of decorative work in architecture, if we are obliged to accept the material that nature has provided near at hand, and select from varieties which differ indeed much in durability but all of which decay, it would seem only reasonable that due precaution should be observed to take for the best work the most favourable varieties of stone, and use great caution in rejecting manifestly bad or indifferently good samples. That this can be done every quarryman and every stonemason well knows, and there are means of determining the good from the bad which are independent of their experience. Where enormous sums are to be expended on decorations for a permanent building, it is surely not unreasonable to expect and require that a little niggardly economy in regard to the material of construction should not be indulged in. But I regret to say that in most modern public buildings, it has not been thought necessary either to determine the kind of stone with reference to its probable durability, or to appoint a competent person to reject on the spot bad samples. With regard to our architects, it seems hardly to be a part of their education to inquire into and understand such matters, and they do not consider themselves responsible ultimately for the consequences of neglect. I have endeavoured to show what must happen when bad stones are placed in a building erected in or very near a large town. The whole of the stone decays, but the more prominent and the more ornamental parts, those on which the effect most depends, and on which most money has been spent, these decay first. Moisture is absorbed, frost comes, and the delicate projecting parts fall. Gases and acids are absorbed together with smoke, and the stone is first blackened and disintegrated, and then reduced to powder. But of course there are bad and good pieces; there are exposed places and sheltered places, and the result of this is that not only does the stone decay, but it decays with the utmost irregularity: adjacent stones become very soon in a state so different that no one could have supposed they were dug from the same quarry, and the whole surface is unsightly and disfigured.

None of the nobleness and beauty of decay is seen in these cases. There is a decent and picturesque appearance, not unfrequently met with, in old buildings which inspires respect instead of dislike. There is the hoary front of age, of which none complain. It is seen in the marbles of Greece and Asia Minor, in the limestones of Rome, and even in some of the porphyries in Egypt. Time, we are told, devours all things. All human contrivances must submit to it, and as it is a natural, so it is often a beautiful condition. But premature decay, like an artificial ruin, has a poor and mean appearance. It does not give the idea of waning strength, but of absolute innate weakness. It is a *coup manqué*—a thing not merely imperfect, but unnecessarily imperfect.

It is important to remark also that bad stone was not al-

*Since the lecture was delivered a correspondence has been printed by order of the House of Commons which renders some further observations desirable:—Mr. Szerelmey had not, I now find, allowed me to ascertain the real nature of the method he adopted, which consists in the use of soluble alkaline silicates, succeeded by a wash of bituminous matter also in solution. This was stated in confidence to Dr. Faraday, who, however, does not say that the application of the soluble silicates is succeeded by a second wash producing a deposit of silicate of lime. We are led to infer that the second wash is the bitumen only, and the object of this must be to shelter the surface while the alkaline silicate is undergoing slow decomposition and becoming converted either into hydrate of silica, or silicate of lime, just as by Kuhlmann's method. It would thus appear to be Kuhlmann's process with the addition of a bituminous and temporary sheltering surface. It still remains to determine whether by this process permanent protection is given, as if the deposit consists of hydrate of silica, the alkaline carbonates to which it must soon be exposed will no doubt destroy it. The temporary shelter of bitumen cannot be taken into account as having permanent value, although for the time it lasts it may no doubt appear to be more efficacious than any thing else. I observe that Dr. Faraday, in expressing a qualified opinion on the present appearance of the stone thus acted on, speaks "of the short and insufficient evidence now existing." It is indeed clear that the real value of the method of Kuhlmann depends on the nature of the deposit formed, and I believe it has not yet been determined what this is, simply because there has not been time enough given for the experiment. Complete exposure of a surface protected by Mr. Szerelmey left without any subsequent treatment for some years (four at least) could alone decide the question. The condition of the Speaker's Court, in the houses of parliament, will thus, after a time, be a fair test of the value of his method.—D. T. Ansted.—26th May, 1860.

ways used. Many of our old buildings have scarcely shown incipient decay—many of those in large towns have decayed so as not to be unsightly. This, it is true, must not be altogether attributed to the material, as such buildings, if erected now with picked stone from the same quarries, would probably injure much sooner, owing to the much larger quantity of impurity in the atmosphere to which they are exposed. When a stone has been for some time exposed to pure air it hardens, and thus buildings, placed where we see them before the large town arose around them, have stood exposure better than they could do now. But there is reason to know that the selection of stone was much more careful formerly than it has been lately, and the result is manifest.

There is one more point. If the method of protection and preservation so ingeniously contrived by Mr. Ransome is successful, as it really seems to be, the softer and cheaper stones may be used. It is certainly the case that a hard, almost flinty surface is obtained by it, and that such surface is not acted upon by the acids which rapidly destroy the same stone when unprotected. For four winters stones thus protected have stood the action of the weather, and if it turn out to be as durable as seems likely, from this and other trials on a large scale, if absorption is checked—so far at least as its injurious effects are concerned—for mere absorption does not seem to be injurious, and if decay is thus arrested, then there are means at hand which cannot fail to have a great influence on decorative stonework, for the material most easily carved and sculptured is just that one which is most completely improved by the process.

In thus speaking of the decay and preservation of stone, I have endeavoured to confine myself strictly to the subject before me, not travelling out of the record. I feel, however, so convinced of its importance that I offer no apology for bringing it before you, and, perhaps, when in your summer ramblings you visit some noble cathedral, or wander over the ruins of some ancient castle or tower of classical or middle age construction, you may feel an interest in examining the cause of the beauty you there see arising from decay, and contrast it with the dissatisfaction and disappointment I am sure you cannot help feeling on examining some of the recent restorations of Westminster Abbey, or the richly decorated surface of the great palace of the nation immediately adjacent.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 30th Annual Meeting of this Association will be held at Oxford, and will commence on Wednesday, June 27th, under the direction of the following officers:—President: The Lord Wrottesley, M.A., V.P.R.S., F.R.A.S. Vice-Presidents: The Earl of Derby, K.G., D.C.L., Chancellor of the University; the Rev. F. Jeune. D.C.L., Vice-Chancellor of the University; the Duke of Marlborough, D.C.L., Lord Lieutenant of Oxfordshire; the Earl of Rosse, K.P., M.A., F.R.S., F.R.A.S.; the Lord Bishop of Oxford, D.D., F.R.S.; the Very Rev. H. G. Liddell, D.D., Dean of Christ Church; Charles G. B. Daubeny, M.D., LL.D., F.R.S., F.L.S., F.G.S., Professor of Botany; Henry W. Acland, M.D., F.R.S., Regius Professor of Medicine; William F. Donkin, Esq., M.A., F.R.S., F.R.A.S., Savilian Professor of Astronomy. General Secretary: Rev. Robert Walker, M.A., F.R.S., Professor of Experimental Philosophy. Assistant-General Secretary: John Phillips, Esq., M.A., LL.D., F.R.S., F.G.S., Professor of Geology. General Treasurer: John Taylor, Esq., F.R.S. Local Secretaries: George Rolleston, M.D., F.L.S., Linacre Professor of Physiology; Henry J. S. Smith, Esq., M.A., F.C.S., Fellow of Balliol College; George Griffith, Esq., M.A., F.C.S., Jesus College. Local Treasurers: Rev. Edward Hill, M.A., F.G.S., Christ Church, and Sheering Rectory, Harlow, Essex; Rev. John Griffiths, M.A., 63, St. Giles's, Oxford.

The Town-hall will be open as a reception room, on Monday, June 25, at 10 a.m., and on the following days at 8 a.m., for the issue of tickets to members, associates, and ladies, and for supplying lists and prices of lodgings, and other information, to strangers on their arrival. On and after Monday, June 25, members and persons desirous of becoming members or associates, or of obtaining ladies' tickets, are requested to make application in this room.

The Radcliffe Library will be open on and after Monday, June 25, at 8 a.m., for the purpose of supplying information regarding the proceedings of the meeting. The *Journal*, containing announcements of the arrangements for each day, will be laid on the table in the Inquiry room on Wednesday and the following mornings at 8 a.m. for gratuitous distribution. Lists of members present will be issued as soon as possible after the commencement of the meeting, and will be placed in the same room for gratuitous distribution. The published volumes of the British Association will be sold in this room, only to members and associates, at the reduced prices appointed by the Council.

The General Committee will hold its First Meeting in the Convocation House, on Wednesday, June 27th, at 1 p.m., for the election of sectional officers, and the despatch of business usually brought before that body. This Committee will meet again, in the same room, on Monday the 2nd July, at 3 p.m., for the purpose of deciding on the place of meeting in 1861. The concluding meeting of this committee will be held in the same room, on Wednesday, the 4th July, at 1 p.m., when the Report of the Committee of Recommendations will be received.

The First General Meeting of the Association will be held in the Sheldonian Theatre, on Wednesday, June 27th, at 4 p.m., precisely, when His Royal Highness the Prince Consort will resign the Chair, and the Lord Wrottesley will assume the Presidency, and deliver an address.

The sections are the following:—

A.—Mathematical and Physical Science.—President: Rev. B. Price, M.A., F.R.S., Professor of Natural Philosophy, Oxford.

B.—Chemical Science.—President: B. C. Brodie, Esq., M.A., F.R.S., Professor of Chemistry, Oxford.

C.—Geology.—President: Rev. A. Sedgwick, M.A., F.R.S., Professor of Geology, Cambridge.

D.—Zoology and Botany, including Physiology.—President: Charles G. B. B. Daubeny, M.D., F.R.S., Professor of Botany, Oxford.

(A subsection of Physiology will be proposed in the General Committee, Wednesday, 27th June.)

President: G. Rolleston, M.D., Professor of Physiology, Oxford.

E.—Geography and Ethnology.—President: Sir R. I. Murchison, G.C.St. S., D.C.L., F.R.S., Director of the Geological Survey of the United Kingdom.

F.—Economic Science and Statistics.—President: Nassau W. Senior, Esq., M.A., late Professor of Political Economy, Oxford.

G.—Mechanical Science.—President: W. J. Macquorn Rankine, Esq., M.A., LL.D., F.R.S., Professor of Engineering, Glasgow.

The List of Sectional Officers will be completed by the General Committee on Wednesday, June 27.

The meetings of the different sections will be held in the rooms appointed for them, for the reading and discussion of reports and other communications on Thursday, June 28; Friday, June 29; Saturday, June 30; Monday, July 1; and Tuesday, July 2, at 11 a.m. precisely.

The Committees of Sections will meet in rooms adjacent to the Section Rooms, at 10 a.m. precisely, on the same days.

Persons desirous of reading communications in any section are requested to give early notice of their intention, by letter, addressed to the Assistant-General Secretary, or to the Local Secretaries for the Oxford Meeting.

Reports on the progress of science and of researches entrusted to individuals and committees, are expected to be forwarded in letters addressed to the "Assistant-General Secretary, Oxford," previously to the meeting, accompanied by a statement whether the author will be present, and on what day, so that the business of the sections may be satisfactorily arranged.

The reports complete, and concise abstracts of other communications, are to be delivered to the secretaries of the sections before which they are read, previously to the close of the meeting, for publication in the Transactions.

On Thursday evening, June 28, there will be a Conversazione in the University Museum, commencing at half-past 8 o'clock.

On Friday, June 29, at 4 o'clock, in the Theatre, the Rev. Professor Walker, M.A., F.R.S., will deliver a discourse on the Physical Constitution of the Sun.

On Friday evening, a Conversazione in the University Museum, at half-past 8 o'clock.

On Monday evening, a Conversazione in the University Museum, at half-past 8 o'clock.

On Tuesday evening, July 3, there will be a Microscopical Soirée in the University Museum, commencing at half-past 8 o'clock.

(It is expected that another discourse, of which due notice will be given, will be delivered in the Theatre on Monday.)

The concluding General Meeting will take place in the Theatre, on Wednesday, July 4, at 3 p.m. The proceedings of the General Committee, and the grants of money sanctioned by it, will then be stated.

GEOLOGISTS' ASSOCIATION.

In accordance with the recent resolution of the committee of this Association to conduct occasional excursions to places of geological interest, several of the members visited Maidstone on Tuesday last. The party, which was under the guidance of the Rev. Thomas Wiltshire (President), Professor Tennant, and Mr. Bensted, first visited the quarry belonging to the latter gentleman in the neighbourhood of the town. The quarry is excavated in the Kentish ragstone, and, besides exhibiting many remarkable geological features, is interesting as having been the place in which were found the fossil remains of the Iguanodon, described by the late Dr. Mantell, and now in the British Museum. The Charles Museum was next visited, and the party had an opportunity of seeing the valuable collection formed by the late Mr. Charles. They then proceeded to Aylesford, and inspected an extensive drift bed and other interesting objects in the neighbourhood, returning to town in the evening.

Proceedings of Institutions.

The Glasgow Institution.—The second annual meeting of this Institution took place on Monday evening, 21st May, for the purpose of hearing the annual report and granting certificates to those pupils and students who had passed the local examination. The large hall was completely filled with the students, and a number of directors, and other influential gentlemen interested in the spread of education. Sheriff Strathern occupied the chair, and the Rev. Mr. M'Gregor, of Hope-street, opened the meeting with prayer. The chairman complimented the directors on the efficient management of the Institution, and called on the secretary to read the annual report. The report was of a cheering nature, showing that the classes in connection had made satisfactory progress during the year, the total number of individuals who had received instruction having been 737, of which about 13 per cent. attended more than one class. The number of students in the roll for the summer session is 337. During the year a library has been formed for the day classes, and arrangements are being made to extend it to the evening classes. The report then referred to the system of granting certificates to the students in connection with the Society of Arts, London, and showed an increase of those who came forward to the final examination this year—the number being 22, working 26 papers. Besides these, the local board examined and granted its certificates to 30 others in various branches. Both classes of certificates are the means of obtaining good situations for young men, and are therefore of the highest importance. The report having been read, the most interesting part of the proceedings took place—the distribution of the certificates awarded on the authority of the Local Board. Fifty-eight persons received sixty-two board certificates, embracing from the elements of education up to those deep in the classics, logic, French, mathematics, &c. The learned Sheriff made brief remarks to each student, male and female. Several resolutions were passed; the first of which was proposed by Capt. George Anderson of St. Rollox, and seconded by Mr. Miller—"That, in the circumstances of this country, the most effectual means of ensuring the education of the young is to make it imperative that up to some stipulated age no young person be permitted to work for hire till it be certified by competent authority that he has a certain knowledge," and was passed with acclamation; as was also the second, proposed by Mr. Hartley, and seconded by John M'Harg, Esq.—"That the system of examinations and certificates, promoted by the Society of Arts, and granting certificates by local boards to pupils of an early age, as done in this Institution, are steps in the right direction, and of great importance to every young person who stands in need of a ready introduction to a good situation." After some formal resolutions, the proceedings were concluded by a speech from the chairman, in which he urged the successful candidates to still greater exertions; exhorting at the same time those who had not succeeded not to be disheartened by their defeat, but to persevere, following in the footsteps of their more fortunate competitors. The proceedings, which were of unusual interest, then terminated.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Geographical, 8½. 1. Capt. R. W. Torrens, "Journey to Fort Simpson, Queen Charlotte Islands." 2. Capt. Palliser and Dr. Hector, "Latest Explorations in British North America." 3. Prof. W. Jameson, "Journey from Quito to Cayembe."

Tues. .....Horticultural, 1. (at South Kensington Museum). To Elect Fellows and Ballot for Plants.
Medical and Chirurg., 8½.
Zoological, 9.

Wed. .....Society of Arts, 4. Anniversary.

Thurs. ...Royal Soc. Club, 6. Anniversary.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 8th June, 1860.

328. Packet and Telegraph Contracts—1st Report from, with the Proceedings of, the Committee.
353. Mint (Sydney)—Copy of Capt. Ward's Report.

Delivered on 9th and 11th June, 1860.

187. Government Contracts—Papers.
237. (1) Coroners' Inquests—Further Return.
350. Steam Vessels, &c. (Number of Passenger Ships, &c.)—Abstract Return.
351. Steam Vessels, &c. (Tonnage, &c.)—Return.
354. Ribbons (French and Swiss)—Return.
357. Cape of Good Hope—Return.
346. Army, &c. (Receipt and Expenditure)—Account.
355. Fisheries (Ireland)—Return.
356. Navy (Roman Catholic Sailors)—Return.
338. Lunacy—14th Report of the Commissioners.
167. Bills—Felony and Misdemeanour.
168. „ Highways, Roads, &c.
Sicily (Landing of Garibaldi)—Further Correspondence.

Delivered on 12th June, 1860.

169. Bills—Phœnix Park.
170. „ Selling and Hawking Goods on Sunday.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 15th*, 1860.]

Dated 13th April, 1860.

924. A. Bamlett, Middleton Tias, Yorkshire—Imp. in reaping and mowing machines, and in implements connected therewith.

Dated 8th May, 1860.

1140. T. M. Gladstone, London-street, City—An imp. in the construction and form of anchors.

Dated 21st May, 1860.

1250.—Lieut.-Colonel V. Baker, Hounslow—Imp. in breech-loading and other ordnance.

Dated 22nd May, 1860.

1260. W. T. Shaw, 110, Bunhill-row, Middlesex—Imp. in thaumatropes or phenakistoscopes.

1268. M. Henry, 84, Fleet-street—An improved mode of suspending gas-lights. (A com.)

Dated 25th May, 1860.

1292. E. De Block Stevens, Antwerp—Imp. in ladies' stays.

Dated 26th May, 1860.

1302. J. Moule, 15, Seabright-place, Hackney-road, Middlesex—An improved apparatus applicable to flushing purposes.

Dated 28th May, 1860.

1308. S. Chatwood, 22, South John street, Liverpool—Imp. in iron safes, and in locks for the same, which locks are also applicable to other purposes.

1310. J. J. Welch, Cheapside, London—Imp. in collars for gentlemen's, ladies', or children's wear.

1312. T. Coltman, Gas-street, Leicester—Imp. in the manufacture of reels for reeling cotton and other thread.

1314. W. Tasker, jun., Waterloo Iron Works, near Andover, Hants Imp. in straw-shakers for threshing machines.

Dated 29th May, 1860.

1320. T. Gullick, Pall mall, Middlesex—An improved spur box.

1322. W. Jones, Pendleton, near Manchester—Imp. in machinery or apparatus for doubling or cutting woven fabrics, paper, and other similar materials.

1324. F. Heindryckx, Brussels—Imp. in the construction of railway chairs.

1326. J. Trayes, Belfast—Imp. in steam boilers, or steam and heat generators, and in the application of heat.

1328. A. J. Paterson, Edinburgh—Imp. in agricultural traction engines and implements.

Dated 30th May, 1860.

1332. F. B. Cox, Birmingham—Imp. in measuring rules.

1334. C. Greenway, 4, Albert-place, Cheltenham—Imp. in the manufacture of salt, and in apparatus used therein.

1336. W. E. Newton, 66, Chancery-lane—Certain imp. in machinery for preparing and spinning hemp and similar fibrous materials. (A com.)

Dated 31st May, 1860.

1338. L. E. Fletcher, Upper Norwood, Surrey—Imp. in steam engines and boilers and their appurtenances.

1340. A. V. Newton, 66, Chancery-lane—Imp. in the application of steam to the warming of buildings and apartments, and in apparatus therefor. (A com.)

1342. W. Farrell, St. Helens, Lancashire—Imp. in apparatus used in hoisting and lowering, as applied to mine shafts.

1344. J. Kinniburgh, Shotts Iron Works, Lanark, N.B.—Imp. in the manufacture or production of metal pipes and other generally similar tubular articles.

1346. J. Menday, Quarry House, Frindsbury, Rochester, Kent—Imp. in kilns employed in and for the manufacture of cement.

1348. C. Clay, Walton Grange, Wakefield—Imp. in implements for scarifying and grubbing or cutting up weeds, and otherwise cultivating land.

Dated 1st June, 1860.

1349. R. Threlfall, Bolton, Lancashire—Imp. in the spinning machinery commonly called self acting mules.

1350. T. Cresswell and H. Lister, Huddersfield—Imp. in or applicable to fabrics composed of wool, cotton, silk, or other fibrous substances, or combinations of these or other fibrous substances.

1351. G. Parsons, Martock, Somersetshire—Imp. in the manufacture of carts, waggons, and drays.

1352. T. Greenwood and T. Batley, Leeds—Improved machinery for cutting and shaping wood.

1353. W. E. Newton, 66, Chancery-lane—A new and improved regulator for gas burners. (A com.)

1354. A. G. Hunter, jun., 43, Dean-street, Newcastle-upon-Tyne—Imp. in the manufacture of chlorine.

Dated 2nd June, 1860.

1356. W. Stratford, Mile-end, Old Town, Middlesex—Imp. in fire bars.

1357. C. W. Lancaster, New Bond-street, Middlesex, J. Brown, and J. Hughes, Newport, Monmouthshire—Imp. in cannon and other ordnance.

1358. J. Austin, Mill Isle Mills, Donaghadee, Down, Ireland—Imp. in traction engines in connection with machinery or apparatus for ploughing or cultivating land.

1359. G. Horner, Falls-road, Belfast—Imp. in hackling flax and other fibrous materials, and in machinery for the same.

1360. W. E. Newton, 66, Chancery-lane—An improved permutation lock. (A com.)

1361. W. E. Newton, 66, Chancery-lane—Improved machinery for kneading or preparing clay for the manufacture of bricks or other articles made from plastic materials. (A com.)

1362. W. W. H. Smith, Birmingham—Imp. in the mode of and apparatus for preparing leather for harness and boot and shoe manufacturers.

Dated 4th June, 1860.

1363. I. James, Tivoli Works, Cheltenham—Imp. in washing, wringing, and mangling machines.

1365. J. Juckes, Newgate-street, London—Imp. in pipes for smoking tobacco.

1367. W. E. Gedge, 11, Wellington-street, Strand—Improved machinery or apparatus for manuring land. (A com.)

1369. J. Pinches, 27, Oxendon street, Haymarket—An improved press for embossing and stamping paper, linen, and other fabrics and substances.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

1387. C. Stevens, 1B, Welbeck-street, Cavendish-square—A new material for packing and other purposes, together with the apparatus used in the manufacture thereof. (A com.)—6th June, 1860.

1410. G. Kane, 69 and 70, Dame-street, Dublin—The making or fabricating in wood, metal, or other suitable substances, bedsteads capable of being collapsed into a convenient size and form for transport as personal luggage, and to be styled "Kane's portable folding bedsteads."—8th June, 1860.

PATENTS SEALED.

[*From Gazette, June 15th*, 1860.]

June 15th.

2018. G. Parsons.
2878. J. D. Hinsch.
2882. E. B. Wilson and R. S. North.
2883. G. S. Goodall.
2884. L. Serbat.
2885. A. Bathgate and J. H. Wilson.
2890. D. Hitchin.
2892. F. Fairclough.
2922. M. A. F. Mennons.
2950. T. S. Truss.
2957. A. V. Newton.
2966. G. T. Peppé.
2968. E. Kirby.
2970. A. V. Newton.
2987. W. Robertson.
3. W. Simons.
46. E. J. Harland.
52. J. Garnett.
306. A. V. Newton.
1001. W. Macnab.

[*From Gazette, June 19th*, 1860.]

June 19th.

2717. C. A. Fournier.
2896. J. Willcock.
2904. J. Ferrabee.
2905. H. Bayley.
2910. W. Dempsey.
2913. W. Abbott.
2914. J. Glasson.
2921. B. Fleet, J. Rawlings, and T. Cloake.
2938. R. G. Hill.
2977. J. Cliff.
2979. J. Cliff.
41. R. C. Videgrain.
107. W. Smith.
109. J. Chatterton & W. Smith.
261. A. Stoddart.
421. C. Spryc.
803. G. F. Wilson.
915. G. Addenbrooke & F. Lewis.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June 15th*, 1860.]

June 11th.

1651. E. Brasier.

[*From Gazette, June 19th*, 1860.]

June 14th.

1686. J. Ellis.
1699. A. V. Newton.
1724. S. Fox.
1726. S. Fox.
1830. W. Pole.

June 15th.

1682. J. Fowler, jun.
1684. J. Fowler, jun., and T. Clarke.
1697. H. Brinsmead.

June 16th.

1795. J. Bourne.
1802. S. Gaudrion.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, June 15th*, 1860.]

June 11th.

1453. J. Dilkes and E. Turner.

June 12th.

1442. J. L. Talabot and J. D. M. Stirling.

June 13th.

1472. J. Warren.
1504. W. Hodgson and H. Hodgson.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4264	9th June.	A Minnow or other Fish Trap	Moore and Co.	90A, St. Martin's-lane, W.C.
4265	14th ,,	Revolving Central Folding Chair.	Francis Tschezy	31, Berners-street, W.
4266	20th ,,	The Fez Burnous	William Woodrow	3, Princes-street, Hanover-square, W.
4267	20th ,,	The Spiral Spring Petticoat Cord	W. and T. S. Blenkiron	Wood-street, Cheapside, E.C.

Journal of the Society of Arts.

FRIDAY, JUNE 29, 1860.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council, at their meeting on Wednesday last, the 27th inst., that the amount of the Guarantee Fund promised up to that date, was £322,800.

NINTH ANNUAL CONFERENCE.

The Ninth Annual Conference of the Representatives of the Institutions in Union, and the Local Educational Boards, with the Council of the Society, was held on Friday, the 22nd inst. Sir Thomas Phillips, F.G.S., Chairman of the Council, presided.

An account of the proceedings of the Conference will appear in the next number of the *Journal.*

ONE HUNDRED AND SIXTH ANNIVERSARY DINNER.

The One Hundred and Sixth Anniversary Dinner of the Society took place at St. James's Hall, Piccadilly, on Friday, the 22nd inst., the Right Honourable Benjamin Disraeli, M.P., in the chair.

The Chairman was supported by the Right Hon. the Lord Mayor, Viscount Elmley, M.P., Lord William Lennox, Sir William A. Fraser, Bart., Mr. J. Pope Hennessy, M.P., Sir Edward Belcher, Sir Thomas Phillips, Sir Cusack P. Roney, Sir John Rennie, F.R.S., Mr. W. H. Bodkin (Assistant Judge), Mr. G. F. Wilson, F.R.S., Mr. Charles Brooke, F.R.S., Mr. J. G. Appold, F.R.S., Mr. Chief Justice Temple, Rev. J. S. Howson, Rev. Samuel Clark, Mr. Akroyd, Mr. Alderman Mechi, Mr. Harry Chester, Mr. Thomas Winkworth, Captain Charles Ratcliff, Mr. C. Wren Hoskyns, Mr. C. Wentworth Dilke, Mr. William Hawes, Mr. John Dillon, &c., &c.

The band of the Coldstream Guards was in attendance during dinner, and performed the following selection, as well as airs appropriate to the toasts :—

March . .	"Flauto Magico" . . .	Mozart.
Overture .	"La Sirène"	Auber.
Selection .	"Victorine"	A. Mellon.
Valse . .	"Kathleen"	D'Albert.
Glee . .	"Blow, Gentle Gales". .	Sir H. Bishop.
Reminiscences of Auber		A. F. Godfrey.
Polka . .	"Pech"	Brouai.
Duett . .	"L'Elisir D'Amore" . .	Donizetti.
Selection .	"Lurline"	Wallace.
Galop . .	"Antelope"	Tinney.

Grace having been said by the Rev. J. Saul Howson,

The Chairman proposed "The Health of her Majesty, the Queen."

The toast was drunk with all the honours.

The Chairman, in proposing the next toast, said in proposing a toast connected with the Royal Family of this realm, he felt they would not be surprised if, for a moment, he dwelt upon the connection between the Society and his Royal Highness, who was its President. Under ordinary circumstances he should shrink from dwelling upon the personal qualities of a Prince so near the throne; but upon this occasion, the anniversary of their existence as a Society, and remembering, as they must do, how much their present flourishing condition was owing to their connection with his Royal Highness, it would be not merely a want of feeling, but it would be a want of taste, which he was sure they would all recognise, if he were merely to allude to his Royal Highness with the formality which usually accompanied toasts of that description. He himself had had the honour, during many years, of serving with his Royal Highness upon a commission intimately connected with the Society, and he could bear witness, as well as they, and especially those who were members of the Council, to the intelligence, the labour, and the ready resource with which his Royal Highness always investigated and considered those questions which properly applied and belonged to such a Society. He was sure they would remember, too, that his Royal Highness had lost no opportunity of educating those who might hereafter influence the fortunes of this kingdom in those principles of taste, and of sympathy with human invention, of which, on all occasions, his Royal Highness had been the advocate. With these feelings he would propose "The health of his Royal Highness, the Prince Consort, President of the Society, the Prince of Wales, and the rest of the Royal Family."

The toast was drunk with the customary honours.

The Chairman, in proposing the next toast, observed that, under ordinary circumstances, he should take the opportunity of proposing to them merely the "Army and Navy," which, though often before the consideration of this country, were themselves open upon all occasions to novel illustration, because both services perpetually furnished the country with new instances of the heroism of their illustrious achievements. But on the present occasion he must take the liberty of coupling with the Army and Navy of Great Britain a new service, which although recent, had already excited the enthusiastic sympathy of their countrymen—the Volunteers. He hoped that to-morrow, under a bright sun, they might encounter the brighter smile of their Sovereign. He would propose "The health of the Army and Navy, and the Volunteers." He had reason to believe that the army and navy were ably represented by a personal friend of his own, Sir Wm. Fraser, and by Sir Edward Belcher, and he was quite sure that the Volunteers were represented in every quarter of the hall.

The toast was drunk with much enthusiasm.

Sir William A. Fraser, Bart., said he thought a slight error had been committed in calling upon him to respond to the toast, inasmuch as he was not at present in her Majesty's service. It was true that some years ago he held a commission in the Household Cavalry, and he was proud, as every soldier must be, of the English army. The British army was at present resting upon its laurels; but it was almost common place to say that if they should be called upon—which he trusted might not be the case—to defend their country, or to carry British glory to the extreme points of the earth, he had no doubt whatever they would do as they had done ever since they had existed as an army. He was sure too that the British army, by their conduct at home, excited the respect of men of all classes, and that notwithstanding occasional attempts to disparage them, the honest public spirit of England was in their favour. English soldiers were worthy of admiration, not only when on the field of battle, but at home, mingling in the domestic circle, and taking part in every good and worthy object. Returning from the field on which they had earned immortal glory, they were content to sit down with the blush of modesty on their brow, only too unwilling to accept that homage which a grateful nation rendered to

them. So long as these qualities of manliness and honour distinguished the British soldier, so long would he be respected. Attempts might be made to disparage him, and cast a slur upon him because his officers were of better blood, but so long as men and officers retained the qualities he had alluded to, no attempts to disparage the character of the British army would ever succeed. He thanked them for the way in which the toast had been received, and he felt quite sure that so long as the British army existed, it would be excelled by none on the face of the earth.

Sir Edward Belcher responded on behalf of the navy, and begged the assembly not to believe every word that appeared in the public prints, or even what was stated in the House of Commons, about the state of the English navy, or about their ships. He was one of the old school, and had served in the last war, and he knew that whenever they captured a ship which looked like a ship of war they put guns into her, sent men to man her, and she went forth and upheld the honour of the British flag. So they would do again. When they wanted ships they would find them in the Thames; and as to the gun boats, if they turned out rotten they would find others. They did not want large ships, but large hearts. An opinion had gone forth that when a man attained the age of 60 he was useless, and ought to be shelved. He was one of those unfortunate men of sixty, but he could tell them he believed he was just as able to do his duty as he was 30 years ago. As to the volunteers, it must be a great satisfaction to them all to know that, at their country's call, 150,000 or, probably, 200,000 men started up, leaving their counting houses in the city, and their business in various parts of the country, to come forward in its defence, and he was quite sure that when the hour of need arrived, they would go forth and support the honour of their country.

Captain Ratcliff responded on behalf of the volunteers, expressing his conviction that in the hour of danger the volunteers would not be found wanting. They were willing to sacrifice time from their daily avocations; to debar themselves from business and pleasure in obtaining a knowledge of the use of arms, so as to be thoroughly fitted for their duties; and should necessity require a sacrifice of life, the volunteers would willingly come forward to tender their services to their Queen and country, and to lay down their lives in defence of these shores. He had the honour, in his district, of commanding a corps which was not backward in their new calling, for they were often at drill twenty-four times a week, and this fact would prove that there was an earnestness about the movement and a determination to learn their duties. He was delighted to be associated with a body of men who, without any kind of remuneration being offered, came forward at their country's call. To-morrow they would be called upon to show some little of their willingness, for they had been desired to appear before her Majesty; and right gladly had many come from the country in order that they might be present to receive one gracious smile from their sovereign in return for the sacrifice that they were making. The feeling of enthusiasm was not confined to localities, but it had spread all over the whole country. They were preparing themselves in order that should an enemy dare to invade these shores, they might be enabled to uphold England in that proud position which for years she had held, and from which might she never fall.

The Chairman then rose and said,—Gentlemen, it is more than a hundred years ago since the Society which is now assembled under this roof was established. A century is no mean period even in the life of a nation. A hundred years ago and the United States of America did not exist. A hundred years ago and the French Revolution had not only not occurred, but was not even contemplated by philosophers. England a hundred years ago had not conquered India; and Australia, it may be said, was not even discovered. The application of steam power to the practical purposes of life a hundred years ago, and all those inventions of science that have aided and animated the industry of man did not exist. We should remember these circumstances; we should not forget these things when we attempt to appreciate the position of those men who a hundred years ago associated themselves together to form a Society to encourage Arts, Manufactures, and Commerce. That association was soon successful. It soon exercised an influence upon opinion, though in those days it was limited in its range. It soon exercised a beneficial effect upon the industry and invention of the country. As years rolled on, those influences became more extensive, those effects became more considerable. But as time advanced this society declined; having declined, it decayed, and only fourteen or fifteen years ago, a very small section in the history of an institution that has flourished so long, even its existence was a question. But just at that moment, when all seemed dark and desperate, this society revived in an extraordinary manner, affected public opinion at a period and in an age when public opinion was omnipotent, conceived and carried out a great enterprise, which still commands the admiration and the fond recollection of the world. Now, gentlemen, what was the cause of your decay? What was the principle of your revival? It appears to me that upon this, I believe, the 106th anniversary of your existence, instead of exchanging mutual compliments and congratulations, it would not be unwise, or inexpedient, to endeavour to ascertain what was the cause of your decline—what was the principle that gave you revival and success. Now, gentlemen, I remember some years ago finding myself in what I have always considered the most forlorn position which humanity can occupy—that is passing a rainy day in a country inn, and the only resource I found, on that occasion, happened to be an odd volume of the Transactions of your Society. It was a volume which described the proceedings of your Society at nearly the commencement of the present century, when half the period of your existence had passed, when perhaps the influence of the Society was probably the most considerable, and when no doubt it exercised a very beneficial effect upon the industry of this country. And at that time, in the earliest part of the present century, the efforts of this Society were very important. It offered numerous prizes, of considerable amount, for the encouragement of the various objects which engaged its attention. These were divided into sections, so as to embrace all those objects which it was the wish of the Society to encourage and to develope; and I remember that this was about the proportion in which the energies and the resources of the Society were then applied. There were, I think, fifty-one heads relating to planting and husbandry; about twenty-five to the fine arts; something like twenty for the encouragement of chemistry and mineralogy; about ten or twelve for mechanical inventions; and six for manufactures. There is no doubt that that disposition of the resources of your Society, some fifty or sixty years ago, was extremely advantageous to this country. There is no doubt, though that is forgotten in the present day, that the agriculture of England is much indebted to this Society. There is no doubt that at that time, all those arrangements for the application of your resources were wise and satisfactory. But great changes have occurred since that period: take husbandry and farming for example. There is hardly any language that can express the colossal advances which have been made by agriculture as a science during the last twenty-five years in England; and agriculture is a jealous mistress, and requires the devotion of those who attempt to encourage her efforts and to guide her fortunes. Agriculture has now in this country a Society entirely devoted to her development and improvement. It has its own exhibitions. It publishes its Transactions, which for information and criticism are not inferior in any point to the transactions of any learned society ever made public. So it is with the various branches of science. Your predecessors fifty or sixty years ago, at the culminating point of your success, did a great deal in encouraging chemistry and mineralogy; but science in all time has opened up new

branches, has developed itself in new forms, and requires for each of these classes its own institution, its own means of illustration, and it will not be satisfied with the partial assistance and favour which may be granted to it by a society which from its very origin and title is of a miscellaneous and almost universal character. I can easily understand that under these circumstances, the position of affairs being so changed from the time when you were first formed and when you first flourished, there should have been a great decline, and subsequently a great decay in your fortunes. But happily, gentlemen, there was one subject which, while others were appreciated by the country and obtained the patronage of special associations, was not thus taken up, and which this Society for the Encouragement of Arts, Manufactures, and Commerce, had the quickness of perception to see was neglected, although inferior to none in importance, and that it must, if properly developed, exercise a very great effect upon the fortunes of this country. That was a subject which was least thought of fifty or sixty years ago, namely, the manufactures of this country. That was the subject to which, fifty or sixty years ago, this Society only devoted half-a-dozen premiums, and with the utmost desire to assist and patronise the efforts of that industry, it could only find six sections under which it could apportion its rewards. Fourteen or fifteen years ago, when you were on the eve of your extinction, you fortunately recognised this great truth: you found out that this Society had a mission to fulfil, and that mission was to educate the artisan of England. It was then you discovered that in educating the artisan of England, you improved the manufactures of England; and that in improving the manufactures of England, you were rapidly stimulating and strengthening, diffusing and increasing the commerce of England; and it was from that period that your prosperity revived. From the moment that you recognised that there was one great mission to fulfil which no society had accepted—the moment that you made up your minds to fulfil that mission—the moment that you felt that in increasing the knowledge, refining the taste, and advancing the skill of the English artisan, you were in fact improving the manufactures of your country, and by thus improving its manufactures, increasing its commerce—from that moment, you occupied a position which enabled you to influence public opinion, and if you adhere to that principle, it will still greatly advance the fortunes of this Society. If that be true with regard to this society which has now so long existed—if that be the fair and just view of your position during the century that has elapsed, what we have to do to-day is to inquire—having ascertained the right principle upon which this Society is founded—how that principle is most completely and most satisfactorily to be applied and developed, and that is the question which, on the anniversary of your existence, I think it properly becomes you to consider. So far as I can judge from reflection upon the subject, there are two modes by which the great mission of the Society—the education of the English artizan—can be fulfilled. The first is, in my opinion, by exhibiting the productions of the art and industry of man. In the early days of this Society, that course was to some extent followed, but even comparatively recently the effort to form an exhibition on a great scale of the productions of the arts and invention of the country was one of very great difficulty, which excited great prejudice, only to be overcome by the utmost energy. Other countries have not found those difficulties. Germany and France, for a series of years, have produced very respectable exhibitions of the native productions and the native industry and manufactures of their country; but even so late, I believe, as 1848, when, fortunately for this Society, our Royal President assumed the position which he now occupies with regard to it, and took a lively and individual interest in its fortunes and efforts—at that time, although many present will scarcely credit it, a proposition that we should hold in this metropolis an Exhibition of our arts and manufactures was looked upon with no relish whatever even by those who were most interested in its success, and nothing but the personal support—I would say the personal exertions—of your Royal President animating those around him, could then bring about such small exhibitions as ultimately laid the foundation of that great event to which, in the course of this evening I shall have occasion to refer. There were two exhibitions confined to the products of this country, held, I think, in 1848 or 1849, or about that time. Then the idea was first conceived that we should pass the line which hitherto had been observed by other countries, and to a certain degree following their example, should excel their original conception, and instead of having an exhibition of the productions of the art and industry of a particular country, we should make it an international exhibition. That idea was at first received with coldness. It was with very great difficulty that the country could be taught to embrace the largeness of that conception, and the inconceivable benefits which it might bring about. But fortunately for England—fortunately, I will say, for Europe and civilisation, those obstacles were overcome, and the Great Exhibition of 1851 was conceived and carried out by this Society—the only Society for the encouragement of the Arts, Manufactures, and Commerce of this country. I need not tell you in what position that has placed the Society. The Society, from that time, became responsible to civilisation. You affected, from that moment, public opinion; though previously almost extinct, and utterly unknown to the world at large, from that moment you appeared before the world as a body of men who had conceived and conducted a great enterprise to perfect success, which is even now recognised by all nations with sentiments of admiration and fondness. On an occasion like the present anniversary, which if it be only to celebrate your existence, would be but a barren ceremony, but if it be a meeting which is to guide us for the future, may be fruitful and fertile in results—it would be well for you to recollect that, having achieved that great success, there yet devolves upon you the duty of maintaining the position which you now occupy, and of establishing the claim which you have successfully asserted of permanently regulating and influencing public opinion in reference to those objects which the Society undertakes to promote. Now, gentlemen, it may seem a paradox, but I will venture to say that it will turn out to be a profound truth, that it is absolutely necessary that exhibitions of the character to which I have adverted must not be isolated; that if they are isolated they produce effects exactly contrary to those which you aim to achieve; that instead of assisting progress, if they are not continued, they arrest it; instead of encouraging merit by competition, they, if not periodically repeated, really establish monopoly; and, therefore, it is for you to consider whether you have not incurred a great responsibility in that marvellous and triumphant effort which you made in 1851, if now you arrest your course, and, content with that success, make no further and analogous effort. In my mind, though it may have given for a moment a great reputation to this Society, though it may have enlarged your numbers and increased your revenue, yet if you do not pursue the principle which happily for your existence you recognised 14 or 15 years ago, you will soon fall into the same position of decline and decay from which you rescued the Society a few years back. But it may be said that the Great Exhibition of 1851 was one of those events that can only rarely occur in the history of man, and that these efforts, by attempted repetition, defeat their purpose; and what on particular occasions arrests and charms the intellectual feelings of men, if continually brought under their cognizance, leads to a feeling of satiety. Unquestionably there is a certain degree of truth in these remarks, and exhibitions of that character, though periodical, must not be too frequently renewed. When the Great Exhibition of 1851 was first planned, there was an intention not only that it should be repeated, but repeated quinquennially. I think myself, although that is a matter for you to discuss on other occasions, that

a lustre is too short a period at which to take stock, as it were, of the inventive progress of mankind; but that you should fix upon some interval which will allow the community at large to watch and recognise the advance in the arts which adorn life and render it delightful and useful, and at the same time that you should not fix upon a period which by its length makes the energy of competition languish, appears to me to be a very sound principle, and I should say that a decennial period is one certainly long enough, and on the whole a wise period to fix upon. Great events have been done in ten years. The siege of Troy was accomplished in ten years. Ten years are now more rapid in their flow than they were in the days of Priam. But I have always felt that if we could have repeated, in 1861, the exhibition of 1851, it would have been greatly for the honour of the country, and for the advantage of the world generally. Now, gentlemen, unfortunately, although the design of this Society, wisely I think, was for decennial exhibitions, and there was a determination to repeat in 1861 what was so successfully done ten years ago, unfortunately events occurred which have prevented your taking that course. War, which at one time was thought impossible, was raging only twelve months ago; and the plan, which I thought was a wise and well-considered plan, of repeating the exhibition was, in deference to the opinion of the majority, judiciously, as I think, given up. But at the same time we ought to consider whether it is expedient to lay it down as a principle that, because war may exist, therefore all attempts to develope the arts of peace, or to promote their improvement, should, as a matter of course, be arrested. That is a matter for grave consideration, and should not be decided upon hastily. Some years ago it was a very prevalent, and to a certain degree popular opinion, that war was extinct, that war would never be revived; and, in consequence of the prevalence of this opinion, the arts of war were neglected. It is my opinion, and I do not say it to occasion any controversy, as I am sure it will not do so—it is my opinion that they were injuriously neglected. I think it was a very great mistake to suppose that war would never again occur, and a still greater mistake to act as if peace were perpetual. But, at the same time, with this feeling, which is very strong in my mind, I am still of opinion that you may make an equal mistake in another direction, and that, because you fall upon troubled times, you might immediately conclude that because war exists or may be possible, all the traditions of civilisation are to be neglected. That is a still greater mistake, and, therefore, I am of opinion that, if the Society wishes to maintain the proud position which it now occupies, and to continue the beneficial effects which it has exercised upon the arts and manufactures of this country, it should use every effort to carry out another Great Exhibition. I see no reason, so far as acts can evince public opinion,—I see no reason to doubt that that effort will be successful. The very fact that you have been called upon—that the country has been called upon to furnish a guarantee fund—the very fact that, without any special effort having been made, a greater sum than £300,000 has been already subscribed, shows that the remembrance of your former triumph and success, and the sympathy with your future efforts are deeply rooted in this country. If that Exhibition takes place, as I hope it may take place, I do not contemplate, nor do I suppose that the Council of this Society contemplate, that the Exhibition should be a mere repetition of the brilliant effort of 1851. That was a preliminary and essentially an exceptional exhibition. You had, as it were, to reveal to this country and to the world the resources of the world, and you very wisely decided that the Exhibition should mainly consist in placing before the eyes of the country all the various products of the different countries—but having made this revelation, having shown to this country what are the numerous productions which the various regions of the earth can supply—having given them that preparatory knowledge which nothing but ocular demonstration could have produced upon millions, you should now, in my opinion—and I believe I speak the opinion and sentiments of those who have deeply considered the subject, and with which I confess I entirely agree—you should produce an exhibition which shall not be arranged according to countries, but according to the classes of manufactures shown. Your next exhibition should be an exhibition of excellence in every department of arts and industry, and I need not say that to such an exhibition foreigners should be admitted on precisely the same conditions as our fellow subjects; and I sympathise with the recommendation that has been made, that in such an exhibition the arts of music and of painting should be included. I look forward with great interest to an exhibition of that character. It is only by a dynasty of such exhibitions that you can maintain the great repute and peculiar influence of this Society. Remember upon this subject the great difficulties that we encountered in establishing the Exhibition of 1851. We had to send agents and lecturers to the great manufacturing towns to persuade them it was for the advantage of the arts and the industry of England that their merits should be known, and their excellence acknowledged. I will venture to say that that effort is no longer necessary. I will venture to say that there is throughout all the great institutions of this country, and all those communities deeply interested in the industry of this land, a quick—a lively sympathy with this Society, and they will only be too ready to pour forth the treasures of their invention in order to maintain the honour of their country. I therefore contemplate very great success if you will pursue this course. Remember the reluctance with which the last Exhibition was first received; but remember also, the great fact that upwards of six millions of visits were made to that Exhibition. It still remains. We live as it were in the sunset of that event, but we live also in an atmosphere of progress. Since that period the means of communication have been greatly enlarged; the population of the country at large, and also of the metropolis, upon which the success of such an enterprise must mainly depend, has greatly increased. You have in England one-third more of railway communication since the last Exhibition, and the railway communication on the continent has proportionately increased. The pilgrims of intellect, of invention, and of taste, who will frequent your next Exhibition will be very much multiplied by such means; and therefore I think that, statistically speaking—for we live in an age of statistics—we have every right to believe that the effort will be successful. Of this I am quite persuaded, that it will be one which ultimately must be advantageous to this country, and I think even to human nature in general. I have now touched upon the first means by which you will be able further to develope the principle, by the quick and happy recognition of which at a moment when you were on the point of extinction, you filled the Society with new life. I think to obtain that result there is yet one other means which you have not neglected, but which should receive still further attention, and that is the drawing into union with this Society all those local societies, the object of which, though not in so great a degree, is also to educate the English artizan, and ultimately to accomplish that great purpose which you have proposed to yourselves as your peculiar mission. I see with great satisfaction that you have now in union with this Society several hundred local associations, chiefly among the Mechanics' Institutions of this country. I have myself taken some pains at various times with the management of these Institutions. I, myself, entertained very sanguine hopes that they would effect very advantageous results in the position of the artizan of this country, and so increase the value of our national industry, on which England must mainly depend. I have no shame in acknowledging that I have been for many years disappointed in the results which I contemplated from those Institutions. The Mechanics' Institutions can often hardly be said to deserve their title,

which seems in some cases to have been given them on the *lucus a non lucendo* principle. A great portion of their members are often not taken from the classes for which they were established, and even when this is the case, the Institutions do not always supply the advantages that these classes require. This Society has, however, introduced a new principle, which has already produced a most beneficial effect, and I am glad to see that it is carrying it into effect in a liberal spirit and on a great scale, and is rapidly realising those advantages which we desire—the formation of classes for systematic instruction, and the introduction of Examinations to test the acquirements of the students. The Society has been extremely successful in those objects. You have this year I think, between 500 and 600 students who have submitted themselves for Examination, and who, where they have deserved them, have received from this Society, upon the reports of able examiners, certificates of their merit. By pursuing this course you are acting up to the principle upon which this Society exists, upon which it can alone exist, and by which it can alone flourish, namely, the education of the artizan of this country. The population of this island is limited, and if you compare it with that of other countries, and depend solely upon the numerical amount you must shrink with alarm from the comparison. How, then, are we to enter into the great area of competition? How, then, are we to maintain and to increase, I hope, not only the excellence, but I will venture to say the supreme position which this country occupies in every respect, unless we make an Englishman, whatever his class, position, or duty—whether he is a cultivator of the soil—whether he is a manufacturer, or a mechanic, or a labourer—whether he is engaged in intellectual or manual service—worth more, and trebly more than the men of any other country. Unless we place that aim and object before us it is absurd to suppose—it is the height of egotism, benighted egotism, to suppose that with the limited population of this country we can maintain the position which we now occupy. And it is only by effort in every class, effort not limited to any particular class, but in every order in this country, effort to excel, that we can maintain the position which this country now occupies. That is the principle for which you are striving, and the education of the artizan is the method by which you are carrying it into effect. I venture to impress this upon you, because it appears to me that on an anniversary meeting it is of very great importance that a society should clearly understand why they have failed, if failure has been their lot, why they have succeeded, if triumph has been their portion. This is a society which has existed beyond the experience of any one generation of man. It has a venerable character alone from that circumstance, which entitles it to the respect of the country at large. In old days great things *were* done; in modern days great things *are* done. You have had in the interval periods of decline. It becomes you to consider why you succeeded at the beginning of this career, and why, when a moiety of this century had passed, you were on the point of failure. It is because a hundred years ago when you were founded, and for thirty years afterwards, you were adapted to the circumstances of the times in which you lived; and fourteen or fifteen years ago, when you were on the point of extinction, you had amongst you able men, and especially men who understood the circumstances of the times, and adapted their exertions to those times. You must draw your conclusions from these facts. There is no use in having lived a hundred years if you have not the advantage of experience to guide you. I think you ought to adhere to the principle which you adopted in 1851—that you ought to devote yourselves to that which has already been characterised by success—that you should accept, as as your great office, that which no other association has appropriated to itself—namely, as I have already said, the education of the artizan of this country. You should still continue your efforts to increase his knowledge, and refine his taste, and advance his skill, and thus improve the manufactures, and thus stimulate and strengthen the commerce of the country. You should not allow yourselves to be influenced in your course by the politics and gossip of the day. We live in times when we "hear of wars and rumours of wars," but the ministers of the country did not shut up the colleges because there was even a civil war; and a Society that arrogates to itself the high title of the Society for the Encouragement of Arts, Manufactures, and Commerce, and which has existed more than a century, is not to suspend its labours and its sympathies because a province is annexed or a rivulet is passed. It is not for me to disparage the difficulties which you have to encounter. Those who pursue the paths of peace, and occupy themselves with the cultivation and development of the industry of man, no doubt have fallen—I will not say upon evil times—but doubtless on a period of great anxiety. But, gentlemen, remember this—the arts are eternal, and the nation that pursues and applies them with devotion and sincerity, in the intellectual power and in the elevating sentiments that their enterprise developes, finds the best security for the welfare of the people and for the duration of the state. It is with these feelings that I propose to you that we drink "Prosperity to the Society for the Encouragement of Arts, Manufactures, and Commerce, and Success to the International Exhibition of 1862."

The toast was drunk with protracted cheering.

Sir Thomas Phillips (Chairman of the Council), in responding to the toast, expressed to the Right Hon. Chairman the grateful sense entertained by the Council, and he was sure by all members of the Society, of the manner in which he had advocated the interests of the Society, and expressed his sympathy with the Society's purposes and objects. The chairman had reminded them that the Society had now endured for more than a century. A century was no brief period even in the history of a nation, and certainly the last century was remarkable for having crowded into that space of time more great events which had had an influence upon the history of the country, than perhaps had ever been crowded into any other similar period. The chairman had directed the attention of the meeting to some of the events of the century, and he (Sir Thomas Phillips) perhaps might be permitted to remind them of the difference between the empire of Great Britain at the time when the Society was founded and its present condition. At that time India was not ours; Australia was inhabited by bushmen; the Cape of Good Hope was in the possession of the Dutch, and the Canadas belonged to France. At that time, probably about 12 millions of human beings spoke our language; whereas, at this moment, it was estimated that 60 millions were familiar with and spoke the English tongue. It was easy to state those numbers, but very difficult to realise them. During the same period what an enormous advance had been made in the cotton manufactures of the country. In like manner they would find that the development of almost every other branch of manufacture had been without precedent, owing chiefly to the application of science to the arts and industry of the country, which application of science had been greatly aided by the efforts of the Society. They should ever, as the Chairman had said, keep before them the importance of educating the artizan; for it now became necessary, in almost all departments of labour, to have really skilled workmen. Again, the Society had done what lay in its power to promote the Exhibition of 1862. He was anxious that they should not lose sight of this,—that progress was an inevitable condition of human affairs. Movement must be either forward or backward; they must either retrograde or progress; and he felt sure that the Society of Arts would never be satisfied with anything but that progress which all so much desired. On behalf of the Society, he desired to thank the hon. Chairman and those around him for the cordial manner in which the toast had been received.

Mr. John Dillon proposed "the City of London,"

coupling with it the Right Hon. the Lord Mayor. He was not one of those who thought that trade and commerce lowered the human character, or rendered it inaccessible to the claims of literature, science, and art, or of anything that ennobled human nature.

The toast was drunk with enthusiasm.

The Lord Mayor responded, and said he was delighted at being associated with so many gentlemen connected with a Society which promoted Arts, Manufactures, and Commerce. Intimately connected as he was with science of a peculiar kind, he must at all times feel proud of having his name associated with such a Society, the 106th anniversary of which they were met to celebrate. He considered that the commerce of the country was largely indebted to the gentlemen who directed the operations of the Society of Arts, and he believed that the contemplated Exhibition of 1862 would be a great success.

Mr. Wm. Hawes proposed the health of the chairman, and said it was one of the most striking features of public life in England, that no matter to what party we belonged, no matter to what sect we might be attached, all parties met on such occasions as this, striving to promote the common interests of the country, and especially those of the industrious classes, and it formed one of the surest elements of our prosperity, that no matter what might be the political views of our statesmen, they all vied in endeavouring to advance the common good of our country, and thus assured us that our best interests were safe in their hands. With reference to the Exhibition of 1862, he thought he might be allowed to state that, however confident we might be of success, and however large might be our subscriptions, we ought not to lose sight of the importance of securing, by the cordial approval of all our proceedings, the continued support of these in authority, and especially of the Royal Family, without which it would be impossible for us to satisfy foreign nations that the Exhibition in 1862 will be as thoroughly international as that in 1851, and would therefore secure to them the amount of consideration they would require and deserved.

The toast was drunk with all the honours.

The Chairman, in responding to the toast, said: I thank you cordially, gentlemen, for the manner in which you have drunk my health. I am very inexperienced in the duties which I have attempted to perform to-day; I have no talent for them, and my time is so occupied that I seldom fill a chair under circumstances such as the present. But I have always deeply sympathised with the exertions of this Society; I believe they are of a character which, if properly supported, will conduce to the welfare of this country. I believe that they are inseparably bound up with the cause of civilisation; and, therefore, it has given me sincere pleasure to be present here this evening.

Mr. Harry Chester proposed, "The Institutions in Union, including the Local Educational Boards." He expressed the great pleasure with which the Council welcomed the representatives of some 300 or 400 corporations, established for purposes of public utility. It was highly gratifying to know that there were at the present time about 80 Local Educational Boards brought into existence for the purpose of co-operating with the Society of Arts in promoting the education of adults, and providing for their examination. Examinations had recently been held with great success, in 67 different places in the United Kingdom; the number of candidates had greatly increased, and the examiners generally were extremely well satisfied. He had no doubt that, next year, the number of places would more nearly approach a hundred; and this he considered a very important branch of the operations of the Society.

The toast was cordially drunk.

Mr. Akroyd responded, and attributed his being called upon to acknowledge the toast to his having taken an active part in the affairs of a Working Man's College at Halifax. As one of the manufacturers of this country, he was interested in practically promoting the arts connected with manufactures, and he had observed the beneficial stimulus which had been given to those manufactures by the Society of Arts, particularly in promoting the Exhibition of 1851, by which the arts of design had been so greatly improved.

Mr. C. Wren Hoskyns proposed "The Visitors;" and, in doing so, took occasion to thank the Ladies for their presence.

The toast was appropriately honoured.

Lord William Lennox responded, and expressed his high admiration of the manner in which the right. hon. Chairman had advocated the cause of the Society.

ANNUAL GENERAL MEETING.

Wednesday, June 27, 1860.

The Annual General Meeting for receiving the Council's Report and the Treasurer's Statement of the Receipts, Payments, and Expenditure, during the past year, and also for the Election of Officers, was held on Wednesday, the 27th inst., at 4 p.m. Sir Thomas Phillips, F.G.S, Chairman of the Council, presided.

The Secretary having read the Bye-Laws relating to the Annual General Meeting,

The Chairman said that, by the Bye-Laws, he was directed to nominate two gentlemen to act as scrutineers of the Ballot for the election of officers. He would ask Mr. J. P. Bull and Mr. Frederick Lawrence to undertake that office.

Those gentlemen having consented to act, the Chairman declared the Ballot open. He then called upon the Secretary to read the

ANNUAL REPORT.

The Charter and Bye-Laws provide that at the Annual General Meeting all holding office in the Society shall retire, and that the Council shall lay before the members assembled to elect the officers for the coming year, an account of the manner in which they have discharged their duties during their term of office. In compliance with these provisions the retiring Council now present their Report.

Committees.

The Gutta Percha Committee still continues its investigations, and two of its members are conducting on an extended scale, under the direction of the Government, a series of experiments in reference to this material, more particularly as regards its qualities for telegraphic purposes. Already it is understood that these experiments, though not concluded, have led to valuable additions to knowledge in electrical science and its applications. The Committee, however, is not yet in a condition to make a report. Its investigations, from the very nature of the subject, must extend over a considerable period of time.

The Artistic Copyright Committee has resumed its labours. The Bill for securing an Artistic Copyright, as originally drawn, has been carefully revised, and an influential deputation, with Sir Charles Eastlake, P.R.A., at its head, and introduced by the Right Hon. S. H.

Walpole, M.P., accompanied by many members of Parliament, waited upon Lord Palmerston, as First Lord of the Treasury, with the object of inducing his Lordship to introduce the Bill into the House of Commons as a Government measure, or give its promoters the facilities and support without which, looking at the position of public business in the House of Commons this Session, it appeared scarcely reasonable to expect success. The Government, however, though it is believed that individual members of it are favourable to the principle of the measure, has hitherto been unable to comply with the wishes of the Committee, and it is now impossible that any Bill could be carried through the legislature this year. The Council, however, feel that much has been done to advance the cause they have in view, by the steps which the Committee have taken, in making more generally known the defects of the existing law on this subject, and the wants as well of artists as of purchasers of Works of Art.

The Committee states that:—"In nearly every country in Europe, except England, the law secures a Copyright to Artists of every description,—generally during the life of the artist, and a term of 20, 30, or 50 years after his death. In the United Kingdom there is, practically, no Copyright in original works, except Sculpture. Pictures, Photographs, and Architectural Drawings are wholly unprotected; while the Acts conferring a Copyright on Sculpture and Engravings (which latter are generally copies, seldom original designs) afford even to these a very insufficient protection. In this want of protection the Works of Artists stand alone: for Literary and Musical Works, Mechanical Inventions, and even Designs, so far as they are applicable to manufactures, all have their appropriate Copy or Patent Rights.

"The justice of securing Copyright to all Works of Art,—especially to those which possess original design and invention,—will not be disputed. So natural, indeed, does the right appear, that it is often supposed actually to exist: a supposition which gives rise to much imposition and confusion both as regards the artist and the public.

"The ill consequence of this defect in the law is apparent in the frauds perpetually and systematically practised on artists and on the public, by the manufacture and sale of spurious Copies of Works bearing the forged Signature of the original artists; by Printing Copies of worn-out, mutilated, and botched up Plates (in which the Copyright now afforded by law has expired), retaining the name of the original artist and engraver; by making, without the Artist's leave, inferior Copies of his Works, by Engraving, Lithography, Photography, or otherwise using his name and damaging his reputation.

"Instances may be multiplied almost without end. And in all it appears that the fraud is rendered effectual and profitable to the pirate by the unauthorised use of the original artist's name. Upon this assumption the Bill has been framed, assimilating the Artist's Signature, as much as possible, to a Trade Mark.

"Again, in the case of Photographs, advantage is taken of the defective state of the law by making a new negative from a bought copy of the original; and thus, at a trifling expense, and without trouble or artistic merit, the means are procured of indefinitely multiplying positives (*i.e.* copies), which, though inferior to the original, compete with it in the market, and rob the Artist of his just reward; in the case of Architectural Drawings, by inviting a competition of Designs, selecting, perhaps, one, but borrowing from the rejected Designs important points of originality without acknowledgment or remuneration.

"In the course of their inquiries the Committee received information from many of the most distinguished Artists and other persons connected with the Fine Arts, affording conclusive evidence of the defective state of the Laws of British Artistic Copyright, and of the wrongful and fraudulent acts which are extensively and constantly committed with impunity, to the serious injury of Artists and the purchasers of Works of Art, as well as to the demoralisation of the parties to such acts."

The Council have fully concurred in the conclusion of the Committee, that the only practical way of supplying the defect in the present law, will be to give to all Artists Copyright in such only of their Designs as are authenticated or warranted by their Signature, and to make the Forgery of such signature an Indictable Offence.

It has been suggested by some that the Copyright to be so enforced ought to be made conditional on the Registration in some way or other of the Works to be protected, but after carefully considering the suggestion, the Council, fully agreeing with the decision of the Committee, unanimously decided that Registration was practically impossible—would be of no public utility, and would make any enactment including such a scheme virtually a dead letter; an opinion in which they believe all Artists, with scarcely an exception, entirely concur.

The Council of the Society of Arts, and the body of Artists, came to the further conviction that no law could be properly framed for creating an Artistic Copyright which did not at the same time afford Protection from the numerous Frauds practised by the Manufacture and Sale of Spurious Copies, pretending to be Original Paintings of Works in in which no Copyright could exist—such as those by old Masters and the like.

With these objects in view, the Draft of the Bill was prepared.

The delay which, from unavoidable causes has taken place, from the opportunity which it has given for discussion and for enabling the objects of the Committee to be completely known and appreciated, will lead, it is believed, to the certainty of success in the next Session of Parliament.

The Committee appointed to investigate what Musical Pitch it would be most desirable to adopt as the uniform standard for this country, has made its report, which, together with the proceedings of the Meeting of Musicians, Amateurs, and others invited by the Council to take it into consideration, will be found at page 572 of the present volume of the *Journal*. The pitch recommended by the meeting for adoption, in conformity with the report, is that of 528 vibrations for C, a pitch which is nearly intermediate between the high opera pitch at present in use, and the pitch of 512 for C, hitherto taken as a basis in mathematical treatises It also differs but slightly from that lately fixed as the *diapason normal* in France, so slightly indeed as to result in no practical difference.

The musicians having, at a well attended meeting last year, unanimously agreed that a uniform standard was most desirable, and careful investigation of the subject, in all its bearings, having led to the recommendation—by a large number of eminent musicians, subsequently assembled in the Society's House—that the foregoing standard should be adopted, the Council confidently hope that its use will ultimately become general.

It must be borne in mind that there is not in this country, as in France, any authority or power which can compel the adoption of any one pitch as a standard, and that the pitch recommended by the Committee, and chosen by the meeting, must rest on its own merits for general adoption. The Council, with a view of bringing this pitch into use, intend to seek the signatures of as large a number as possible of musicians and others, to a declaration that for the future they will adopt this pitch and promote its use as far as lies in their power, and the Council, as recommended by the meeting, have caused a standard fork to be prepared, verified copies of which will soon be ready for general use.

International Exhibition of 1862.

The main business of the Council, during the past year, has been the International Exhibition of 1862, and a very large portion of its time has been occupied on this subject. In the last report of the Council laid before the members, at the Annual Meeting in 1859, it was explained, not only why they had originally proposed to hold an Exhibition in 1861, and the success they foresaw for it, but why they had subsequently seen reason to postpone it until a more favourable opportunity. The actual state of war in Italy, and the uncertainty as to its duration and extension, which had induced the Council reluctantly to assent to this postponement having ceased, the new Council, on their first assembling, in the autumn, passed the following resolution, affirming the importance of proceeding with the arrangements for holding an International Exhibition in 1862 :—

"Resolved, that the war in Italy having terminated, the Council are of opinion that, although the aspect of Continental affairs may not be favourable to Arts, Manufactures, and Commerce, it is nevertheless their duty to resume measures for carrying into effect an International Exhibition, in accordance with the 1st, 2nd, and 3rd resolutions of the Council, passed on the 14th of April, 1858."

The first step of the Council to give effect to this resolution was to promote the formation of a Guarantee Fund, of not less than a quarter of a million in amount, and they passed resolutions inviting the following noblemen and gentlemen to become trustees of the undertaking, their acceptance of the trust to depend upon the amount and character of the guarantee list, as evincing the extent of interest and support which the Exhibition would receive from the public and those interested in its success ;

The Earl Granville, K.G., Lord President of the Privy Council.

The Marquis of Chandos, Chairman of the London and North-Western Railway.

Thos. Baring, Esq., M.P., C. Wentworth Dilke, Esq., } Royal Commissioners for the Exhibition of 1851.

Thomas Fairbairn, Esq., Chairman of the Art-Treasures Exhibition at Manchester.

The guarantee list had, during the previous session, been privately commenced, amongst the members of the Council and their friends, Mr. Matthew Uzielli, one of the Vice-Presidents, putting down his name at the head of the list as guarantor for £10,000, but the postponement of the Exhibition led necessarily to the suspension of all further proceedings in relation to the guarantee. When, however, the subject of the Exhibition was resumed, and the Council determined to proceed with the next Exhibition in 1862, they resumed their operations for forming the guarantee fund, and in February last an appeal was made by circular to the members of the Society, and by this means, as well as by correspondence with others, but without any public advertisement, the guarantee fund has been raised to £322,800 at the present time, including the sum of £10,000 which H.R.H. the Prince Consort, President of the Society, has intimated his intention to guarantee.

The time to which it was originally proposed to limit the formation of a guarantee fund of a quarter of a million was six months; but within three months from the date on which the first

appeal by circular to the members was made, the fund exceeded £300,000 in amount.

The Council congratulate the Society on the great success which has attended this movement. They are now in communication with the proposed Trustees, and have applied to the Royal Commissioners for the Exhibition of 1851, for the grant of a portion of the land at South Kensington, purchased with the surplus of the proceeds of that Exhibition as a site for the Exhibition of 1862. The object of the Council is not only to hold an International Exhibition of Industry and Art in 1862, but to establish such Exhibitions periodically in future; and with this object in view, they are seeking from the Royal Commissioners of 1851 not merely a site for the Exhibition of 1862, but such an appropriation of the land as will secure it for future Exhibitions, and it is intended that a portion of the buildings to be erected for the Exhibition of 1862 shall be of a permanent character. It is one condition of the guarantee agreement that any surplus which may arise from the Exhibition shall be at the disposal of the guarantors for objects connected with the encouragement of Arts, Manufactures, and Commerce. The Council can, however, do no more whilst these questions are under consideration, than lay before the members of the Society the objects they have in view and what they have already accomplished. They leave the subject in the hands of the new Council, to be dealt with by them, feeling assured that the foundation which has been laid by the guarantee fund warrants them in anticipating a decided success for the undertaking.

The Council however, in retiring from office, desire to record that they look upon the action of the Society of Arts in promoting the Exhibition so far as eminently successful, and they cannot avoid the expression of their strong opinion that, under proper direction, and considering the enormous extension of commerce, the much more intimate knowledge of this country by foreigners, the greater facilities for travelling, the advance of education, and the extension of liberal commercial principles since 1851, as well in England as abroad, a more interesting Exhibition, and one more valuable politically and commercially, may be organised than in that year; and that the exhibition of the marvellous progress which has taken place during these ten years will give a more powerful stimulus to future improvement than could be effected in years of ordinary competition.

Exhibition of Inventions.

The Twelfth Annual Exhibition of Inventions was opened to the public on Easter Monday, as customary, and has just closed. It is unnecessary to enter on any particulars, as the descriptive catalogue forms part of the *Journal* for the 7th of April, and has long since been in the hands of the members.

Exhibition of the Works of the late Sir William Ross, R.A.

The late Sir W. Ross, R.A., had in early life received encouragement from this Society; and on his death it was considered a just tribute to the labours of so distinguished an artist, that the Society should endeavour to do honour to his memory by collecting a number of his works for public exhibition in the Rooms of the Society. Her Majesty the Queen graciously consented to lend four cases, containing 41 miniatures, from the Royal Collection, and for the remainder of the collection which adorned the walls of this room the Council were indebted to the liberality of private individuals, and they desire to record their great appreciation of the assistance then rendered to them by the contributors, when it is recollected that the Works entrusted to their care were not simply valuable as works of Art, but had the peculiar value of personal interest to their possessors. The Exhibition was visited by Her Majesty, H.R.H. the Prince Consort, and the Princesses Alice and Helena.

A catalogue was published by the Society, which contains an interesting memoir of Sir Wm. Ross, for which the Council are indebted to the kindness of Mr. Herbert L. Smith.

Conversazioni.

There have been held two Conversazioni during the present Session, one at the Society's House, when the members and their friends had the opportunity of inspecting the Ross Collection of Miniatures and the Exhibition of Inventions; the second at the South Kensington Museum. The latter was attended by 2,500 persons.

Medals.

The Council have, on the recommendation of Committees, awarded the following medals:—

To Mr. R. Thomson, for several novel and ingenious instruments and tools, for use in dental surgery. *The Society's Silver Medal.*

To Mr. Leonard Wray, for his compound of materials as a substitute for gutta percha. *The Society's Silver Medal.*

To Mr. J. C. Morton, for his paper read before the Society, "On the Forces used in Agriculture." *The Society's Silver Medal.*

To Mr. Leonard Wray, for his paper read before the Society, "On the Means of Increasing the Production of Sheep's Wool and Angora Goat's Hair." *The Society's Silver Medal.*

To Mr. George R. Burnell, for his two papers read before the Society, "On Building Stones—the Causes of their Decay, and the Means of Preventing it," and "On Building Woods—the Causes of their Decay and the Means of Preventing it." *The Society's Silver Medal.*

To Dr. Dauglish, for his paper read before the

Society, "On a New System of Bread Manufacture." *The Society's Silver Medal.*

To Dr. J. Forbes Watson, F.R.S., for his paper read before the Society, "On the Chief Fibre-Yielding Plants of India." *The Society's Silver Medal.*

The Council desire to call the special attention of the members to the paper by Dr. Forbes Watson. The illustrations were all furnished at the expense of the Indian Government, who also supplied the funds to enable the chemical analyses of soils to be made. Under these circumstances, and taking into consideration the importance of diffusing as widely as possible, and in the proper channels, the valuable information therein collected, the Council have thought it right to comply with the request of the Indian Government, and present them with three thousand copies of the paper, for distribution in India and elsewhere. The Council have also made arrangements for the publication of the paper as a book, by Messrs. Bell and Daldy, at a royalty of a fixed sum for each copy sold.

Marine Algæ.

The Council hope that the Prize of One hundred pounds, placed at the disposal of the Society by Sir Walter Trevelyan, Baronet, for the best "Original Essay on the application of the Marine Algæ, and their products, as food or medicine for man and domestic animals, or for dyeing or other manufacturing purposes," will receive the best attention of those interested in the subject. The particulars and conditions relating to this Prize have already appeared in the *Journal*, and may be had on application to the Secretary. The time for delivering in of the Essays is the 31st December in the present year.

The Prize Writing Case.

The members of the Society will be interested in learning that the cheap portable writing case, for which the Council awarded last year to Messrs. Parkins and Gotto the Special Prize of £20, given by Messrs. Trench and MacGregor, and the Society's Silver Medal, has been appreciated by the public, upwards of 20,000 having been sold up to the present date, and the sale continues at an undiminished rate.

Union of Institutions.

For an account of the Society's proceedings in reference to this branch of its action, the members are referred to the Secretary's report, read to the Conference of the representatives, held on the 22nd inst., which will be published in next week's *Journal*. In this report it will be seen that the Council have been successful in urging upon the Trustees of the National Gallery to permit the Vernon and Turner collections to be visited by the public of an evening. These galleries are now open to visitors gratuitously three evenings in the week.

Finances.

Appended to this report is the Treasurers' accounts for the year ending the 31st of May, the period to which the Society's books are made up.

From the accounts it will be seen that the ordinary income of the Society from annual members is satisfactory, being rather in excess of the income of last year, while the receipts from life members elected during the year, always a very fluctuating item, has, however, been unusually small. The extraordinary receipts are somewhat less than last year. The expenditure of the Society during the year has been in excess of its income, but a large proportion of this excess it is hoped will be repaid, viz., the advance which has been made in aid of the Exhibition of 1862.

The statement of the assets and liabilities shows a balance in favour of the Society in excess of that of last year. The accounts have all been published in the *Journal* of last week.

Alteration of Bye-Law.

Serious inconvenience has been frequently found from the necessity which the Bye-Laws impose of changing the Chairman of the Council every year. The Council have decided to propose to the meeting a resolution for the repeal of that portion of Bye-law No. 9 which declares "That the Chairman of the preceding year shall not be re-elected to that office."

Mr. Alger moved that the report of the Council be received.

Mr. Frederick Lawrence, in seconding the resolution, said that with regard to the Great Exhibition of 1862, he was somewhat disappointed at the progress made, as stated in the report. It did not appear that a site for the building had been secured; and it was much to be desired that this point should at once be settled, as there were many other questions which would arise, and occupy considerable time. Amongst these, he might mention the character of the building, the conditions of the contract, and other details. He would urge upon the Council a vigorous course of action. He believed that it was nearly two months since the guarantee fund had reached a quarter of a million.

Mr. William Hawes explained that a much shorter time than that stated by Mr. Lawrence had elapsed since the Council were in a position to take a definite course in reference to the site and other points. He quite agreed with Mr. Lawrence as to the importance of vigorous action, but he need hardly say, it was impossible to discuss in a public meeting the many and delicate questions which such an undertaking as this Exhibition necessarily involved.

The report of the Council was then unanimously received.

The Chairman then read the following resolution, of which notice had been given by the Council:—

"That that portion of the bye-law No. 9 relating to the election of the Chairman of the Council which declares, 'that the chairman of the preceding year shall not be re-elected to that office,' be repealed."

Mr. F. Lawrence said he thought the effect of passing this resolution would be that the Society would virtually have a perpetual chairman, which would certainly be a serious disadvantage. A judicious change instilled new life and

energy into all public bodies, the proceedings of which were, at all times, to a great extent, in the hands of their officers. A new chairman always felt bound to redouble his exertions in carrying out the objects of the body over which he presided. He (Mr. Lawrence) could not support the resolution in its present form, but if it had only been proposed to suspend the bye-law for a limited period, he should have had no objection to offer, particularly when so able a gentleman as the present chairman was in office.

Mr. Chester quite agreed with the last speaker as to the undesirableness of having a perpetual chairman, but having himself filled that honourable position some years since, and knowing how onerous its duties were, he had little fear that any gentleman would be desirous of holding it for too long a period. It had been found, however, that it always took some time before a chairman became thoroughly conversant with his duties, and, under the existing bye-law, no sooner had he become thoroughly efficient, than the Society was compelled to forego the advantage of his services.

Mr. J. P. Bull said there could be no doubt as to the undesirableness of having a chairman whose office was virtually perpetual. He felt no difficulty in making this observation in the presence of so remarkably efficient a Chairman as Sir Thomas Phillips, and he wished it to be understood and recorded that if this bye-law was repealed it was not to be understood that the Chairman should look forward to re-election as a matter of course.

Mr. Atkinson supported the recommendation of the Council.

The resolution was then put and carried.

Mr. Lawrence called attention to the heavy charge in the balance sheet on account of the *Journal*, and suggested the propriety of discontinuing its publication during the recess, as a means of economising the Society's funds.

Mr. Hilton asked whether it was intended to take any steps with a view to rendering the library more accessible and useful to the members. It contained some very valuable books, which he thought were scarcely sufficiently known.

Mr. Atkinson concurred in the desirability of improving the library as much as possible.

Mr. Meredith proposed a cordial vote of thanks to Sir Thomas Phillips for the able manner in which he had conducted the business of the Society during the past year.

The motion was seconded by Mr. Atkinson, and unanimously passed.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following noblemen and gentlemen had been unanimously elected to fill the several offices. The names in *italics* are those of members who have not, during the past year, filled the offices to which they have been elected.

COUNCIL.

PRESIDENT.

H.R.H. The Prince Consort, K.G., F.R.S., &c., &c.

VICE-PRESIDENTS.

Thomas Dyke Acland.
Lord Ashburton, F.R.S.
Thos. Bazley, M.P.
W. H. Bodkin.
Harry Chester.
C. Wentworth Dilke.
John Dillon.
The Earl Ducie.
William Fairbairn, F.R.S.
The Earl Granville, F.R.S.
Henry Thomas Hope.
The Marquis of Lansdowne.
Lieut.-Col. H. Cunliffe Owen, R.E., C.B.
Sir Thomas Phillips, F.G.S.
The Marquis of Salisbury, K.G.
Lord Stanley, M.P.
William Tooke, F.R.S.
Matthew Uzielli.
Thomas Winkworth.
Vice-Chancellor Sir William Page Wood, V.P.R.S.

OTHER MEMBERS OF COUNCIL.

John Bell.
Thomas King Chambers, M.D.
Henry Cole, C.B.
J. Griffith Frith.
John MacGregor.
William Hawes.
Francis Le Breton.
J. C. Macdonald.
William Thomas Mackrell.
F. R. Sandford.
Thomas Sopwith, F.R.S.
Wm. Spottiswoode, F.R.S.

TREASURERS.

Peter Graham.
Samuel Redgrave.

AUDITORS.

John Alger.
Arthur J. Lewis.

SECRETARY.

Peter Le Neve Foster, M.A.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

At the conclusion of the General Meeting, a Special Meeting, called for the election of members, was held, at which Sir Thomas Phillips, Chairman of the Council, presided.

The following candidates were balloted for, and duly elected members of the Society :—

Allen, Charles J. H.
Ash, George Claudius.
Bailey, Samuel.
Cook, Thomas.
Elias, Hyman.
Harvey, George.
Hatchard, Rev. John Alton.
Hewett, Charles.
Iselin, John Frederick, M.A.
Kidd, John Howard.
Lorimer, George B.
Macintosh, Alexander.
Marsh, Matthew Henry, M.P.
Newell, Thomas Frederick.
Oppler, Adolph.
Oxley, James.
Riddell, Robert Flower.
Roberts, Richard.
Robertson, William.
Shanks, Peter Martin.
Stewart, John.
Trower, George S.
Venning, James M.

Home Correspondence.

ON THE FIBRE-YIELDING TREE-MALLOW.

Sir,—Having seen, in the *Literary Gazette* of the 12th May, that a paper by Dr. J. Forbes Watson, "On the Fibre-yielding Plants of India," was read to the Society of Arts, in which the author appears to have made some "observations on the measures required for the encouragement of the growth of those and other Indian products, to meet the wants of Britain," I take the liberty of sending to you a specimen of a much-neglected British plant, with a short account of it and of its fibre-yielding property.

The plant is the tree-mallow, or *Lavatera arborea* of Linnæus, and of our British botanists, which has long been a native of some of our sea-cliffs and coasts, not only in England, but also in Ireland and Scotland. Being, the last week, in August, 1857, on the South Coast of Ireland, I gathered some ripe seeds, from a specimen which I found there, the plant itself being scarcely more than four feet high; half the number (six or eight) I sowed in the following spring, namely, on April 17th, 1858, in very rich soil, in my own garden, situate in the south-east of the county of Durham. I believe five of the seeds germinated and grew strongly; I did not transplant them, and none of them flowered in the first season. I did not protect or take any care whatever of the young plants during the winter of 1858-9. Although last spring and summer were unusually dry, two or three of the plants grew rapidly, and attained a height of about 8 feet; they also produced an abundance of handsome purple flowers during that summer and the succeeding autumn.

The specimen that accompanies this letter is the lowest portion of the largest of those plants, which all continued

green and in full strength, until the unusually early and severe frost which occurred about the middle of last December killed them.

I am particular in giving you these exact accounts, in order to show that no care is requisite in the cultivation of this species of *Lavatera*, and that only an intense frost, as it seems to me probable, will destroy them.

The specimen now exhibited was cut close to the bark, and measures, without the bark, 9½ inches in circumference, and about 3 inches in diameter; an inner circle, somewhat darker in colour, is apparent, and this I am inclined to think must be the size, or quantity, of the woody portion of the first year's growth; the diameter of it gives a little more than 1⅛ inches, and the radius about four and a half eighth's of an inch, whilst the radius of the paler or outer circle, which I consider as the portion increased during the second year's (1859) growth, is eight-eighth's of an inch, *i. e.*, one inch. The thickness of the bark with the inner and fibrous lining, varies from two-eighths to two and a half eighths of an inch.

Thus the specific name of *arborea*, or "woody," has been very appropriately bestowed on it by the older botanists. If the specimen be handled it will immediately be ascertained that it belongs to a plant of most rapid growth, and if the same rate of growth could continue for a succession of several years, the increase of the woody stem and of the inner bark, or fibre-yielding portion of the entire individual, would be truly astonishing.

Now, it is chiefly to this latter portion, or the bark, that I am desirous of calling the attention of the Society of Arts. On April 19th last, I presented a specimen of one of the lower stems of the same individuals, raised by me two years ago from the Irish seeds, to the Linnean Society, with a note on its probable economic value. From being so abundantly fibrous in its nature, although somewhat coarse, I conceived it might prove well-adapted for the manufacture of ropes, mats, strong cording, and similar articles.

The specimen which had then been exhibited to the Linnean meeting, I sent to the new Museum of Economic Botany at Kew, and on visiting that museum on May 3, I noticed that that specimen, with its piece of fibrous bark, was well-placed among the *Malvaceæ*, in case 8, Upper Room No. 2, and next to it I was most unexpectedly pleased to see not only some prepared fibre of the *Lavatera arborea*, and a coil of rope manufactured with it, which had been sent from Madeira, by a Mr. Johnson, but likewise some of the fibre of the same species of *Lavatera* from Ireland. This last was presented by Lady Doneraile; it is beautifully prepared, and is of a finer quality than the Madeiran sample.

Soon after my return home, on May 5th, I collected a little of the fibrous bark, which I found upon the lowest portions of two plants that I had cut down in the previous December, and took them to a ropemaker in my neighbouring town of Stockton. He prepared the fibre as well as he could, and endeavoured to make it into cord, but he did not succeed, because, as he said, the fibre had "lost its nature;" in fact, it proved rotten, owing to its having been exposed to the frost, snow, and rain of all last winter. There can, however, be no doubt but the fibrous portion of the bark is suitable, if taken at a proper time, for the making of many textile substances, and for ropes, and articles of the like fabric. I am even very sanguine that the same fibrous portion of the Tree-Mallow, if taken at the right season and properly prepared, could be rendered of use in the manufacture of paper, and which in our future and extended demand for a cheap and easily-obtainable substance for paper-making, I hope and really expect, could with a little attention and experience, prove ultimately of much service for that purpose. The colour, perhaps, of the cordage and paper manufactured with this fibre would be dark, but this could, by bleaching or other modes of preparation, be remedied.

With these views, and with the intention of causing the Tree-Mallow fibre to be tried both for ropes and paper at an early period, I have this spring sown the remaining seeds (about eight) which I brought with me from Ireland, as well as some more obtained from a gardener near London. Many of them have germinated, and I therefore hope to communicate to the Society on another occasion the results of my experiments.

This species of *Lavatera* being biennial, I do not know whether the fibres of the first year's growth would be sufficiently developed and strong enough for the purposes which I have mentioned; but this is of little consequence, inasmuch as a succession of plants sown every season could be always procurable.

The quickness of increase of the species, particularly in a rich soil, and the large size to which it attains, render it well worthy of cultivation, especially as this is very cheap, simple, and involving no pruning or great care.

Being a sea-side plant, inland frost, or cold in high, exposed situations, might in some seasons be detrimental to the young plants; so, to avoid this risk, it would be advisable to protect them in some degree during the first winter.

In thus bringing this neglected and fibre-yielding native plant to the notice of the Society, I trust that its cultivation may be promoted; and if the quality of the fibre itself should prove satisfactory, it will be highly useful at the present day to meet some of "the wants of Britain," and that too without looking to India, or other foreign countries, for the entire supply.

I am, &c.,
JOHN HOGG.

8, Serjeants'-inn, Temple, May 29th, 1860.

HOW TO PRESERVE WOOD FROM DECAY WHEN USED FOR BUILDING AND NAVAL PURPOSES.

Sir,—The House of Commons and the whole kingdom are ringing with indignation at the discovery that nearly all the gun-boats built during the Crimean war, at such an enormous expense to the country, are rotten, and that the bolts which fasten the outside planks and timbers together are several inches too short. In a letter in the *Times*, May 14, 1860, signed, "Forewarned and Forearmed," the writer asserts that the condition of some of our reserve steam fleet is not much better than that of the Crimean gun-boats. Admiral Seymour (see *Times*, May 16, 1860) stated in the House of Commons, "that the original sin of these vessels (Crimean gun-boats) appeared to be the character of the timber of which some of them were built. It was well-known that not only in her Majesty's dockyards, but in the private building yards of the country, there was a lack of that properly seasoned timber which the undertaking of a large number of such boats would require."

If such be the nature of a great part of the timber used in our naval dockyards, unseasoned, and consequently liable to rot and decay, the Wooden Walls of old England will, therefore, be unfit to defend her in the hour of danger. It behoves the Admiralty to try every means to have the shipbuilding timber more carefully looked after and better seasoned. With this view, the following method of preparing timber for building purposes, introduced by the late Sir Charles G. Stuart Menteith, Bart., of Closeburn, on his estates, is now given. He was in the constant practice of soaking his timber, after it was sawn into planks, in a pond of water, strongly impregnated with lime. In consequence of this soaking, the saccharine matter in the wood, in which the worm is believed to live, is either altogether changed or completely destroyed. Scotch fir wood, employed in roofing houses, and other in-door work, treated in this manner, has stood in such situations forty years, sound, and without the vestige of a worm. In a very few years, fir timber so employed, without such preparation, would be eaten through and through. Besides freeing the wood from all attacks of the worm, it is found that the lime water steep in a great measure prevents dry rot, and makes the wood sounder and more durable for years.

The method pursued at Closeburn, by the late Sir Charles G. S. Menteith, in preparing wood for the purposes of building, was to saw it into such lengths as the occasion demands; next, to plunge the planks or beams into a pond, of suitable dimensions, having the bottom and sides rendered water-tight. Before receiving the wood, a quantity of fresh-burned lime was thrown into the pond, and well-stirred with the water, to dissolve as much as possible of it. Into this strongly-impregnated solution of lime-water the planks or beams were then thrown. As lime-water absorbs carbonic acid from the air, the lime previously held dissolved in the water becomes insoluble and falls to the bottom, and becomes carbonate of lime. Hence the necessity of now and then throwing in fresh portions of recently-calcined lime, that the solution may maintain its strength.

With respect to the time that it is necessary to soak the wood in lime-water, it must depend very much upon the thickness and texture of the wood; roofing timber of fir will require at least a fortnight; larger and closer-grained wood, as oak and other ship timber, ought to be steeped for three or four weeks, or even a longer time.

After removing the wood from the lime-water pond, it must be allowed to dry and season before it is used.

Among the benefits that this preparation of wood by the late Sir C. G. S. Menteith presents, we may safely enumerate the following, viz.:—

1. The lime which is absorbed by the pores of the wood appears to alter or destroy the albuminous and saccharine principles, and, destroying the food of the worm, saves the wood from its ravages.

2. The last elements, the albumen and sugar, having been so acted upon by the lime, there is less apprehension of the wood being infected by the dry rot.

3. The wood soaked in lime-water becomes firmer in texture and more durable. It is the well-known property of waters holding lime in solution, called "petrifying wells," to penetrate and deposit upon all substances exposed to their influence small crystals of carbonate of lime. When wood is plunged for some time in a strong lime-water solution, a slight petrifaction of the wood is observable. The carpenter who has to work up the wood taken out of the lime-water pond, complains grievously that the edge of his plane is constantly blunted, and requires to be again and again sharpened. This arises from the small crystals of carbonate of lime covering the surface of the wood, and also from their having insinuated themselves into the pores of the wood; the plane coming in contact with these has its edge taken off. Were the wood, prior to being put into the pond, smoothed with the plane, this objection of the carpenter would be prevented.

From these observations upon the late Sir C. G. S. Menteith's treatment of building timber, it must be apparent that no readier, no more economical method of preserving wood has yet been discovered.

In preparing wood for ship-building, it is well worthy of the attention of the Lords of the Admiralty to ascertain by experiment, whether or not the wood used in our naval dockyards, by being previously well steeped in strong lime-water, would not have at sea the same durability and toughness which it is found to have, when so treated, in buildings on land. I am, &c.,

JAS. STUART MENTEITH, Bart.

Mansfield-house, May 23rd, 1860.

Proceedings of Institutions.

Wrexham Literary Institute.—In the eleventh annual report for the year 1859, the committee state that they have an unusual but very gratifying fact to communicate, namely, that there is a balance of funds, though small, in favour of the Institute. Through the liberality of the president, vice-presidents, treasurer, and other gentlemen, the debt which had so long crippled the usefulness of the Institute had been entirely liquidated. The ordinary income for the year, amounting to £97 4s. 1d., is larger than has been realised in any previous year, and is exclusive of the sum of £36 16s. subscribed for the purpose of clearing off the old debt, making the total receipts £134 0s. 1d. The ordinary expenditure for the year was £96 12s., which added to the previous year's debt of £36 1s. 2d. makes a total disbursement of £132 13s. 2d., thus leaving in the hands of the treasurer a surplus of £1 6s. 11d. Arrangements have been made for instituting a course of lectures of a superior kind, and it is hoped on a permanent basis. Towards this object, the Mayor of Wrexham has given £10, with the gratuitous use of the County Hall.

MEETINGS FOR THE ENSUING WEEK.

Mon. .....Entomological, 8.
Thurs. ...Zoological, 4.
Fri. .....Archæological Inst., 4.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 13th June, 1860.

353. Aggravated Assaults on Women (Metropolis)—Return.
359. Sir John Soane's Museum—Return.
364. East India (European Forces Organisation)—Return.
372. Post Office Department (Packet Service)—Estimate.
297. Poor Rate Assessment (Ireland)—Return.
171. Bill—Agricultural Servants.
Defences of the United Kingdom—Report of the Commissioners.

Delivered on 14th June, 1860.

304. Cambridge University—Papers.
371. Expiring Laws—Report from Committee.
376. Civil Services—Estimate for Votes "On Account."
377. Navy—Proposal for the Retirement of Naval Officers.
126. Bills—Aggravated Assaults Act Amendment (amended)
172. „ Tenure and Improvement of Land (Ireland) (amended).
174. „ Austruther Union Harbour (as amended by the Select Committee).
177. „ Passing Tolls.
Customs—4th Report of the Commissioners.

Delivered on 15th June, 1860.

202. Civil Contingencies—Account and Estimate.
303. (VII). Civil Services—Estimates (Class 7).
175. Bill—Criminal Lunatic Asylum.

Delivered on 16th and 18th June, 1860.

292 (1). Universities and Durham University—Further Return.
321. Benefices under Sequestration—Return.
331. Poor Relief—Returns.
361. East India (Army)—Return of the number of troops.
363. Coals (Navy)—Return.
358. War Department (Temporary Clerks)—Return.
382. Railway and Canal Bills Committee—6th Report.
683 (A). Poor Rates and Pauperism—Return (A).
277 (1). Parliamentary Voters—Further Return.
360. East India (Army)—Returns.
367. Militia—Return.
381. Army (Troop Horses)—Return.
384. Harbours of Refuge—Paper.
180. Bills—Sale of Gas Act Amendment (No. 2).
181. „ Roman Catholic Charities (as amended in Committee and on Re-committal).
182. „ Tenison's Charity.
183. „ Metropolis Local Management Act Amendment (No. 2).
Christianity in China—Correspondence.
Affairs of Sicily—Papers.
Public General Acts—Cap. 27, 28, and 29.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 22nd, 1860.*]

Dated 28th May, 1860.

1316. Rev. H. Moule, Fordington, Dorsetshire, and J. Bannehr, Exeter—Imp. in the nature and construction of closets and commodes for the reception and removal of excrementitious and other offensive matter, and in the manufacture of manure from thence.

Dated 4th June, 1860.

1370. T. Reid, Monkton Mill, Ayr, N.B.—Imp. in machinery, apparatus, or means for actuating or working railway brakes.

Dated 5th June, 1860.

1371. W. Taylor, Nursling, near Southampton—The improved heating of hothouses and other buildings by means of flat pipes made of any malleable material, and for manufacturing thereof.
1373. C. Senior, Deadwaters, near Huddersfield, Yorkshire—Apparatus for utilizing the waste heat in the flues of steam and other engines.
1375. F. C. Richer, Waterloo-road, Surrey—Imp. in breech-loading fire-arms and in their cartridges.
1376. W. Trenter, 44, Clerkenwell-green, Middlesex—Imp. in washing and wringing machines.
1377. J. Jardin and P. A. Girard, 29, Boulevart St. Martin, Paris—A new or improved machinery for manufacturing trick, tiles, and other ceramic products.
1379. E. Lavender and R. Lavender, 31, Bromley-street, Commercial-road, Stepney—Imp. in destructive and vinous distillation.
1380. G. Bower, St. Neots, Huntingdonshire—Imp. in apparatus for manufacturing, controlling, and regulating the flow of gas.
1381. J. Apsey, Cornwall-road, Lambeth, Surrey, and W. G. Buckwell, Phœnix Stone Works, East Greenwich, Kent—Imp. in steam boiler and other furnaces.
1382. G. Hadfield, Carlisle—Imp. in the manufacture of casks or barrels, and in the machinery to be used therein.
1383. G. and J. Jenkins, 17, Young's-buildings, Hare-court, Aldersgate-street—An improved portable arm chair.

Dated 6th June, 1860.

1386. F. H. Wenham, Brixton, Surrey—Imp. in steam engines.
1389. M. G. Deschamps, 261, Strand—Imp. in machinery for carving and sculpturing.
1390. J. Jewsbury, Kinver, Staffordshire—Certain imp. in machinery for the manufacture of screws.
1391. C. Hadfield and W. A. Atkins, Hadfield, Derbyshire—Imp. in machinery for preparing, making, and moulding bricks, tiles, and other articles formed of clay, peat, or other materials.
1392. P. Hooley and J. Wood, Manchester—An imp in the manufacture of cotton wadding and in machinery or apparatus connected therewith.
1393. J. Saunders and J. Piper, Cookley Iron Works, Kidderminster—Imp. in the manufacture of tin and terne plates.

Dated 7th June, 1860.

1395. J. Brown, 2, Ribchester-terrace, Bridge-road, Stratford, Essex—Imp. in fire bars, retorts, and other appliances connected with furnaces, &c.
1397. P. Vangeneberg, La Chapelle, St. Denis, Paris—An improved locomobile steam saw mill.
1398. J. P. Bath, Aigburth, near Liverpool—Imp. applicable to carriage wheels for use on common highways, railroads, or tramways.
1399. Lieut. J. Kingsley, 52, Great Coram-street—Imp. in testing screw propellers and paddle wheels.
1400. E. H. Higginbotham and A. Beech, Macclesfield, Chester—Certain imp. in machinery or apparatus for the prevention of explosions of steam boilers, arising through deficiency of water or over pressure of steam.
1401. R. Bromwich, Birmingham—An improved cock for drawing off or regulating the flow of liquids or fluids.
1402. E. J. Hughes, Manchester—Certain imp. in machinery or apparatus for roving, spinning, and doubling cotton, wool, flax, and other fibrous materials. (A com.)
1403. W. Clark, 53, Chancery-lane—Imp. in electric telegraph apparatus. (A com.)
1404. W. Clark, 53, Chancery-lane—Imp. in the preservation of animal and vegetable matters. (A com.)
1405. E. Michel-Sainton, 29, Boulevart St. Martin, Paris—Imp. in knitting processes, and in apparatus for the same.
1406. M. Jacoby, Nottingham, J. Redgate, Sneinton, and J. Stones, Nottingham—Imp. in the manufacture of bobbin net or lace, in bobbin net machines.
1407. G. J. Cookson, Dorset-street, London—Imp. in gas regulators. (A com.)
1408. G. A. Waller, Saint James'-gate, Dublin—Imp. in apparatus for filtering and solidifying.

Dated 8th June, 1860.

1409. J. Wright, 42, Bridge street, Blackfriars—An improved apparatus for washing and separating metals or their ores from impurities or other foreign matters which are mixed with them. (A com.)
1411. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in machinery for the manufacture of barbed and other needles for knitting and sewing. (A com.)
1412. A. A. Croll, Coleman-street, London—Imp. in the purification of gas.
1413. G. Mackenzie, Paisley—Imp. in machinery or apparatus for twisting and doubling yarns and thread.
1414. J. Monks, Alton, Hants—Imp. in the rails and chairs of railways.
1415. P. Grimaldi, 26, Great Prescott-street, Middlesex—Imp. in steam generators.
1416. G. Joslin, H. C. Joslin, and J. Joslin, Colchester—Imp. in reaping machines.
1417. W. E. Newton, 66, Chancery-lane—Certain imp. in sewing machines. (A com.)
1418. W. Richardson, 2, Moreton-place, Kentish Town-road, Middlesex—An improved method of joining and fixing together drain, water, or gas pipes made of burnt clay or other earthy vegetable or mineral matter, thereby rendering them air and water tight, and preventing leakage.

Dated 9th June, 1860.

1419. C. Stevens, 1B, Welbeck-street, Cavendish-square—Imp. in smoke-consuming furnaces. (A com.)
1421. R. Matley, Manchester—Certain imp. in machinery or apparatus for printing woven fabrics.
1423. C. Breese, Birmingham—Imp. in metal bedsteads.
1425. J. Combe, Belfast, Ireland—Imp. in roving and slubbing frames, and in the means of transmitting power thereto, and machinery generally.

Dated 11th June, 1860.

1427. W. Johnson and I. Adamson, Liverpool—Imp. in hydraulic and other like presses, and in the apparatus connected therewith, for extracting oils from seeds.
1429. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in governors or regulators for steam engines. (A com.)
1431. Captain A. T. Blakely, R.A., Holywood, Down—An imp. in rolls or rolling mills.

Dated 12th June, 1860.

1433. T. Redwood, 19, Montague-street, Russell-square, Middlesex—Imp. in the manufacture of paper.
1435. J. Clarke, Heaton Norris, Lancashire—An improved registering apparatus applicable to guages for steam, water, vacuum, heat, and similar purposes, and also an improved mode of weighting or balancing the ordinary index finger of guages.
1437. T. Willis and G. Chell, Longsight, Manchester—Imp. in machinery for twisting, doubling, and winding yarn and thread.
1441. G. Burrows, Nottingham—Imp. in the manufacture of figured lace made on bobbin net machines.
1443. G. Catlin, Manchester—Imp. in the construction of ships and other floating bodies.
1445. J. H. Thierry, Paris—Imp. in the manufacture and composition of ink for printing.

Patents Sealed.

[*From Gazette, June 22nd*, 1860.]

June 22nd.

2923. F. A. Abel.
2925. W. E. Gedge.
2930. R. D. Guthrie.
2931. R. A. Brooman.
2932. J. Giles.
2936. D. Hulett and G. Boccius.
2943. F. G. Spilsbury.
2953. X. Carrère de Nabat and A. Carrère de Nabat.
2961. F. P. Janniard.
2962. C. Sylvester Rostaing.
2988. W. E. Gedge.
24. M. A. F. Mennons.
31. A. Chambers.
77. W. E. Newton.
128. W. Smith and P. Smith.
157. W. E. Gedge.
206. C. F. Varley.
211. J. H. Johnson.
228. W. E. Newton.
343. W. E. Newton.
866. E. T. Delafield.
928. W. Burgess.
1121. D. West.

[*From Gazette, June 26th*, 1860.]

June 26th.

2958. A. McDougall.
2960. F. Dressler.
2967. S. King.
2972. T. Fearnley.
2973. T. R. Russell.
2975. T. S. Cressey.
2997. H. Hunster.
15. F. Hudson.
21. G. Davies.
215. W. E. Newton.
265. W. E. Newton.
289. W. E. Newton.
307. A. V. Newton.
821. W. Richardson.
935. M. A. F. Mennons.
991. T. G. Dawes.
1099. W. Henderson.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, June 22nd*, 1860.]

June 18th.

1713. T. Spencer
1728. B. Richardson
1765. J. Juckes.

June 19th.

1721. E. Kirk, J. Leadbetter, and C. Wilson.
1734. L. Cowell.
1770. J. Exley and J. Ogden.

June 20th.

1752. D. Evans.
1986. A. Upward.

[*From Gazette, June 26th*, 1860.]

June 21st.

1742. Sir F. C. Knowles, Bart.
1812. W. E. Newton.
1921. Sir F. C. Knowles, Bart.

June 22nd.

1754. J. S. Rousselot.
1793. J. Lloyd.
1794. R. Hattersley.
1810. G. Swindells & J. Arnold.

June 23rd.

1783. J. Ingham, E. Ingham, and B. Ingham.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, June 22nd*, 1860.]

June 19th.

1549. J. E. Lightfoot.

[*From Gazette, June 26th*, 1860.]

June 21st.

1736. W. Huntley.

June 22nd.

1530. T. W. Dodds.

Journal of the Society of Arts.

FRIDAY, JULY 6, 1860.

MEETING OF COUNCIL.

Wednesday, July 4, 1860.

At the first meeting of the Council since their election, Sir Thomas Phillips, F.G.S., was unanimously elected chairman for the current year.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reported to the Council, at their meeting on Wednesday last, that the amount of the Guarantee Fund promised up to that date, was £329,600.

NINTH ANNUAL CONFERENCE.

The Ninth Annual Conference of the Representatives from the Institutions in Union and the Local Educational Boards with the Council of the Society, was held at the Society's House on Friday, the 22nd ult., at half-past 10 o'clock, a.m. Sir Thomas Phillips, F.G.S., Chairman of the Council, presided.

The following is a list of the Institutions and Local Boards of Examiners represented at the Conference, with the names of their respective Representatives :—

Aberdeen, Mechanics' Institution	Mr. Charles Fyfe.
Ashford, S.E.R. Mechanics' Institution	Mr. C. W. Eborall, President.
,, Local Board	Rev. J. P. Alcock.
Banbury, Mechanics' Institute and Local Board	Mr. J. H. Beale.
Barnet Institute	Mr. S. Baldock
,, Local Board	Mr. J. Thimbleby.
Basingstoke, Mechanics' Institution	Mr. W. W. B. Beach, M.P.
Bath, Athenæum	Mr. William Tite, M.P.
Bath, Mechanics' Institution	Mr. Horace Martin.
Berkhampstead, Mechanics' Institute	Rev. J. R. Crawford.
Bexley Heath, Useful Knowledge Society	Dr. Flaxman Spurrell.
Birmingham and Midland, Institute	Sir Francis E. Scott, Bart., President.
	Mr. Wm. Mathews, jun., Vice-President.
	Mr. J. B. Hebbert.
Bromsgrove, Literary and Scientific Institution	Mr. T. H. Galton.
Bury, Athenæum	The Rev. W. R. Thornburn, M.A., President.
	Mr. Jno. Heap.
,, Local Board	The Rev. E. G. Hornby.
Chesterfield, Institute	The Rev. F. Calder, Head Master of the Grammar School.
Chichester, Literary Society and Mechanics' Institute	Mr. H. W. Freeland, M.P.
Chippenham, Literary and Scientific Institution	Mr. G. Poulett Scrope, M.P., President.
Darlington, Church of England Institute	Mr. Henry J. Grieveson.
,, Local Board	Mr. J. W. Pease (Chairman).
Derby Mechanics' Institution	Mr. Wm. Ferneyhough.
Faversham, Mutual Improvement Society	Mr. F. W. Monk.
Glasgow, Institution and Local Board	Mr. Robert Dalglish, M.P.
Gosport and Alverstoke, Literary and Scientific Institution	Mr. Walter O. Field.
Halifax, Working Man's College	Mr. George Gibb.
Hartlepool (West), Literary and Mechanics' Institute, and Local Board	Mr. W. W. Brunton.
Hastings, Mechanics' Institution	Mr. C. J. Womersley, President.
	Mr. J. Huggett.
Hertford, Literary and Scientific Institution, and Local Board	Rev. Thos. Lander.
Hitchin, Mechanics' Institution	Rev. L. Hensley.
Holmfirth, Mechanics' Institution	Mr. Jas. Hixon.
	Mr. Sam. Wimpenny.
Huntingdon, Literary Institution	Mr. Robert Honey.
Ipswich, Mechanics' Institution	Mr. T. Shave Gowing.
Kingston (Surrey), Mechanics' Institute	Mr. John M. Clabon.
Leeds, Young Men's Christain Institute	Mr. J. N. Brigg.
,, Local Board	Mr. Osburn, F.R.S.L.
	Mr. C. S. Spence.
Leeds, Yorkshire Union of Mechanics' Institutes	Mr. Barnett Blake.
Liverpool, Institute	Rev. J. S. Howson.
London, British Horological Institute	Mr. Valentine Knight, President.
	Mr. Adam Thomson.
	Mr. Theodore Gordon
,, Clerkenwell Working Men's Institute	Rev. R. Maguire, President.
,, ,, Local Board	Mr. C. Binyon.
,, Domestic Mission	Mr. J. M. Wade.
,, ,, Local Board	Rev. John Broome.
,, Hackney, Literary and Scientific Institution	Mr. J. W. Clennell.
	Mr. G. B. Dalby.
,, Mechanics' Institution	Mr. S. Vallentine.
	Mr. T. J. Pearsall.
,, ,, Local Board	Mr. T. A. Reed.
,, Metropolitan Evening Classes, Sussex Hall	Rev. C. Mackenzie.
	Mr. F. Reynolds.
,, Royal Polytechnic Institution Evening Classes	Rev. C. Mackenzie.
	Mr. Fred. Gaussen.
	Mr. J. B. Buckmaster.
,, St. Stephen's, Westminster Local Board	Rev. W. Tennant.
,, and South-Western Literary and Scientific Institution	Mr. Hayes Kyd.
,, Tailors' Labour Agency Literary Institute	Mr. R. Edwards.
,, Walworth Literary and Scientific Institution	Mr. J. S. Noldwritt, Mr. Thos. Carter.
Macclesfield Useful Knowledge Society	Mr. Jno. Brocklehurst, M.P., President.
Macclesfield, Local Board	Mr. T. U. Brocklehurst.

Manchester, Mechanics' Institution	Mr. John Heywood, Chairman. Mr. R. Rumney.
Morpeth, Mechanical and Scientific Institute	Mr. Matthew Soulsby.
Newbury, Literary Institution and Local Board	Mr. Jno. Alexander, J.P. Mr. W. J. Cowper. Mr. Thomas Gurney.
Nottingham, Mechanics' Institution	Mr. Charles Paget, M.P.
Salisbury, Literary and Scientific Institution	Mr. M. H. Marsh, M.P.
Slough, Mechanics', Literary, and Scientific Institution	Mr. James Chapman. Mr. J. Brown.
South Staffordshire Union Local Board	Lord Lyttelton.
,, Messrs. Chance's Glass Works Institution	Mr. J. T. Chance. Mr. F. Talbot.
St. Leonard's, Mechanics' Institution	The Rev. J. A. Hatchard.
Wakefield, Mechanics' Institution	Mr. E. A. Leatham, M.P., President.
Waterford, Mechanics' Scientific Institute	Mr. Michael D. Hassard, M.P. Mr. John A. Blake, M.P.
Wenlock, Agricultural Reading Society	Mr. J. M. Gaskell, M.P.
Whitby Institute	Mr. Edwin Cockburn.
Wigan, Mechanics' Institution	Col. the Hon. J. Lindsay, M.P., President. Mr. H. Woods, M.P., Vice-President.
Winchester, Mechanics' Institution	Mr. Geo. J. Knowles.
Wolverhampton, Working Men's College	Rev. T. H. Campbell.
York Institute of Popular Science and Literature	Mr. John Prescott Wood.

The Secretary read the following

REPORT

To the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Gentlemen,—Before I proceed to enter upon the proceedings of the Union for the year which has just ended, it is but right that I should report, in connection with last year's Examination, that two of the successful Candidates at that Examination have since obtained appointments under Government, the Council having had the privilege accorded to them by Lord Palmerston of making two nominations to compete. Mr. Geo. Wm. Wicker, of the Portsea Watt Institute, and Mr. John Palethorp, of the Mechanics' Institution, Glasgow, were selected by the Council for these nominations, and it is gratifying to report that both were successful in obtaining the appointments. In this competition, there were five vacancies and fifteen competitors. It must be borne in mind that, in making the selection of the Candidates for these nominations, the Council were not only limited in their choice by the conditions laid down by the Treasury, as regards age and the subjects with which Candidates are required to be familiar, but the field for selection was narrowed, since many of the successful holders of Certificates, qualified for nominations, were already engaged in employments which the Government service offered no temptation for them to quit.

The Examinations of the present year have been held on an extended scale, and the same system has been continued as that on which they have been conducted for the two previous years, an explanation of which was given in my Report read to the Conference in June, 1858, and which is familiar to all. The system then adopted has been found to work well, and to adapt itself readily to the greatly increased number of candidates, who have shown themselves desirous of having their attainments tested by it. There have been formed since the commencement of the system 96 Local Educational Boards, being an addition of 16 since last year; 63 of them have been in active operation during the present year, examining 700 candidates at the Previous Examinations, of whom 574 passed as qualified to undergo the Society's Final Examinations.

Both at the last Conference as well as by correspondence, the attention of the Council was called to the multiplication of Local Boards in the same town, and in the autumn of last year I visited Manchester, Glasgow, Leeds, and Halifax, with a view of conferring with the managers of the several Institutions and members of the Local Boards, and ascertaining whether arrangements might not be made for uniting the several Boards at these places. I found, however, that owing to a variety of local circumstances, there were difficulties which at all events, for the present, rendered it impracticable that an amalgamation of Boards could take place, with the exception of Manchester, where a general Board for the City and the districts around was at once formed, the Mayor consenting to be the Chairman. At Leeds, however, subsequently, the Yorkshire Union has united several, but not all, of the Boards into one, and that Board has undertaken not only the management of the Society's Examinations, but also of the Oxford Middle Class Examinations, and proposes to examine and grant Certificates, on its own authority, to children between the ages of 13 and 16. Whilst on the subject of the consolidation of Local Boards, I am bound to notice that, notwithstanding it was found impracticable to unite the three Boards at Glasgow, that place has sent 96 candidates, who have proved their attainments by obtaining the Society's Certificates. The amount contributed in prizes has this year increased, viz., to Candidates £122, in the place of £116 last year. To Institutions £60, as compared with £35 last year; and to Local Boards £28, the same as last year.

At the Final Examinations this year, 586 attended, as compared with 480 examined last year.

That there were 586 examined at the Final Examinations, whilst only 574 were returned as passing the Previous Examinations, is readily explained, when it is remembered that when a candidate who has obtained a Certificate of the second or third class in any subject desires to be examined in the same subject, there is no necessity for his again undergoing the Previous Examination. Out of the 586 candidates examined, 478 have passed, 108 only not obtaining Certificates, a smaller number than last year, when 112 were recorded as unsuccessful out of 480 examined, evidencing more care in preparation on the part of the candidates, as well as more careful sifting by the Local Boards at the Previous Examinations. The number of papers worked were 821, and on these the Examiners have awarded 656 certificates, divided thus:—110 of the 1st class; 234 of the 2nd class; and 312 of the 3rd class. In the *Journal* for the 8th of June, the results of the Examination as regards the prizes and certificates awarded to candidates will be found, and in the *Journal* of the following week the prizes awarded to Institutions and Local Boards are recorded. In the Appendix will be found Tables giving the statistics of the Examinations, as well as the observations of the Examiners in reference to the general character of the Examinations.

The following are the occupations, or intended occupations, of the 625 Candidates whose return Papers were received:—

Accountants	3
,, Clerks ...	2
Apprentice in Cloth Warehouse ...	1
Architects	2
Assistant-Reader ...	1
,, Registrar ...	1
Attendant on Machinery	1
Baker	1
Banker's Apprentice ...	1
Bellows Maker ...	1
Book-keepers	19
Booksellers	5
Boot and Shoemakers	7
Brass Finisher... ...	1
,, Founders ...	2
Brewer	1
Bricklayer	1
Brick and Tile Maker	1
Brush Stock Maker ...	1
Butcher	1
Butler	1
Cabinet-makers ...	3
Card Printer	1
,, Writer	1
Carpenters	3
Carver and Gilder ...	1
Cashiers	2
Cash-keeper	1
Caulker	1
Chemical Teacher, Assistant ...	1
Chemists and Assistants	2
,, Dispensing ...	1
,, and Druggists	4
Clerks, Customs ...	1
,, Law, &c. ...	24
,, Mercantile, &c.	188
,, Railway ...	12
,, Telegraph ...	2
Cloth Finishers ...	2
,, Looker	1
Coachmaker	1
Colour-makers ...	2
Commission Agents and Salesmen	2
Compositors	5
Confectioners	2
Cooper	1
Damask Weaver ...	1
Designers	2
Dispensers	2
Drapers and Assistants	8
Draughtsmen	3
Drawer-in	1
Druggists and Assistants	2
Drysalter	1
Dyer	1
Engineers & Apprentices	13
,, Civil ...	2
,, Mining ...	1
Engine Fitters ...	2
Engraver	1
Engravers' Tool-maker	1
Estate & House Agents	3
Factory Operative ...	1
Farmers	2
File-cutters	3
Forage Contractor ...	1
Forgeman	1
Fustian Shearer ...	1
Gardeners	3
Glass-cutter	1
,, Packer	1
,, Painter	1
Governesses	6
Grinder	1
Grocers and Assistants	8
Hair-dresser	1
Hatters	2
Hay Merchant ..	1
Hosier	1
Housekeeper	1
In a woollen mill ...	1
Inland Revenue ...	2
Ironmongers	4
,, moulder	1
,, turner	1
Jeweller, Working ...	1
Joiners	4
Labourers	2
Land Surveyors ...	4
Letter Carriers ...	2
Lithographers... ...	2
Manufacturers	3
Masons	2
Measurer	1
Mechanics	13
Merchants	3
Mill-wrights	2
Missionary	1
,, town ...	1
Organists	2
Overlookers	3
Painter	1
Paper-makers	2
Pattern-drawer ...	1
,, makers ...	5
Pen-blade Grinder ...	1
Piecer	1
Plasterer	1
Photographer	1
Presser and Stamper ...	1
Printers, &c.	7
Pupil Teachers ...	13
Reed-makers	2
Reporter	1
Rope-maker	1
Sack-dealer	1
Saddler	1
Salesmen	2
Scholars	2
School Assistants ...	6
Schoolmasters ...	2
,, Certified	1
Seaman	1
Shingler	1
Ship Draughtsman ...	1
Shipwrights and Apprentices ...	13
Shopmen	2
Slubber	1
Smiths	2
Soldier	1
Spinner	1
Stationers & Assistants.	6
Stone-mason	1
Stuff manufacturer ...	1
Surgeon and Apothecary	1
Tailors	3
,, and Draper ...	1
Teachers	11
Tobacconist	1
Tobacco pipe-maker ...	1
Turner...	1
Waggon-maker ...	1
Warehouseboys ...	2
Warehousemen and Assistant ditto	29
Warper	1
Watchmakers... ...	2
Weavers	8
Wheelwright	1
Woolsorters	6
Woolstapler	1
Writer...	1
Uncertain, or not given	17

While on this portion of the subject, I would remark on the continued paucity of candidates in several of the subjects. It is remarkable that in Agriculture, during the last two years, no candidates whatever have appeared; and, indeed, scarcely any have come forward since the Examinations were originally established. It surely cannot be objected that this is a subject in which the members of Institutions in Union ought to take no interest. Many of these institutions are in rural districts, and the papers formerly set in that subject were of an eminently practical character. In Botany and its application to Horticulture, 11; Physiology, including the Laws of Health, 5; Principles of Mechanics, 7, and Practical Mechanics, 7; Navigation and Nautical Astronomy, 2; Magnetism, Electricity, and Heat, 11 candidates only have appeared. Whilst in no degree undervaluing the great importance of the other subjects in which the great bulk of the candidates have been examined, it must be a matter of surprise as well as regret that so little interest should be taken in these in this land of gas and furnaces, of steam and electricity, where,

perhaps, above all other nations of the world, science has been practically applied with no niggard hand, and which has thus become great in peace and mighty in war. It must not be said these are subjects of no avail to the working man, who can afford but little leisure for attention to them. Believe me, independently of the mental condition which the study of such subjects eminently supplies, there is no grade of life whether high or low, no occupation or calling in which the principles they teach are not applicable. I believe there are some who say that the practical man, the class for whom these Examinations are specially designed, needs not to trouble himself with the theories of science. Professor Willis, in the lecture which he gave in this room as one of the series on the results of the Great Exhibition of 1851, on this point observes: —"It is no secret that there has always existed an unfortunate boundary wall or separation between practical and scientific men, a marked distrust, a misunderstanding of their relative value, which have deprived them of many great benefits that they might have mutually derived from each other's pursuits. It is true that in many branches of science, as in chemistry, geology, and botany, this barrier has been broken through; the practical man has found the benefit of scientific generalizations, and the theorist has been compelled to seek the facts upon which his theories are to be based in mines and manufactories, thus compelling the two classes to work together and learn to understand each other. Still there remains too much of the ancient contempt for theory, and of an overweening and conceited value for 'facts' and 'practice.' * * * * *

"A profound knowledge of theoretical mechanics is not necessary for all persons concerned about machines, any more than an elaborate acquaintance with the entire subject of astronomy is needed by every sailor, yet sailors have no horror of mathematics, and know very well how to make use of the parts that are prepared for them. And all men who are engaged in the contrivance of machinery, whether in reducing to practice their own inventions, or those of others, should be competently instructed in the elements of the subject as well as in the history of machinery, and the artisans themselves would find their labour greatly facilitated by a knowledge of geometry and mechanics to a limited extent proportioned to their requirements."

These observations, though made with especial reference to those engaged in the making of tools and machines, are in a great degree applicable to the other subjects above alluded to. The object of these Examinations is not to stimulate men to become profound mathematicians, botanists, chemists, and philosophers, but to induce them to become acquainted with those elementary principles of science on which the concerns of their every-day life are based. On the importance of Physiology, as a branch of knowledge desirable for all classes, I will simply quote the words of Mr. James Paget, F.R.S., in a lecture given by him before the Royal Institution a few years since:—"I believe that even a moderate acquaintance with the principles of physiology, acquired in early life, would benefit a man with regard to both his body and his mind, and that it would do this by guiding him in the maintenance and improvement of health, by teaching him the true economy of his powers, whether mental or corporeal, by providing worthy materials for thought, and by cultivating peculiar modes and suggesting peculiar ends of thinking."

The foregoing observations may seem to some to be out of place in a report to the Council, but I have ventured to make them, knowing that it will be read at the meeting of the representatives from the Institutions in Union, whose attention and sympathy I am anxious to enlist on behalf of this portion of the Examination scheme.

With regard to the other proceedings connected with the Union, they have become now so much a part of the routine business, that it is unnecessary to do more than allude to them. The system by which the Institutions can purchase books under the Society's arrangements at reduced prices, still continues to be made use of by the Institutions on as large a scale as ever. With regard to the Collections of Photographs and Chromolithographs, which the Society have for circulation amongst the Institutions, I have to suggest that some portion of it will, by the lapse of time, have partially lost some of its interest, and that consequently additions should be made in order that it may fairly represent the state of these Arts at the present time. This, however, I should only recommend if it appeared probable that a considerable number of Institutions were likely to require the loan of the Collection for Exhibition, and it would therefore be desirable that Institutions desiring it during the ensuing year should communicate their intentions as soon as possible.

It will be remembered that at the last Conference it was reported that the Council were in correspondence with the Trustees of the National Gallery, with a view of inducing that body to make arrangements that the Vernon and Turner Collections then about to be exhibited at South Kensington should be open of an evening. It will be gratifying to the Conference to learn that the Council has been successful in their efforts, and that the Vernon and Turner Collections are now open several evenings of the week. In reference to this subject, I may add that a Committee of the House of Commons has been sitting during this Session to investigate the question, and before this Committee I was examined, with

a view to lay before the members the opinions which the Conference have more than once expressed in favour of the extension of this principle to all Museums and Galleries of Art supported at the public expense. The report of that Committee recommending the adoption of this principle has been made well known.

There are now 300 Institutions in Union with the Society; and if I may judge of their activity and usefulness by the tone and character of my correspondence with them, as compared with that of former years, I may with confidence report that the Institutions are gradually becoming stronger, more educational in their character, and in the same proportion becoming entitled to, and receiving an increasing amount of, public sympathy and support.

I am, Gentlemen,
Your obedient servant,
P. LE NEVE FOSTER, Secretary.

APPENDIX.

EXAMINERS' REMARKS.

The Examiner in Arithmetic remarks:—"The papers this year, as a whole, were characterised by much cleverness and judgment, some of them being among the very best which have come under my notice as an Examiner. If I may be allowed to hazard a conjecture, I would add that some of the Institutions appear to be doing their work, as far as arithmetic is concerned, extremely well, while others, I regret to say, appear to have spent but little time or means in preparing candidates for the Examination. I draw this inference from considerable similarity of working and results in groups, both of successful and unsuccessful candidates."

The Report of the Examiner in Book-keeping by Double Entry says:—"The number of candidates in this branch continues to increase. In 1856, it was 2; in 1859, it was 84; and now, in 1860, it is 103, to 95 of which certificates have been awarded. Of the 95 examinants to whom certificates have been awarded, 68 are persons to whose efficiency in their respective callings a knowledge of book-keeping by double entry has a direct relation. Some few of the papers exhibit very decided merit, and the average result is satisfactory."

The remarks of the Examiner in Algebra are as follow:—"In successive years I have made the paper more and more simple, and I am disposed to think that in the present year I may have erred a little in that direction. Two or three questions of a severer character might possibly have made wider differences amongst some of the higher candidates, but of this I am not sure. I am led to make the remark by the fact of the intervals between successive candidates having been very small throughout the whole list. On the whole, the performances of the examinees were respectable. There were few, though there were some, of whom I should say that they ought not to have presented themselves, and there were none whose performances impressed me as being of unusual excellence. I found in this, as in former years, a very fair acquaintance with the methods of performing the simpler algebraical processes, and with respect to the large majority of candidates, I should suppose that the production of this result is the most satisfactory proof of the utility of the Examination."

The Examiner in Geometry says:—"The number of candidates was much smaller this year than last, and, with a few exceptions, I think the quality of the performances rather below the standard of last year. There was much less evidence of power of dealing with geometrical problems. At the same time, those who were in the first division all showed some geometrical skill, as well as an accurate knowledge of the elements. There was, generally speaking, evidence of a careful study of the subject on the part of the candidates who are ranked in the first two classes, but I do not find that any of the papers deserve special mention for any remarkable ingenuity or power."

The Examiner in Mensuration reports:—"My impression of this year's Examination in Mensuration is, that it has not been very satisfactory. Not one of the candidates has succeeded in obtaining a place in the first class. Great inaccuracy characterised the work of several of them; others showed that they had had little or no practice in Examinations on paper. I did not find so much technical knowledge as I had expected. The small number of candidates adds to the belief that, however useful a knowledge of mensuration may be, the subject is by no means popular. Having taken no part in previous Examinations, I can make no comparison between the work of this year and that of former years."

The report of the Examiner in Trigonometry, says:—"The general character of the answers was creditable, and above the average in freedom from gross blunders, which are so often seen in Examinations, and which are generally indicative as much of bad teaching as of bad learning. At the same time, no very remarkable talent exhibited itself."

The Examiner in Conic Sections reports:—"The questions in Conic Sections were answered by few, but the papers for the most part showed that the subject had been well studied, both geometrically and analytically. There was a readiness in translating the algebraical results into their corresponding geometrical theorems which was very creditable to the candidates, and afforded evidence that neither the geometrical demonstrations were learnt by rote, nor that the analytical proofs were the results of mere algebraical manipulation. I think that the subject thus mastered is an excellent discipline, and deserves all the encouragement that the Society of Arts can give it."

The Report of the Examiner in Navigation and Nautical Astronomy is as follows:—"After three years' experience as your Examiner in Navigation and Nautical Astronomy, I am left only to speculate on the almost total absence of candidates for the Society's certificates in these subjects. This may arise either from the limited number of students, or from all the requisites of such examinations being fully supplied in other quarters. Masters and mates of merchant ships are compelled to undergo examination, and are certificated for their particular grades; so, also, are a few young teachers attached to schools under the control of the Board of Trade; but of such teachers there are not one-fiftieth of the number requisite for the proper training of the youth intended for sea. In the royal navy provision is made both for teaching and examining young officers; and recently the merchants of Liverpool have exhibited a laudable example to our great seaports, in the establishment of their school-ship 'Conway,' for the training of respectable boys intended to hold the rank of officers in their ships. But I have long been convinced that shipowners and shipmasters generally, are alike indifferent to any scientific preparation on the part of boys whom they employ; such preparation is left to the ambition of those who may desire to occupy a creditable position in the profession they have chosen. Where do the masters and mates of ships obtain even the scanty supply of professional knowledge necessary to pass their examination? Generally, from the cramming schools, whose sole object is to coach the candidates through the narrow routine of the examination, without any pretence of sound teaching. With such appliances as at present exist there would be ample grounds for the operations of the Society's examinations were there any hearty appreciation of these

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	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	186	1858	1859	1860	1858	1859	1860	1858	1859	1860
Aberdeen	...	48	33	...	39	30	...	32	26	...	18	14	...	60	33	...	...	...	...	4	8	...	19	7	...	...	...	...	...	...	...	...	...	...	14	12
Andover	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ashbourne, Lit. I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	...	...	...	2	4
Ashbourne, W.M.I.	...	4	4	...	4	4	...	4	5	...	2	1	...	4	5	...	...	...	...	...	5	...	2	3	...	...	...	...	...	...	...	...	...	...	...	...
Ashford	...	4	9	...	2	6	...	2	7	...	2	7	...	4	12	...	2	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bacup	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Banbury	2	4	...	2	4	...	2	3	...	2	1	...	4	4	...	2	...	...	2	...	...	...	2	...	2	...	...	...	...	...	2	...	...	...	2	...
Barnet	...	...	3	...	...	3	...	...	3	...	...	3	...	...	3	...	...	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Basingstoke	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Bedford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Belfast	...	18	9	...	17	9	...	13	8	...	7	6	...	21	12	...	...	1	...	1	2	...	7	5	...	...	...	...	...	...	...	...	...	...	6	2
Berkhampstead	10	...	4	10	...	3	8	...	3	6	...	1	8	...	3	...	...	...	3	...	3	3	...	...	...	...	...	...	...	...	...	...	...	2	...	2
Birmingham and Midland I.	...	27	14	...	22	14	...	18	19	...	14	17	...	22	19	...	3	5	...	8	7	...	6	5	...	1	2	...	...	...	...	1	1	...	4	2
Bishop's Stortford	...	...	1	...	...	1	...	...	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Blackburn	15	9	12	5	9	8	4	5	6	2	1	3	10	7	8	1	...	...	2	1	...	3	1	4	...	...	...	...	...	...	...	...	...	2	4	3
Blandford	...	6	...	...	3	...	...	3	1	...	3	1	...	5	2	...	...	1	...	1	...	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...
Bradford, Yorks.	23	24	18	17	22	12	17	20	19	16	19	19	26	33	28	1	4	5	13	6	14	9	20	9	...	1	1	...	...	1	...	...	1	1	1	...
Brighton, for Sussex	3	3	...	3	3	...	2	1	...	2	1	...	4	2	...	...	...	...	2	1	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Bristol Athenæum	11	16	5	11	14	5	9	14	4	8	12	4	15	29	7	3	9	...	8	8	5	3	8	2	2	7	...	...	1	...	1	...	...	1	2	...
Brompton, (near Chatham)	...	...	7	...	...	7	...	...	7	...	...	6	...	...	11	...	...	1	...	...	4	...	...	5	...	...	...	...	...	...	...	...	...	...	...	1
Bucks and Berks Lecturers' Ass.	...	...	24	...	...	3	...	...	2	...	...	1	...	...	4	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1
Burnley, E. Lancashire Union	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bury, Athenæum	...	6	1	...	4	1	...	4	4	...	4	3	...	4	4	...	...	...	...	2	1	...	2	2	...	...	...	...	...	...	...	...	...	...	...	1
Canterbury	...	3	6	...	2	5	...	2	5	...	1	4	...	2	8	...	...	1	...	1	4	...	...	1	...	...	...	...	...	...	...	...	...	...	1	1
Carlisle	...	4	16	...	4	16	...	3	14	...	1	11	...	3	23	...	...	1	...	...	8	...	1	9	...	...	...	...	...	...	...	...	...	...	2	3
Carshalton	...	2	3	...	2	3	...	2	3	...	2	2	...	4	6	...	2	1	...	...	1	...	3	1	...	...	1	...	...	...	...	...	...	...	...	1
Chelmsford	...	1	2	...	1	1	...	1	1	...	1	1	...	1	2	...	...	2	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
Darlington	...	...	5	...	...	5	...	...	5	...	...	5	...	...	6	...	...	1	...	...	3	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Derby	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Devonport	...	...	3	...	...	3	...	...	3	...	...	3	...	...	8	...	...	2	...	...	1	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...
Dover	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1	...
Frome	...	3	...	...	3	...	...	3	...	...	2	...	...	4	...	...	1	...	...	21	22	...	24	19	...	2	4	...	1	1	...	2	3	...	5	6
Glasgow, M.I.	...	48	65	...	42	45	...	41	53	...	36	47	...	63	65	...	8	17	...	10	14	...	7	19	...	2	1	...	...	...	...	...	...	...	7	5
,, Athenæum	...	24	40	...	24	39	...	24	36	...	17	31	...	29	48	...	4	9	...	...	6	...	2	10	...	...	2	...	...	1	...	...	2	...	1	2
,, Institution	...	4	24	...	4	22	...	3	21	...	2	19	...	3	25	...	...	6	...	...	6	...	2	10	...	...	2	...	...	1	...	...	...	...	...	...
Greenwich	1	...	...	1	...	...	1	...	...	1	...	...	2	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Halifax, M.I.	35	4	6	17	4	6	12	4	4	10	4	4	18	5	5	3	4	...	7	...	1	4	1	4	1	3	...	...	1	...	...	1	...	2	...	...
,, W.M. College	67	28	14	21	14	13	15	14	16	11	12	14	23	20	19	1	3	1	4	4	4	10	7	10	...	...	...	...	...	...	...	...	...	4	2	2
Hanley, "Potteries," M.I	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hartlepool (West)	5	4	9	3	4	8	2	4	6	2	3	6	5	7	11	...	...	...	2	...	3	3	5	6	...	...	...	...	...	...	...	...	...	...	1	...
Hertford	...	...	6	...	...	2	...	...	2	...	...	2	...	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hitchin	...	2	4	...	2	4	...	2	5	...	2	4	...	3	12	...	...	...	...	...	9	...	3	2	...	...	...	...	...	...	...	...	...	...	...	1
Holbeck (in con. with Leeds York. Un.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Holmfirth	...	1	3	...	1	2	...	1	2	...	1	2	...	3	3	...	...	...	...	...	2	...	3	1	...	...	...	...	...	...	...	...	...	...	...	5
Ingrow and Hainworth	...	...	6	...	...	6	...	...	6	...	...	1	...	...	6	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Ipswich	7	10	5	6	8	5	5	4	3	4	2	3	11	6	4	...	1	2	5	...	1	10	2	1	...	...	1	...	...	...	...	...	1	...	2	3
Leeds M.I. (Yorks. Union)	13	5	39	10	4	39	10	4	22	8	4	19	22	10	37	2	...	3	6	2	15	7	6	14	2	...	...	...	...	...	1	...	2	2	3	7
,, Y.M. Christian I.	14	42	47	14	39	41	14	37	40	11	29	35	43	68	60	5	9	9	9	8	14	10	32	27	3	2	3	...	1	...	2	...	2	3	7	5
Leicester, Ch. of Eng. I.	...	13	2	...	13	2	...	13	6	...	13	6	...	21	13	...	5	4	...	8	5	...	6	4	...	1	1	...	...	...	...	...	...	...	...	...
*Lewes	2	...	...	2	...	...	1	...	...	1	...	...	5	...	...	...	...	...	2	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Not now in Union.

TABLE I.—COMPARATIVE RESULTS OF THE EXAMINATIONS OF 1858, 1859, AND 1860.—(*Continued.*)

Name of Local Board.	No. of Candidates Examined at the previous Examin. at Local Board.			No. of Candidates who passed the previous Examinations.			No. of Candidates Examined at the Final Examination.			No. of Candidates who passed Final Examination.			No. of Papers Worked at the Final Examination.			No. of 1st Class Certificates Awarded.			No. of 2nd Class Certificates Awarded.			No. of 3rd Class Certificates Awarded.			No. of Prizes Awarded to Candidates.			No. of Prizes Awarded to Local Boards.			No. of Prizes Awarded to Institutions.			No. of Unsuccessful Candidates.		
	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860
Liverpool	35	21	13	35	19	12	32	15	11	16	12	9	56	29	21	3	...	..	8	4	4	17	16	9	...	...	...	...	...	...	...	...	...	16	2	2
Lockwood	1	2	...	1	2	...	1	2	1	1	1	...	2	2	1	...	...	...	1	...	...	...	1	..	...	...	...	...	...	...	...	...	...	...	1	1
London, Roy. Poly.	29	20	6	8	14	6	14	11	9	12	10	8	29	18	10	4	4	1	4	3	5	13	7	2	2	2	...	...	...	...	...	1	...	2	1	1
,, Clerkenwell	...	...	6	..	...	4	...	...	4	...	...	2	...	...	4	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	2
,, Crosby Hall, now Met. Ev. Cl., Sussex Hall	27	35	21	25	35	20	24	34	22	17	25	19	39	48	27	11	5	9	8	11	7	19	17	7	6	2	2	1	...	...	3	1	2	7	9	3
,, Domestic Mission	1	2	...	1	2	...	1	2	...	1	1	...	3	2	...	...	...	...	2	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...
,, Jews' and General L.I.	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,, Mech. I.	12	10	11	8	10	7	6	9	10	5	8	10	13	12	16	4	1	6	6	3	6	1	6	3	...	...	3	1	...	1	...	...	1	1	1	...
,, St. Stephen's M.	...	...	4	...	...	3	...	...	3	...	...	2	...	..	3	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1
,, Tailor's Labour Agency L.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* ,, West Brompton	4	...	...	4	...	...	3	...	...	3	...	...	6	...	...	...	...	...	3	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Longton	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Louth	4	3	5	4	3	5	4	3	5	4	2	3	5	4	8	...	...	...	...	1	2	4	1	2	...	...	...	...	...	...	...	...	...	...	1	2
Lymington	1	...	...	1	...	...	1	...	...	1	...	...	5	...	...	1	...	...	3	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Lynn (King's)	...	3	4	...	3	4	...	3	5	...	3	5	...	7	8	...	1	1	..	3	3	...	1	4	...	...	1	...	...	...	...	...	...	...	...	...
Macclesfield	83	...	16	83	...	10	8	...	7	4	...	2	12	...	7	1	...	...	...	...	1	5	...	1	...	...	...	...	...	...	...	...	...	4	...	5
Manchester, M.I.	32	36	31	32	31	27	24	26	27	10	21	21	39	48	42	...	3	2	8	10	8	10	22	21	...	1	1	...	...	...	...	...	...	14	5	6
,, Inst., Association	591	...	...	100	...	...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Middlesborough	...	..	2	...	...	2	...	...	2	...	...	2	...	..	2	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Neath, M.I.	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Newbury	...	...	2	...	...	2	...	...	2	...	...	2	...	...	6	...	...	...	...	...	1	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Newcastle-on-Tyne	3	7	...	3	7	...	3	7	2	3	6	2	5	14	2	...	...	...	1	2	1	3	6	2	...	...	...	...	...	...	...	...	...	...	1	...
*Northowram	1	1	...	1	1	..	1	1	...	1	1	...	4	3	...	...	...	...	...	1	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...
Oldham	...	...	4	...	...	4	...	...	4	...	...	3	...	...	8	...	...	...	...	...	2	...	...	5	...	...	...	...	...	...	...	...	...	...	...	1
Paisley	...	2	...	...	2	...	...	2	...	...	1	...	...	3	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Pembroke Dock	4	5	7	4	5	7	4	5	8	...	4	8	13	9	16	1	1	1	5	2	3	6	4	11	...	1	...	...	...	...	...	...	...	...	1	...
Portsmouth	2	5	4	2	5	4	2	5	4	2	5	4	13	15	12	3	2	1	5	4	5	4	6	3	3	...	1	...	...	...	4	...	...	...	...	...
Richmond (Surrey)	...	5	12	...	4	9	...	4	6	...	4	3	...	7	9	...	1	1	...	2	3	...	2	2	...	1	...	...	...	...	...	...	...	...	...	3
Rotherham	...	...	7	...	...	7	...	...	3	...	...	3	...	...	5	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...
Salford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury	1	...	...	1	...	...	1	...	...	1	..	...	4	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Selby	10	12	1	9	10	1	9	7	1	3	5	1	11	15	1	...	1	...	2	1	1	2	8	...	...	...	..	...	...	...	...	...	...	6	2	...
Sheerness	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sheffield	20	42	13	18	35	11	16	32	23	9	26	15	23	47	26	3	2	2	3	12	8	5	23	8	3	1	...	...	...	...	...	1	...	7	6	8
Skipton	...	2	6	...	2	6	...	2	7	...	2	3	...	4	9	...	...	...	...	2	...	...	2	4	...	...	...	...	...	...	2	...	...	...	...	4
Slough	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Staffordshire	...	...	36	...	...	24	...	...	24	...	...	21	...	...	32	...	...	2	...	...	3	...	...	22	...	...	2	...	...	...	...	...	...	...	...	3
†Messrs. Chances' Library	2	14	...	2	7	...	1	7	...	1	2	...	3	8	...	...	2	...	1	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	5	...
Wakefield	4	4	3	4	2	3	4	2	3	3	2	3	6	3	4	...	...	1	...	2	1	5	1	1	...	...	1	...	...	...	...	...	...	1	...	...
Warminster	1	3	...	1	2	...	1	1	...	1	1	...	2	1	...	...	...	...	1	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Waterford	...	25	12	...	16	6	...	6	5	...	2	3	...	6	5	...	...	1	...	2	1	...	...	1	...	...	...	...	...	...	...	...	...	...	4	2
West Bromwich	..	...	8	...	...	3	...	..	3	...	...	3	...	...	3	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...
Wigan	9	5	9	6	5	7	6	5	9	5	2	8	11	6	9	...	...	1	2	...	3	5	2	4	...	...	1	...	...	...	...	...	...	1	3	1
Windsor	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wirksworth	...	3	...	...	2	...	...	2	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
York	11	7	8	7	6	8	7	6	8	5	6	7	14	6	10	3	2	2	2	1	2	5	1	5	...	...	1	...	...	...	...	...	...	2	2	1
Total	1107	641	700	501	544	574	288	480	586	197	368	478	516	766	821	53	78	110	132	154	234	176	308	312	25	28	30	2	4	4	16	7	12	79	112	108

* Not now in Union.

† This Board is now merged in that for South Staffordshire.

important subjects in our public or private schools (always excepting Greenwich). There would then be many young teachers and scholars who would gladly avail themselves of the advantages offered by the Society's examinations, no special provision being made for these in any other quarter. It remains a matter of regret and astonishment that so little attention is paid to Navigation and Nautical Astronomy, in a country whose prosperity depends, so largely as ours does, on its commerce beyond sea. Bad navigation is the cause of a large number of the lamentable shipwrecks with which the newspapers teem. It has been suggested to me that the modern system of insurance has tended to diminish the interest which wealthy and educated shipowners would otherwise have felt in the proper education of those to whom they entrust the care of their property."

The Examiner in the Principles of Mechanics writes:—"I beg to state my satisfaction with the general character of the papers submitted to me for examination. They evince a considerable amount of reading, and impress me with the idea that a further attention to the subjects already studied, and especially a more frequent use of examinations such as those offered by the Society, will enable the candidates of this year to display their resources more efficiently than they have at present done. The questions attempted merely, or wholly unanswered, will discover to them the direction which their future reading will most profitably take; and the respectable amount of acquaintance they have shown with regard to the present subjects of examination affords hope for the future."

The Examiner in Practical Mechanics reports:—"The examination in the present year has been more satisfactory than upon any previous occasion, and certain of the candidates nearly obtained a first-class certificate."

The Examiner in Electricity, Magnetism, and Heat, reports that the number of competitors has this year been considerably augmented, and that the results of the examination are generally satisfactory; but that the standard of excellence is somewhat lower than at the previous examination. The two first candidates are so nearly equal that it required careful discrimination to draw the line between them.

The Examiner in Astronomy says:—"I am unable to add any specific remarks to my report, beyond an expression of satisfaction at the general display of ability and industry, even on the part of a few candidates in a subject which is not professional or practical, showing that it is cultivated from a desire for intellectual improvement."

The Examiner in Chemistry says:—"I have much pleasure in remarking a decided improvement in the general character of the papers since last year."

The Examiner in Animal Physiology says:—"I have little to remark concerning the Examination in Animal Physiology beyond what I had to report last year. It is but fair, however, to add that the answers of the candidates who passed afford evidence of diligent reading of elementary books; and, in one case, while but few answers are given, they show greater accuracy and completeness than those submitted to me in any former year."

The Examiner in Botany says:—"Some of the papers are extremely good, and the others passed are creditable. But it is evident that the candidates are better acquainted with vegetable physiology, which can be got up from books, than with practical botany, to be acquired only in the field. This is shown by 5 out of 11 not having even attempted to answer Question 5 in Section II., by 3 out of 11 having passed over Question 6 in Section I., and by many of the attempts at answering Question 6 in Section II. having been complete failures; and yet they were all easy questions. Therefore, I am of opinion that the paragraph in the Programme referring to this subject will require alteration before another Programme is issued, Systematical (or Practical) Botany being made a subject distinct from Vegetable Physiology."

The Examiner in Political and Social Economy says:—"I thought there was some improvement since last year, and that there was a good deal of ingenuity and logical power, as well as knowledge of principles, in some of the papers, but I would still recommend a greater attention to the historical and statistical part of Political Economy, and a more frequent reference to such books as M'Culloch's Dictionary of Commerce, his account of the British Empire, Porter's Progress of the Nation, and the Blue Books of miscellaneous statistics, published under the superintendence of Mr. Fonblanque."

The Examiner in Geography reports:—"The results of this year's Examination are, upon the whole, highly satisfactory, more so than those of any preceding year. It affords me much gratification to be able to express this opinion. There is still, as might naturally have been expected, sufficient room for further improvement, but the average merit of the papers is decidedly higher than upon former occasions. Of a total of 34 papers, I find only two which fall under the head of "Not Passed," while as many as sixteen (or nearly 50 per cent. of the whole number) entitle their writers to second-class certificates, and there is evidence of thoughtful care bestowed on the subject in the great majority of instances, and real work has evidently been gone through by most, if not by all, of the writers in the course of preparation for their task. I could undoubtedly have wished to find that a greater number of the candidates were entitled to first-class certificates, but the high average merit of the entire series of papers more than counterbalances any regret on this head. I believe that the progress indicated by this year's Examination (looking at its results by comparison with those of preceding years) is entirely in the right direction, and I have nothing to add to the suggestions on the score of preparation made in my last year's report. A determination to master thoroughly the elementary details of the subject before aiming at its higher departments—a diligent and unremitting study of the map, and a reference of every geographical fact to its legitimate place in the great framework which the physical features of the globe, regarded as a whole, exhibit—constitute the indispensable preliminaries to the attainment of distinction on the part of the student of geography."

The Examiner in English History reports:—"The answers given by the students to the questions in this subject, were, on the whole, very creditable to their industry and ability. Very few candidates were rejected, and those who passed in the first class had fairly earned their places by a sound knowledge of the books in which they were examined. Those who failed to get the highest place, generally showed want of judgment or of accuracy rather than want of industry. Students intending to offer themselves next year, will do well to remember that a single question, well answered, counts more than several pages of vague generalities, and, on the other hand, that facts irrelevant to the question ought never to be introduced. Commonly, where a candidate has only a partial knowledge of a question, he had better leave it untouched. Again, it is worse than useless to answer a question on the Norman Conquest by a prefatory sketch on Anglo-Saxon history. Lastly, the student must accustom himself to think over and discriminate what is important from what is comparatively valueless. For instance, a question as to "the principal provisions of Magna Charta," is not properly answered when the writer puts down confusedly all the clauses he can remember. It is clear that the article on taxation and the article on weirs in rivers are not of equal importance, and ought not to be classed together as 'principal provisions.'"

The Examiner in English Literature says:—"I am happy to state that the papers on this subject of the present year have been, on the whole, more satisfactory than those of last year. They have shown a much stricter acquaint-

TABLE II.—Return of the Number of Papers Worked in Each Subject, in the Five Years, with the Result for the Year 1860.

SUBJECTS.	1856.	1857.	1858.	1859.	1860. No. of Papers Worked.	1860. No. of First Class Certificates.	1860. No. of Second Class.	1860. No. of Third Class.	1860. No. of Papers in respect of which no Certificate was given.
Mathematics	27	...	...	...	...	...	...	...	...
Arithmetic	...	77	159	232	263	36	71	91	65
Book-keeping	...	46	48	84	103	11	34	50	8
Algebra	...	58	74	82	77	3	17	38	19
Geometry	...	52	53	} 45 {	27	5	8	11	3
Mensuration	...	42	44		11	...	2	6	3
Trigonometry	...	25	27	17	15	...	4	8	3
Conic Sections	...	14	14	4	5	1	2	1	1
Navigation, &c.	...	4	5	...	2	...	1	1	...
Physics	...	...	...	...	...	...	...	...	...
Statics, Hydrostatics	...	11	14	17	...	...	...	...	...
Mechanics	13	...	...	...	...	...	...	...	...
Principles of Mechanics... ...	...	...	...	...	7	...	...	4	3
Practical Mechanics	...	9	8	7	7	...	3	4	...
Magnetism, &c.	...	9	4	5	11	2	2	4	3
Astronomy	...	...	5	...	6	...	4	2	...
Chemistry	16	22	13	28	28	10	11	6	1
Physiology	6	1	6	2	5	...	2	...	3
Botany	2	1	2	2	11	2	2	2	5
Agriculture...	4	2	0	...	...	...	..	...	...
Political and Social Economy ...	...	6	3	14	7	...	3	4	...
Geography	23	28	...	28	34	4	16	12	2
Descriptive Geography	...	...	29	...	...	...	...	...	...
Physical Geography	...	...	17	...	...	...	...	...	...
English History	38	24	43	38	43	14	10	16	3
English Literature...	17	17	33	30	39	5	15	10	9
Logic	...	...	...	...	12	3	4	5	...
Latin and Roman History... ...	15	19	12	18	10	4	2	3	1
French	17	38	68	87	69	7	10	23	29
German	7	15	13	14	16	1	9	6	...
Drawing	7	...	...	...	...	...	...	...	...
Free-hand Drawing	...	4	37	...	...	...	...	...	...
Mechanical Drawing	...	3	34	...	...	...	...	...	...
English Grammar and Composition.	11	...	...	...	...	...	...	...	...
Music	...	...	...	12	13	2	2	5	4
Totals				766	821*	110	234	312	165

* This total includes Seven Papers disqualified.

ance with the text of the authors that have been read, and a larger proportion of the answers have been pointed and correct. Several, however, of the most diligent and intelligent candidates have made their answers too long and diffuse, and seem hardly to have mastered the distinction between writing an essay and answering a question in an examination paper. I am apprehensive that, in this way, some three or four have failed to do justice to the extent of their acquirements, and occupy a lower place in the class list than they might else have done. Out of 39 candidates, 5 have been placed in the first-class, 14 in the second, and 11 in the third. Nine have failed."

The Report of the Examiner in Logic is as follows:—"The logic papers are on the whole very creditable to the candidates. Those which gained the highest distinction showed a full and accurate knowledge of the subject, with much power both of thought and expression; indeed better papers could hardly be expected. Almost all the rest were entitled to some praise from some special merit. In the application of logical rules to the criticism of examples, few of the candidates seemed to have too much practice. This was the weakest point, although it is obviously one of the most important."

The Examiner in Latin and Roman History says:—"The work has decidedly improved this year. The parsing was very much better, and the translations quite as good."

The Examiner in French writes:—"I have been much pleased with the French papers this year. There is a steady improvement, and I think that by raising gradually the standard, and making the examination in French something earnest and practical, we have at once asserted the daily increasing claims of a great modern classical language, (I use the word classical deliberately,) and have enabled our candidates to show what they can do, if only rightly directed and stimulated. The number of certificates awarded in French this year is relatively about the same as last year, when there was a great increase on the preceding years, but the number of 1st class certificates

is this time larger in proportion, a result both gratifying and hopeful."

The Examiner in German says:—"I have perceived with pleasure a decided improvement in the work of the candidates. It displays a most creditable knowledge of the German language, both theoretical and practical. There is, however, one thing I would wish to see more attended to by the students of German of the class which comes under our inspection, viz., a closer study of the authors; since the least profit a man ought to derive from the study of a foreign tongue, is an ability to understand such writers in it as he would understand in his own language."

The Examiner in the Theory of Music writes:—"I am glad to be able to report considerable improvement in the music papers. The number of them is but small; but several are far superior to any, and none are so faulty as some, of those I examined last year. Fewer candidates have attempted the Harmony paper without preparation; and the answers generally show not only more knowledge, but a better measure, on the part of each individual candidate, of what he might safely attempt."

TABLE III.

This Table shows the Ages of the 625 Candidates whose Return Papers were received; of these 586 underwent the Final Examination.

Age.	No. of Candidates.	Age.	No. of Candidates.
16	66	30	7
17	81	31	7
18	90	32	3
19	98	33	8
20	70	34	3
21	41	35	4
22	39	36	1
23	27	37	3
24	15	38	2
25	14	39	1
26	19	40	2
27	6	41	1
28	5	48	1
29	11		

After the reading of the Report, the Chairman called attention to the programme of the proceedings. The first subject for discussion was:

I. "What further steps can be taken to increase the Importance and Utility of the Local Boards, and whether they might not advantageously hold Annual Examinations of Children between 13 and 16 Years of age, and grant to them, on their own authority, Certificates and Prizes."

Mr. Barnett Blake (Yorkshire Union) said he had given notice of a resolution upon the first subject in the programme, which was one in which he took considerable interest. It appeared that at Leeds some steps had been taken in this direction, where an educational board had been formed, of which the authorities of the town were members *ex-officio*, and the first duty they had undertaken was to carry out examinations under the Society's system. The great difficulty they found in the country, was to educate young men until they were in a position to compete for the Society's certificates. It was the defective link between their previous instruction and more advanced education which required to be supplied. The Yorkshire Union undertook a large share of the educational business of the locality. There were 90 Institutions, besides evening schools, which came within the range of its operations. The point on which he differed from the proposition stated in the programme, was the limitation of the proposed local examinations to those between 13 and 16. The proposition which he had been instructed to support was that all under 16 years of age should be examined, and at Leeds they had taken those whom the Society of Arts, by that limitation, would not take. Between the ages of 10 and 12 immense numbers of children left school to engage in labour, and he saw no reason why they should be excluded from receiving small prizes in the numerous elementary classes which existed. He thought there was no occasion to make a limitation as to the minimum age of children to be admitted to examination. It was, he thought, sufficient to put the limitation at the maximum age of 16. In order to bring this subject fairly before the Conference he would propose the following resolution:—

"That in the opinion of this Conference it is highly desirable that the Local Boards should hold annual examinations of the members of mechanics' institutes and pupils of evening schools who are under 16 years of age, and grant to them, on their own authority, certificates and prizes."

He thought that would remove a great deal of the difficulty which now existed in the country, affording some encouragement to children to pursue the little education they had received in the elementary day schools, and would be an inducement to qualify themselves to compete for the certificates of the Society; it would likewise familiarise them with the practice of examinations. It was to be hoped that much would be done in the way of examining pupils under the age of 13 years.

Mr. Vallentine (London Mechanics' Institution) seconded the resolution.

Lord Lyttelton (South Staffordshire Union) would say a word or two in support of this resolution, which he understood was intended to give effect to the paragraph numbered 16 in the Examination Programme for 1860. In the South Staffordshire Union this subject had been referred to, and a report had been prepared upon it, which he had only just received, and in which a plan was sketched for giving effect to the resolution which Mr. Blake had proposed. It related mainly to the pupils of evening schools, and pointed out the desirability of offering a stimulus to children who, having left school and entered upon occupations, desired to continue evening instruction. The opinion was that, although these Examinations could not be amalgamated with those of the Society of Arts, they might be held concurrently with them, and so far as the subjects were the same they might be entirely concurrent. He hoped this system would prevail throughout the country, and he was inclined to agree with Mr. Blake, that the limitation of 13 years of age ought to be removed.

Mr. J. Milnes Gaskell, M.P. (Wenlock Agricultural Reading Society), remarked that the Institution he represented had taken the initiative in holding examinations of children between the ages of 10 and 14 years, in English and general history, Bible history, and writing, &c., and the girls in plain sewing and knitting, and prizes had been awarded, consisting of books of the value of 5s. each—the prize for drawing being two years' gratuitous instruction. The Institution which he represented was disposed to carry out the principle, but not to put a limitation upon the age to 13 years.

Mr. James Chapman (Slough) said they were doing precisely the same thing in the Institution he represented, the age of the pupils varying from 10 to 25 and 30 years.

Mr. Harry Chester believed that the object in suggesting a minimum age of 13 was that the Examinations might be made more compact and easy to manage. If a wider range were taken it might increase the labour; but after what had been said, it appeared doubtful whether it would not be better to leave the matter open. There was one point in which he should like the resolution to be amended. It restricted the Examination to young persons already connected with Mechanics' Institutes and Evening Schools. There was a large number of children not connected with either, but whose continuance in instruction it was desirable to stimulate by these means. It seemed to him that great advantage would arise if they made the scheme as

liberal and open as possible. They ought not to contract it, but should undertake, he thought, to examine all young persons under 16 years of age who presented themselves, without limiting it to those connected with Mechanics' Institutes and Evening Schools.

The Chairman supposed Mr. Blake intended it to apply to persons not in regular attendance at day schools.

Mr. Blake said it was intended to reach those who were obliged to continue their instructions at evening schools.

The Chairman thought the object might be met if they said, "persons not in attendance at day schools," the idea being that the education should be assisted by attending evening schools, or otherwise, after they had left the elementary schools, and before they had attained the age of 16.

Mr. Blake said that there was no reason why young persons should not be members of Mechanics' Institutes or classes.

Mr. Wm. Hawes thought Mr. Blake hardly understood the suggestion of the Chairman. It was merely to confine the plan to those who had given up regular systematic instruction. He suggested that the words "young persons not in regular attendance at day schools, under the age of 16," should be inserted in the resolution.

Mr. Chester remarked that that would be putting a new limitation in the place of the old one. If they adopted the minimum of 13, they practically excluded those who did not attend day schools. He was prepared to adopt any reasonable suggestion, but let them not say they would only examine those children whose parents did not send them regularly to school.

Mr. T. Shave Gowing (Ipswich) said it seemed to him that by leaving out the words "between 13 and 16 years of age," the resolution would meet the general views of the Conference. He thought that there was no necessity for limitation. If children were willing to attend the examinations let them do so, and he would say let children at schools be brought into competition with those who were not under a regular course of instruction, and if those who were not regularly in attendance at school proved themselves superior to those who were, it would show the necessity for improving the schools, and that improvement he believed would follow as a natural consequence. They must improve education by bringing it into a full and fair field of competition, and in that way the public would find means to improve the character of the education given at the schools.

Mr. Samuel Redgrave asked what was then to become of the children who did not belong either to schools or to Institutes, and also of those who went to private schools?

The Chairman suggested a modification in the resolution.

Mr. Blake was willing to alter it to "persons not being in regular attendance at day schools."

Mr. Chester saw an objection to that. The National and British Schools held examinations for pupil teacherships, but there were no means of bringing together the results of education in different schools, and he hoped that what they now did would establish a fair system of competition. He suggested that they should adopt 16 years as a maximum, and leave the rest open.

Mr. Hawes said one of the important elements of competition was fairness. If they examined children in regular attendance at school up to 16 years of age, there could be no equality of condition with those who were obliged to go to daily work between the ages of 13 and 16 years. It was not the intention under this plan to offer prizes to those children who were kept at school up to 16, but the intention was to stimulate those who obtained their education out of working hours. There was no equality of condition if those who were at work for nine or ten hours a day, and were instructed for only two or three hours, were brought into competition with those who went to school all day. Agreeing, as he did, with the most perfect freedom and the most perfect competition, he believed they would not follow those conditions if they put those children who were under daily instruction in a school in competition with those were instructed under a less advantageous and less regular system.

Mr. James Hixon (Holmfirth) admired the liberality of the sentiments expressed by those who desired the extension of the resolution to as wide a range as possible, but he thought it would have an injurious effect upon the members of Mechanics' Institutes. They had not the advantages that many persons of the same age had, who attended the higher class schools, and such a rule would have a tendency to deter members of such Institutes, who worked hard during the day, and acquired their instruction at the Institutes in the evening, from competing with those who had the superior advantages of a regular education.

Mr. F. Gaussen (Royal Polytechnic Institution) thought the resolution might be amended, so as to meet the views of both sets of gentlemen who had spoken. He questioned whether they ought to give up the advantage of examining the children of schools; and, on the other hand, they wished to encourage those who had not been regularly educated. They might have two classes of examinations—one for children at schools, and another for those who were not under a regular course of education.

Lord Lyttelton hoped the elementary schools would not be included in their system. The object was to undertake a field which was at present uncared for. Elementary schools already had ample means of examination. They would create bewilderment in the minds of those connected with elementary schools, if they increased the number of opportunities for examination.

Mr. J. P. Wood (York Institute) thought the object of the resolution would be defeated if they allowed the matter to remain open. They would have a totally different class from what was intended competing for these prizes, and they would defeat the object of stimulating those who pursued daily labour, and only had the means of evening instruction. He thought it would be well to limit the resolution to those who attended Mechanics' Institutes and evening schools.

Mr. Gowing thought the Examinations ought to be thrown open to all who wished to avail themselves of them.

Mr. Buckmaster (Royal Polytechnic Institution) said he did not think that interference on the part of the Society would tend to any improvement in the present system of elementary education carried on in this country under the direction of the Committee of Council on Education. They had every year the reports of those schools, and they were able to compare pretty well the actual state of the education of the children. The middle-class and grammar schools were already provided for by the Oxford and Cambridge Examinations, and also by the Examinations of the College of Preceptors, which he was glad to say were greatly extending amongst the middle-class schools. He therefore thought this Society would be outstripping its functions if it interfered in the slightest degree with the education of those classes. It would be remembered that an attempt was made, when the plan was first started, to take in that class, and a strong representation was made by the College of Preceptors against the Society having anything to do with it. If the Society was to be useful in an educational point of view, it must confine itself to that state when a boy left the day school till he entered upon the ordinary affairs of adult life. That was the period that was fraught with danger to young men, and if this Society stimulated greater activity amongst Institutions, and gave them greater facilities of action, it would do a great national good, but to interfere with schools which were already provided in a way which he thought could not be superseded by this Society, he thought would be out of place. If these Examinations were to be confined to the Local Boards, there would be the local prejudices and feelings which more or less characterised all local examinations.

Mr. Chester said there was no proposition that the Society of Arts should examine children under 16 years of

age. It was upon one occasion suggested that the Society should examine the pupils of schools as well as adults, but that was rejected, and the Society's examinations were limited to the age of 16. But they were called upon to consider whether the Local Boards should not, as part of their own local action, examine children, and grant certificates on their own authority.

Mr. T. J. Pearsall (London Mechanics' Institution) suggested that the amount of school instruction which the candidates had received should be particularly noted. If that were done they would obtain information which would be of the greatest importance in guiding future legislation upon this subject. In the Huddersfield Institution they examined all youths who presented themselves, and the amount and character of the education they had received was recorded.

Mr. T. U. Brocklehurst (Macclesfield) considered it was not desirable to admit the pupils of day schools to these examinations.

Mr. Barnett Blake, looking at the practical difficulties of the case, thought the local examinations would fail if they admitted the pupils of schools. In the West of England, children attending schools took the majority of the prizes, and people whose children had not had the same advantages of education would not send them up to compete. If they admitted the pupils of schools they would virtually defeat the object of the resolution.

The Chairman read the resolution, as altered with Mr. Blake's consent:—

"That in the opinion of this Conference it is highly desirable that the Local Boards should hold annual examinations of persons under 16 years of age who are not in regular attendance at day schools, and grant on their own authority certificates and prizes."

An amendment was then moved by Mr. Chester, and seconded by Mr. Gowing:—

"That it is highly desirable that the Local Boards should annually examine, and on their own authority grant certificates to persons under 16 years of age."

This amendment having been put and lost, the resolution was carried.

The Chairman read the next subject as follows:—

II. Whether the Lists of Subjects for the Final Examinations can be advantageously extended or otherwise improved.

Lord Lyttelton suggested the addition of Geology.

Mr. Chester said it had been proposed to include Mining and Metallurgy.

Mr. Buckmaster suggested Geology and Mining.

The Chairman said a very numerous class were engaged in converting ores into metals. Metallurgy was, therefore, an important subject. It had been suggested that, as the working of mines and the smelting of ores were carried on in the same localities, instead of having two examinations upon these subjects they should group them together.

The Chairman having put the question whether Mining and Metallurgy should be included in the programme of Examinations, it was carried in the affirmative.

Mr. C. S. Spence (Leeds Christian Institute Local Board) said he had been requested to suggest the propriety of grouping several subjects together, and giving a medal for proficiency in each group. Young men sometimes distinguished themselves in two or three branches—say of mathematics, for example, and he thought it would encourage the further pursuit of the study if certain subjects were grouped into sections, and a medal or some other distinctive reward offered in each. He would suggest that Mathematics should form one section; Ancient and Modern Languages a second; Geography and English History a third, &c. It was considered by the Local Board he represented that this would stimulate the education of young men, and induce them to pursue continuously a certain range of subjects, and make their knowledge of them thorough.

Mr. Gowing asked whether it was intended that, aptitude having been shown in two or three branches of mathematics, the parties should enter into a fresh competition on the subject of mathematical acquirements.

The Chairman understood the suggestion to be this—that if a young man obtained a certain number of first-class certificates in a group of cognate subjects, he should be rewarded in a special manner by a medal, or in some other shape.

Mr. F. Gaussen seconded Mr. Spence's proposition.

Mr. Buckmaster remarked that every one knew his own character of mind better than any one could tell him, and a person having studied one subject would select subjects cognate to it, without their being classified by the Society. Take, for instance, mathematics, or experimental science; he had found that, without classification, if they had a long list of subjects, the pupil who had shown most success in chemistry, for instance, would be almost sure to take up experimental physics, a cognate subject. It was the same with mathematics; pupils would follow out the bent of their tastes in the subjects which they studied. He, therefore, thought no benefit would arise from classification.

Mr. Gowing said if they offered medals they should be the subject of fresh competition. Some of the best of the candidates in the several departments should undergo a fresh Examination. They would then carry the Examinations higher than they had hitherto done, and they would further stimulate those who were most apt, to go on with their acquirements.

Mr. Spence then moved a resolution to the effect:—

"That in addition to the certificates, a medal be offered for competition to the candidates who have distinguished themselves in each class of cognate subjects."

Mr. Blake suggested that it should be referred to the Council to consider whether they would offer extraordinary prizes to the candidates who had most distinguished themselves in any class of subjects. It might be considered that a person who gained three first-class certificates or prizes should have some distinctive reward.

The Chairman said the question of granting medals was one which should be very carefully considered.

Mr. Pearsall remarked that the Council might give the reward of a medal to a person who, in the course of years, had received certificates for specific subjects of study. He could scarcely imagine a greater incentive to the continuance of a course of education.

Mr. Chester said this question of medals was one of great importance, and was one that he had had in his own mind. He should like that candidates who had received a number of first-class certificates should also receive medals, but that was a question of large expense, and a diversity of medals would be required. Whether it was expedient to encourage a particular course of education he was not prepared to say. He thought, considering they did not pretend to present a complete course of education, but rather to supplement what was deficient, it was better to leave the matter open, and not to group the subjects. He, however, thought it desirable, when a man had obtained a number of first-class certificates, whether in cognate or diverse subjects, he should have some further prize awarded to him. He thought the Council were not prepared to come to a decision at present on so large a subject, but next year they might be able to recommend something which would be satisfactory to all parties.

Mr. Spence accordingly withdrew his resolution, and the Conference proceeded to the consideration of the next subject upon the agenda, viz.:—

III. "Whether the Government Examinations in Drawing (both Free-hand and Mechanical) are such that no further provision for Examination in that subject is required by the Institutions?"

Mr. S. Baldock (Barnet Institute) had been requested to ask that Drawing might be included in the subjects for Examination. In a small Institute like that which he represented, they were not in a position to avail themselves

of the Government plan of instruction in that art. He would therefore move:—

"That further provision for Examination in Drawing is required by the Institutions."

Mr. Chapman inquired whether the certificates granted for the Examinations at Kensington-gore would be recognised by the Society.

The Chairman replied that the Society's certificates were given only for the Examinations which they conducted. They would not award certificates upon the Examinations at Kensington.

Mr. Chester remarked that originally drawing, both freehand and mechanical, was included in the Society's Examinations, but the Government School of Design enlarged their system, and made a proposal to provide for the examination of students in drawing where there was a sufficient number of candidates in any particular town or district, and the Society thought it would be a waste of their resources to do that which the Government was doing upon a larger scale. But although they had given up that branch, it was stated at the time that if the Government Examinations proved insufficient for the Institutions it would be taken up again. The Institutions were now asked the question whether the Government Examinations were sufficient for them, or were they so situated as to make it desirable for the Society to revive that subject?

Mr. Chapman expressed his desire that both free-hand and mechanical drawing should be taken up again. Last year seven young men from his town obtained prizes at Kensington, who were now engaged as clerks of works in various parts of the country, and other occupations in which drawing formed an important part of their education, and he wished to know whether, if they came up competent on other subjects, the fact of their having received prizes for drawing from Kensington would be recognised in the certificates given by the Society? He begged to second the motion that drawing be again included in the Programme of Examinations.

Mr. Blake considered the Government Department of Science and Art did its work so well that it was unnecessary for the Society to interfere in the matter. It had worked satisfactorily in connection with the Institutions, and the greatest liberality had been shown in granting teachers where they were required. He thought there was no necessity for the Society to restore that which he considered had been judiciously expunged from their programme.

Mr. Buckmaster expressed a similar opinion. Drawing had been removed from the Examinations because it was considered that the Department of Science and Art did the work more effectually. At all events, there was a greater number of art schools throughout the country than they had Institutions in Union, and wherever 50 persons could come up for examination the Department would send an examiner. If they took up this subject again they must have drawing masters to instruct the pupils, and he thought very few of the Institutions were in a financial position to pay for a competent teacher.

Mr. H. A. Bowler, who said he represented the Government Department of Science and Art, said the number of candidates who entered for the Government examination in drawing last year was nearly 30,000, and 7,000 prizes were awarded; and the examinations had taken place in more than one hundred different places throughout the country. The larger towns formed centres for the various localities. The system embraced both freehand and mechanical drawing.

Rev. J. A. Hatchard (St. Leonard's Mechanics' Institution) said it appeared that an immense number of candidates availed themselves of the opportunities of learning drawing, and he thought the Society might well take up that branch again. He thought the subject of drawing was most important. As a nation they were very far behind their neighbours in the art of drawing, and he thought they would do well to express their approval of that branch of education being again taken up by the Society.

Mr. Gowing said his Institution was only too glad to relinquish the drawing class, as they could not obtain an efficient teacher for the money they could afford to give him. Pupils had now an opportunity of availing themselves of a good system of instruction at no great cost to them, and a good field of competition was presented throughout the country. He thought practically it would be a burden to the Institutions if they were obliged to keep up drawing classes of only ten or twelve members.

Mr. T. U. Brocklehurst (Macclesfield) said there was a School of Design in connection with the Institution he represented, and there were several such schools in the district, which worked very satisfactorily without imposing the necessity upon Institutions of giving instruction in drawing.

Mr. Chapman repeated his inquiry whether the certificates of the government examiners would be recognised by the Society.

Mr. Chester replied that they would be recognised in the same way as University degrees would be. A candidate would not want a second certificate. He hoped the Council would not be asked to resume this branch unless there was a feeling amongst the Institutions that the government system was not applicable in all cases, and that something more was required. The reason this question was put upon the Agenda, was because the Council had received from some important towns a suggestion that it was desirable that the Society should resume its drawing examinations. The Council wished to know whether that desire was generally felt.

Lord Lyttelton thought there was danger of the Society trenching upon a Government department which appeared to be very well attended to. They ought to encourage, as far as possible, the exertions of Government in connection with the schools of design.

The Chairman remarked that the plan of the Society had never been antagonistic to that of the Government, but there were many places where there was no Government teacher. But gentlemen might be willing to give gratuitous instruction to the classes of the Institutions to which they belonged, and those would be the persons who would come up for the Society's examinations.

Mr. Chapman remarked that this was the case in his own Institution.

The Chairman added that Government would not send down an examiner unless there were fifty candidates.

Mr. Buckmaster said candidates could be examined by the Government Examiners although they had not been taught in the Government schools.

Mr. J. H. Beale (Banbury) suggested that the examination might pass, through the Local Board and the Society, to the Department of Science and Art. It was only in the last year that a sufficient number of pupils could be obtained in Banbury to secure the attendance of an inspector. Without wishing to cast any additional burden upon the Society, he should be glad to see drawing again included in the programme, for the sake of those localities which were not able to procure a sufficient number of pupils to obtain a Government Examiner.

Mr. W. O. Field (Gosport Athenæum) approved of the proposition for again introducing drawing, as he believed that gratuitous instruction would be given in many cases by gentlemen resident in towns where there was no chance of getting fifty pupils to join a class or present themselves for examination. He thought it was a pity that where classes of ten or twenty pupils could be formed, they should not have the opportunity of examination.

Mr. Baldock said in making the proposition that drawing should be again introduced, he had no fault to find with the plan adopted by the Government. All he wanted was to obtain for those who desired instruction in drawing the same opportunities as were afforded in other subjects. In his own small Institution there would be persons willing to be examined.

The Chairman said it was not suggested in any degree to enter into competition with the Government plan, as their system would come into operation only in those places which were not reached by it. In such cases, it was for the Society to provide a substitute. The relations between the Government and the Society were of the most friendly character. It would be an easy matter for the Council to communicate with the authorities at South Kensington, to ascertain whether their arrangements and those of the Society could not be combined so as to come in where the Government system did not reach.

The resolution proposed by Mr. Baldock was then put and carried.

The next question on the list was:—

IV. "Would it be well to make special arrangements for women in the Examinations; or are the arrangements of the present Programme suitable or sufficient for them?"

Mr. Blake said thiswas a very important subject, and while he considered it desirable and necessary that women should be instructed in the elementary branches of reading and writing, yet there were pursuits of more consequence to women in humble life, whether as domestic servants or wives of working men. This subject had been taken up by the associated Institutions of Lancashire, and they had undertaken an examination of women in the various branches of domestic economy. He had brought with him one of the examination papers used at Leeds, which showed the points to which the examinations were directed, embracing household duties, cooking, and the prices of provisions. The skill of the candidates in cooking was tested in the preparation of a dinner given to the poor at a festive season. The ignorance of thousands of factory girls and women upon the commonest matters of domestic economy and management was truly deplorable, and he had heard of an instance of a woman cutting out a shirt for her husband by fitting the cloth to his shape as he lay upon the floor. They had no idea either of making or mending clothing. It was of the greatest importance that women who became the wives of operatives should be instructed in the theory of domestic economy. He believed there was an establishment at Finchley where this kind of practical instruction was imparted to females. The resolution he begged to move was as follows:—

"That, in the opinion of this meeting, it would be desirable, whenever practicable, to institute Examinations for women in the most important branches of domestic economy."

Mr. Chester said this subject had been under the consideration of the Council, but they had not yet come to a decision upon it; and if they determined upon holding an examination in that subject, the Dean of Hereford would be the examiner. All they could do was to test the theoretical knowledge of the subject. Anything of a practical nature must be carried out by the Local Boards. It would be necessary for them to superintend the sewing classes and to taste the food. They should endeavour to ascertain whether the women had any knowledge of the reasons why certain things were necessary to the daily health and comfort of the working population. His own opinion was strongly in favour of taking up this subject, from which he was sure they would not be deterred by any ridicule it might excite. No subject was more important than this one which lay at the foundation of the daily life of the working classes of and the country, the ignorance of women and of men upon these subjects was enormous.

Rev. J. A. Hatchard seconded the resolution.

Mr. C. Binyon (Clerkenwell Working Men's Institute) said when he saw the mention of this subject in the circular, he had no idea that it was intended to apply to cooking and other household duties. He imagined it to be rather connected with general education. In looking over the list of successful candidates last year, he found that the ladies were not entirely unrepresented, but that a certificate for French was gained by a female member of the Bristol Athenæum.

Mr. Chester said the lady alluded to had been governess in his own family, and went up for examination in two or three subjects appropriate to governesses, and she was desirous that Italian should be introduced. She found the arrangements for the examination at Bristol very agreeable. Canon Girdlestone was one of the local examiners, and two or three ladies were examined, and the same had taken place in other parts of the country. The education of women was so important, and they had been so long without the means of having their knowledge tested, that he believed a great amount of good would be effected by encouraging women of the different classes to come up for examination.

Mr. C. Wentworth Dilke regretted differing at any time from his friend who had just spoken. It was a grave question with him (Mr. Dilke) whether this was not more strictly the duty of the local committees than of the Council of the Society of Arts. He quite agreed in the advisability of taking some steps for providing for the education of the lower classes of females. He was aware that a large number of young women married who had little or no knowledge of the duties on which they were about to enter, and, therefore, if any steps could be taken, he should highly approve of them; at the same time, he had grave doubts whether it was quite the province of this Society. The Local Boards only could take up this subject with effect, for there were many matters included within it upon which examination could not be made by means of papers.

Lord Lyttelton remarked that they had a good precedent to go by in favour of a resolution of this kind. It was true that Examinations of young women in domestic economy could not be complete when carried on from a central office; but at the same time a good deal might be done by paper Examination, as had been done for many years in the Training Schools. He had no doubt that the steps which had already been taken in other quarters might be followed with good results.

Mr. W. Hawes thought the resolution proposed by Mr. Blake hardly met the case. He suggested whether it would be well to make special arrangements for females in the Examinations. At present domestic economy was not included in the programme, but the Council wished to raise the question whether they should increase the facilities so as to induce young women of the class referred to to come into the examinations in Italian, drawing, and other acquirements. He agreed that it was a difficult subject, and required great consideration, whether upon the more simple matters of domestic economy, they could have an examination that would be satisfactory, by means of written papers sent up to a central office. They must all agree that anything which promoted the employment of women would be productive of good.

Mr. Brocklehurst remarked that in his Institution they had classes for music, French, and drawing.

The Chairman said there could be no doubt of the desirability of this object being carried out by some body or other. The question raised by Mr. Dilke was whether it did not rather come within the province of the local boards. He then put the resolution, which was unanimously adopted.

The next question for consideration was:—

V. "Whether any Changes can be advantageously made in the Days and Hours fixed for the Final Examinations."

Mr. Chester said suggestions had been received from various places that it would be more convenient if the examinations were held from 7 o'clock to 10 than from 6 to 9. It was immaterial to the Council which hours were adopted.

Mr. Binyon proposed that a longer time be given for the working of the papers. This year's examination, he said, was the first that had taken place in his Institution, and out of four candidates for final examination two had

passed. They had found that the time allotted was not sufficient for the working of the papers on book-keeping and some other subjects. In the case of working men very few could write a rapid running hand, and for such persons the writing of three or four sheets of foolscap was a difficult feat of penmanship.

Mr. Spence stated that the same difficulty was experienced in his own Institution with regard to book-keeping. For the other departments the time allowed was quite sufficient.

Mr. Reynolds (Sussex Hall) said it was the same in the Institution he represented.

The Chairman suggested that the examiner might reduce the questions in book-keeping, so as fairly to admit of their being completed within the time allotted.

Mr. Binyon believed that a higher certificate would have been awarded for arithmetic if the students in his Institution had had a longer time to work the paper.

The Chairman said it was a curious fact that out of 103 candidates in arithmetic 95 were awarded certificates.

Mr. Buckmaster said they could not very well lay down a rule upon this subject. There were some persons who would probably not finish their papers in four hours, whilst others would accomplish the task without difficulty in two hours and a half. He thought it was desirable for the Society to give as much time as they could, as the object was not to show what the parties could do in a given time, but what they could do with the paper that was given them to work. A clerk, who was not so good a man as a mechanic, might do more of his paper than the mechanic, because he could give expression to his ideas more quickly.

Mr. Dilke remarked that uniformity in the time for the final examinations was very essential, and when they heard that 95 certificates were granted upon 103 papers, he thought there was not much ground for complaint.

Mr. Chester said it was not merely a question of giving more time, but it was a great point that the Examinations should be simultaneously conducted, and also that they should terminate within a reasonable time. If the period was too protracted the local examiners could not devote the time, and if the hour was fixed too early many candidates could not attend. He thought three hours was a practicable period, and he thought 7 to 10 was better than from 6 to 9.

Lord Lyttelton said the rule in the University examinations was to allow an average time for working the papers. Working men would almost always be slow, and that should be taken into consideration. They ought to allow a liberal time, but cases of extreme slowness could not be provided for without deranging the whole plan.

Rev. Thos. Lander (Hertford) believed that the quality of the writing was taken into consideration, and no doubt much time was consumed by the pains bestowed upon it.

Mr. Blake considered the time for the Examinations was well chosen as it now stood. He knew there were some persons who would like to have it altered, whilst to others this would occasion inconvenience in getting home by the trains.

Rev. J. R. Crawford (Berkhampstead) remarked that as many persons did not leave their work till 6 o'clock, that hour was too early for the commencement of the Examinations.

Lord Lyttelton proposed from 6.30 to 9.30.

After some further conversation, it was agreed that the period should remain at 3 hours, and the time fixed upon should be in accordance with the proposition of Lord Lyttelton. It was also decided that the Examinations should be held on the 30th April, and 1st, 2nd, and 3rd of May.

A conversation then took place relative to a motion which was adjourned from the last conference upon the subject of Government grants in aid to evening classes in Institutions. It was agreed to postpone the subject till the next conference, and that it should then be put upon the programme of proceedings.

The next subject for consideration was,—

VI.—"Are the Institutions of opinion that the principle of Competitive Examinations for Government Appointments already partially introduced into the public service should receive further extension?"

Mr. Spence said it had been found that competitions for government clerkships had not been of much service in his Institution, but there were a number of meritorious young men who had distinguished themselves in various branches of mathematics, and who, following the occupation of mechanics, were altogether excluded from that competition. He would suggest that the Council of the Society should, if practicable, endeavour to induce the principals of eminent engineering and manufacturing establishments to offer appointments to those young men. It had been stated in a lecture by Mr. Scott Russell, that he was obliged to procure men from the continent to do a certain class of work, because he could not obtain persons of sufficient knowledge of mathematics amongst the artizans of this country. He (Mr. Spence) thought it was very desirable to give encouragement to that class of young men to whom he referred, who were incapacitated for Government appointments of the description hitherto granted to the successful candidates in the Society's Examinations, but many of whom were exceedingly clever in mathematics and practical mechanics.

Mr. Gowing suggested a resolution to the effect that the Institutions are in favour of the principle of competitive examinations for appointments of all kinds. If they left out the word government, as the proposition stood in the programme, it would meet Mr. Spence's views.

Mr. Chester suggested the introduction of the words "both for public and private appointments."

Mr. Blake submitted that the better plan would be to pass a resolution affirming the proposition. It would affirm the opinion that good appointments conferred upon successful candidates had been a great stimulus.

Mr. Wood did not see how they could express an opinion as to the mode in which private individuals should conduct their business.

Lord Lyttelton remarked that it would go forth merely as a suggestion to them.

The Chairman said it was announced by the Society, when this system of examinations was originated, that a large number of firms employing skilled labour had intimated their intention of being influenced to some extent in employing persons in their establishments, by engaging those who had obtained the Society's certificates.

Mr. Spence suggested that the employment might be extended to the mechanical departments of the government dockyards.

Rev. J. A. Crawford said the plan had already been acted upon in some of the dockyards.

The Chairman remarked that it would be a valuable extension of the principle of competitive examination that it should be admitted for employment in large private works and establishments.

Mr. Wood thought it desirable that public appointments should be pointed to rather than private. He therefore thought it would not be good policy to expunge that from the resolution, even if the addition suggested were made to it.

A resolution affirming the proposition in the agenda was then adopted.

The next subject for discussion was as follows:—

VII. "Wherever large District Educational Boards or Local Unions of Institutions can be Established, is it not desirable that Organising Masters should be appointed to Promote the Establishment of Adult Classes, and to Assist in Teaching?"

Lord Lyttelton thought there could not be two opinions as to the propriety of affirming this proposition. In

South Staffordshire, where a union of Institutions had recently been formed, they had had the satisfaction of appointing an organising master. One of the best examples of a union of this kind was to be found in the East Lancashire Association of Institutions, formed by Sir James Shuttleworth, and he was sure that gentleman would be prepared to acknowledge that an organising master was the *vis motrix* of the system; and he (Lord Lyttelton) believed that only partial success could be obtained without such an officer, who became, like the secretary of an institution or company, the chief lever in working out the system. The object of such an appointment was by actual teaching, and by co-operation of all kinds, to bring up as large a number of qualified pupils as possible for examination. He begged to move the affirmative of this proposition.

Mr. Brocklehurst seconded the motion, which was unanimously agreed to.

Upon the succeeding subject, viz.:—

VIII. "Is the Opinion of the Conference favourable to Discussion Classes; and if so, under what conditions should they be held?"

Mr. Blake moved the following resolution:—

"That, in the opinion of this Conference, it is desirable that classes should be formed for the composition of essays on scientific, literary, historical, moral, and similar subjects, to be followed by discussion, under such rules as would tend to further the object in view, and prevent the introduction of improper topics."

A short time since, he drew up a series of short rules, which had been recently published in the Society's *Journal*, for the assistance of these classes, and pointing out some fitting subjects for discussion. One of the principal difficulties which these classes met with was in the choice of subjects, whereas if fifty or sixty subjects were furnished, each class could consult its own taste in selecting them. These discussion classes had been attended with good success in various parts of the country. He believed they were instrumental in promoting a knowledge of English literature, whilst they tested the powers of composition and of speaking correctly. He believed if such classes were carried out, they would not only promote the benefit of the young men who were members, but in small country towns they would be a valuable aid to the Institutions themselves, as it was one of the rules that only members of the Institution should be entitled to take part in the discussion.

Mr. Brown (Slough) seconded the resolution.

Rev. J. A. Hatchard supported it, believing that such classes drew forth the latent talents of the members, and would supply a want which was much felt, namely, the want of lectures, which were often so dry and uninteresting as to account for the paucity of the attendance. Although lectures or essays written by a member of an Institution might not perhaps be intrinsically so valuable as those prepared by professional lecturers, they would be listened to with interest, if only because they were drawn up by members of the Institution.

Mr. W. O. Field (Gosport) also supported the motion. In the early part of last autumn, the Institution he represented established a Mutual Improvement Class with very satisfactory results. All controversial political questions were excluded. Within a week of the formation of the class it was joined by 44 members, and the attendance was well kept up during the whole winter. With regard to the selection of subjects, he thought that might be left to the good taste and discretion of the members, and he objected to such a limitation as Mr. Blake had suggested.

Mr. Edwards (Tailor's Labour Agency) would like to know for what purpose that question had been put upon the programme. Discussion classes were no new things, but had existed more or less throughout the country for the last 30 or 40 years, and he thought they had produced a questionable amount of good. If this resolution was to go forth from this conference as a recommendation to the Institutions, he should be inclined to move an amendment, as he was no admirer of these classes upon the footing on which they were generally conducted.

Mr. Chester was aware that difference of opinion prevailed as to the benefits of these classes. His little experience in the matter led him to think that it was easy to establish a discussion class, difficult to maintain it, and most difficult to make it useful. At the same time he thought, under proper regulations, these classes might be made very useful. He had himself recently written rather fully upon this subject in a publication by Messrs. Longman, bearing the title of "Schools for Children; Institutes for Adults." He believed one of the most important rules to be observed by classes of this kind was, that they should be presided over by a competent moderator, and that it should not be left to the young men themselves entirely to guide the proceedings, but that a person of some age and experience, and of the highest education they could get, should on each occasion preside over the proceedings. It was also of importance that the subjects should be carefully chosen. The Council might, perhaps, publish a list of convenient subjects without proscribing other subjects.

Mr. Binyon said the discussion class which had been formed in connection with his Institution had, he believed, not been without some good results. It was found, however, that the exclusion of politics tended to diminish the number of the members. Upon the whole he inclined to the opinion that, properly conducted, these classes were useful helps to education.

Rev. J. R. Crawford said a discussion class had been in existence for several years past in connection with the Berkhampstead Institution, and at times the most lively debates had taken place, particularly upon the subject of Cromwell and Charles I., when he (Mr. Crawford) sat on four evenings as Chairman of that discussion. He was in favour of these classes generally, and approved of the plan of short readings from good authors, followed by the critical remarks of the members of the class.

Mr. Pearsall suggested that each Institution which had had discussion classes should forward to the Society a list of the subjects that had come before them during the last two years, to which additions might be made, and from which objectionable subjects might be struck out.

Mr. Gowing added that having given notice of his intention to bring the subject of "Penny Readings" before the Conference, he thought the present might be a fitting time to introduce it as bearing upon the matter under consideration. Mr. Gowing proceeded to read a list of rules which had been adopted in Ipswich for the regulation of penny readings.* Mr. Gowing described the success which had attended the penny readings at Ipswich, the result of which had been during the last winter not only to afford rational and intellectual amusement to large numbers of the working classes, but also to add a large sum to the funds of the Institution, from which contributions to the local charitable and benevolent institutions of the town had been made. The success of the plan as regarded the numbers attending the readings, he said, had been surprising on some occasions, as many as from 700 to 900 persons having attended. He particularly recommended diversity in the readings, as best calculated to keep up the interest of the audience. He had found that the effect of good public readings had been to improve children in their style of reading, from some regard being paid to expression in the place of the monotonous intonation practised in the schools.

Mr. Edwards detailed the satisfactory results which had followed the formation in Newington of a branch of the Public Readings Society, of which Lord Brougham was the president.

Rev. J. A. Hatchard also described the interest which entertainments of this kind had created at Hastings and St. Leonards.

* See *Journal*, present Vol., page 129.

Mr. Gowing moved a resolution to the effect

"That it is desirable to establish readings in connection with the Institutions in union with the Society."

Mr. Edwards seconded the resolution.

The Chairman remarked that he thought the two resolutions were quite consistent with each other.

Mr. Blake thought the Council might with propriety ask for the aid of the Institutions in preparing a list of subjects for the guidance of the Discussion Classes. He expressed himself in favour of the plan of readings, which had been spoken of by Mr. Gowing, and he thought the penny admission had the least to do with the success of the plan. The members of Institutions, he presumed, were admitted to the entertainments free. He highly approved of the system of short readings from good authors. He believed, in country towns, no class of entertainment had been more popular and successful than these readings.

Mr. Chester concurred in the favourable opinion which had been generally expressed of these readings, and suggested that their attractiveness would be enhanced by a number of gentlemen taking part in them; as for instance in the reading of Shakspere's play of Julius Cæsar, the parts of Mark Antony, Brutus, Cassius, and Julius Cæsar, might be read by persons whose style suited the several characters represented in the play.

Mr. Gowing said he had not brought forward the "penny" as a principle to be rigidly adhered to. But his object was to induce the working classes of towns to avail themselves of intellectual recreation, instead of engaging in amusements of a more questionable character. He expressed his readiness to communicate all the information he was able upon this subject to such Institutions as wished for it.

The Chairman then put the resolution proposed by Mr. Blake on the subject of discussion classes, and it was adopted.

Mr. Gowing's proposition was likewise approved.

After a brief adjournment, the proceedings were resumed under the presidency of Mr. Chester.

The next subject was:—

IX. Without losing sight of the Educational Character which it is desirable that Institutions should always maintain, how far can they judiciously promote such out-door and in-door recreation as may be beneficial to the physical and mental health of the members?

Mr. Blake moved the following resolution:—

"That in the opinion of this Conference, the promotion of healthful and innocent recreation, whenever practicable, is highly desirable, as conducive to physical and mental vigour, and the retention of Members of Institutes during the summer months."

Rev. S. R. Crawford seconded the resolution, and mentioned that a cricket club had been formed in connection with the Berkhampstead Institution, and that for indoor recreation in the winter evenings, chess and draughts were introduced. He gave his cordial support to the resolution.

Mr. T. Milnes Gaskell, M.P., (Wenlock), attached the greatest importance to the subject, as he had a strong opinion that in the education of the children of the working classes sufficient attention was not paid to their physical training. He thought it of extreme importance that as general a system of recreation as possible should be established throughout the country, both in-door and out-door, and he believed that that could be accomplished without any risk of promoting the evil of intemperance. That certainly had been the case as far as his own experience went. The Institution he represented attached great importance to the establishment of Olympian classes, and were very desirous to see the system extended.

The Chairman called the attention of the meeting to the list of proceedings appointed to take place at an approaching gathering of the Wenlock Agricultural Society,* in which games of strength and skill in athletic exercises formed a conspicuous part.

Rev. J. A. Hatchard cordially supported the resolution, and mentioned the satisfactory results which had followed the introduction of the games of chess, backgammon, &c., as amusements for the members of the Institutions during the winter evenings. He believed that if rational amusements were more generally introduced and recognised, they would have a tendency to check demoralising practices amongst the working population.

Mr. T. H. Galton (Bromsgrove) expressed his high approval of the proposition, and related the satisfactory results which had attended the introduction of boating, cricket, and other manly and healthful recreations in the locality which he represented. He was strongly in favour of combining the recreative with the educational element in the institutions.

Mr. Valentine Knight (Horological Institute) supported the resolution.

Rev. Robert Maguire (Tottenham and Clerkenwell Working Men's Institute) said the great question was how were they to recreate the working men of the metropolis and large towns which were situated several miles from the green fields. Rowing clubs were out of the question, and cricket could only occasionally be engaged in. He was glad to hear this resolution seconded by one of his clerical brethren, as he (Mr. Maguire) was not one of those who set their faces against harmless recreation. The social character of the people was next in importance to their religious character, and in proportion as they discouraged innocent and healthful recreation for the people, they inflicted an injury upon society at large. He had never thought it unbecoming his profession to take up the bat and ball with the members of the Institution over which he presided, and in the same spirit he had encouraged rifle practice, and had as far as possible seconded the efforts of the volunteer brigade which had been formed in the north of London. He was glad this subject had been brought before this Society, and he should rejoice if it planted the impress of its name upon this work.

The Chairman said it was evident that entire unanimity of opinion prevailed upon this subject. He believed they could not advance the cause of education amongst the working classes better than by combining physical with intellectual improvement, which seemed to some minds to be the sole object of education. It was for the interests of the nation that the physical training of the population should not be overlooked, for some people appeared to entertain the idea that man might be made a physical being entirely by chance, without anything being done to form or develope his energies.

Mr. Gaskell mentioned that a considerable number of boys were undergoing drill at Wenlock, under the instructions of a sergeant.

The Chairman then put the resolution, which was carried unanimously.

Upon the next subject, viz.:—

X. "Shall the Conference express its opinion in favour of Early-closing and Holidays, with reference to the moral, intellectual, and physical health of the members of the Institutions?"

Mr. Blake moved the following resolution:—

"That, in the opinion of this Conference, it is desirable to promote the early-closing of business establishments and occasional holidays, in order to increase the opportunities for mental improvement and physical recreation."

He said he thought that an expression of the opinion of this Conference might tend to remove some of the objections which were still entertained by the employers of labour to early-closing. As one objection, it had been argued that the young men thus liberated from business

* See page 642.

would spend the time in an improper manner; but it was a poor argument that, because in some individual cases the privilege had been abused, the whole class of assistants were to be immured in the shops until a late hour at night.

Mr. W. O. Field seconded the motion, and remarked that late business hours prevented a large class of persons joining Mechanics' Institutes.

Rev. J. A. Hatchard would have preferred that any recommendation emanating from this Conference on this matter, should have included the Saturday half-holiday, which he thought it was an important thing to accomplish, as generally as possible, throughout the country, in connection with the moral, intellectual, and physical health of the working classes. In Edinburgh and Glasgow it was difficult to get any kind of business attended to on Saturday afternoons, and as showing how extremes sometimes met, it was a curious fact that in ultra-Protestant and ultra-Roman Catholic counties, the boon of relaxation from labour in the after-part of Saturday was alike granted. It was most important that this venerable Society should give its aid in providing more holidays for the people than they at present enjoyed.

Mr. Redgrave expressed himself in favour of national holidays for the people, and his desire to see several in the course of the year. The material wealth of England was evident to all, but he thought, as regarded the working population, they had lost the title of "Merry England." He thought this was a matter which might be practically taken up by every municipality throughout the country.

Mr. Beale (Banbury) saw no reason why the half-holiday should be confined to Saturday. If that day were chosen in those towns where the market day was on Saturday, and which was the principal day of business, the retail shopkeepers and their assistants would be prevented from participating in it.

Mr. J. Huggett (Hastings) expressed his belief that the exertions of the Institution which he represented had materially aided the early closing movement in that town.

The Chairman remarked that this subject was so nearly connected with the one which followed in the Programme, that he might incidentally allude to it. They were aware that most of the Institutions were in the habit of taking an annual excursion, and it might be a point of some consequence if the Council could induce the directors of the Crystal Palace to appropriate two or three days, which should be considered as Institution days. The Institutions of neighbouring localities might unite for those days, and a large number might be brought together at the Crystal Palace, where facilities also existed for engaging in games of strength and skill to which the various Institutions would be proud of sending up their respective champions, and amongst them they would no doubt find their friends of the Yorkshire Union.

Mr. Blake remarked that gentlemen in London must not go away with the notion that the workpeople in the country had no holidays, for that would be a very erroneous impression. Whilst in London Monday was more or less a holiday, in the manufacturing districts Easter and Whitsuntide were real holidays, without the masters being consulted at all in the matter, when the cotton spinners turned out by tens of thousands, and joined heartily in the excursions offered to them.

Mr. Valentine Knight remarked that this proposition was easy in theory, but he was afraid it would be found difficult in practice; for, whilst on the part of the workman it was said "a fair day's wage for a fair day's work," the reply on the part of the employers would be, "a fair day's work for a fair day's wage."

Mr. Pearsall concurred in the suggestion of entering into combined arrangements for the excursions of Institutes, for which the railway system offered such great facilities. From all he had seen of the excursions of provincial Institutions they had been most delightful and harmonious gatherings, and he was greatly in favour of trips taken at judicious times.

The Chairman then put the resolution, which was carried unanimously.

The next question for consideration was—

XI.—Would the Institutions like arrangements to be made for fixing certain days on which the excursion parties of their members and friends might assemble at the Crystal Palace or elsewhere?"

Rev. Robert Maguire moved the following resolution:

"That it is advisable that an arrangement should be made for a general excursion day for the members of Institutions, and that the Council be requested to learn on what terms the Crystal Palace Company and the Railway Companies will enter into such arrangements."

The reverend gentleman gave an explanation of the mode of proceeding usually adopted by him in ascertaining the feeling of his Institution as to the locality to be fixed upon for the annual excursion. For the present year they had selected Southend; another year they might choose Windsor, the Rye House, or the Crystal Palace. With regard to excursions generally, he hoped they would be promoted as much as possible, as he was persuaded they did much good in cementing the friendly feelings which it was so desirable to establish.

Mr. Thomas Martin (Reigate) expressed the interest which he had for many years taken in the excursions of the Institution with which he was connected. He was strongly in favour of the resolution.

Mr. Hixon (Holmfirth) had been requested by his Institution to represent the desirability of organising arrangements with the railway companies for bringing the members to London at reduced fares. Their great distance from the metropolis rendered an excursion of the kind proposed next to impossible, unless some arrangement were made for the terms of conveyance.

Rev. J. A. Hatchard remarked, that to the members of Institutions in the neighbourhood of the metropolis other places might possess greater attractions than the Crystal Palace, which most persons had the opportunity of visiting.

Mr. Dilke explained, that in the course of twelve or eighteen months from the present time, the facilities for excursions from distant localities to London would be greatly increased, by the railways which would be formed to connect the northern with the southern lines. A most ready access would then be afforded to the Crystal Palace to parties coming from the north of England.

Mr. Baldock seconded the resolution of the Rev. Robert Maguire, which was adopted.

Upon the next subject, viz.:—

XII. "Should any Further Efforts be made by the Union to Procure the Opening of the National Museums and Galleries to the Public of an Evening?"

Mr. Edwards suggested that, as the report of the Select Committee of the House of Commons on this subject would probably be shortly published, it would be better to wait until they saw the recommendations which were made in it.

Mr. Gowing moved:—

"That it is the opinion of this Conference that it would conduce to the advantage of large classes of the people if the national museums and public galleries were open of an evening."

The resolution was seconded by Mr. Binyon, and agreed to.

The Chairman read the next subject, as follows:—

XIII. "Can the Institutions, with advantage, make Arrangements to visit the proposed International Exhibition of 1862?"

Rev. Robert Maguire suggested that this matter should be postponed till the next Conference. He thought it was premature at the present time.

Mr. Wm. Hawes said it was competent for the repre-

sentatives to express an opinion in the abstract, as to the desirability of arrangements being made for the visit of the members of the Institutions to the proposed Exhibition. To discuss those arrangements, he admitted, would be premature. He added that the present state of the guarantee fund gave the fullest promise of the consummation of that Exhibition; and it was the wish of the Council to gather from the Institutions their opinion upon the suggestion that, at some future time, arrangements should be entered into for facilitating the visits of the members to that Exhibition.

Rev. Robert Maguire asked whether it was proposed that the Society, as the promoters of the Exhibition, should consider what benefits they could hold out to the members of the Institutions.

Mr. Hawes replied that the Council were not prepared with any definite proposition. All they asked was an expression of opinion as to whether at the proper time it was considered desirable that those arrangements should be made.

Mr. J. N. Brigg (Leeds Christian Institute) thought an expression of opinion on this subject might have the effect of allaying any fears which might be entertained by parties in the country as to the issue of the proposed Exhibition, and might awaken more interest in the manufacturing districts in that event.

Mr. Spence was sure an arrangement for a trip to the future Exhibition would be hailed with delight by his Institution.

Mr. S. Vallentine moved:—

"That this Conference views with pleasure the proposal of the Society of Arts for the holding of an International Exhibition in 1862, believing it will in the highest degree advance the Arts, Manufactures, and Commerce of the country, and the Conference pledges itself to use its best influence in promoting the success of that Exhibition."

This was seconded by Mr. Robert Honey (Huntingdon).

Mr. Thomas Winkworth said the Council of the Society had every reason to believe that the proposed Exhibition would be a highly popular movement, looking to the large interests that were represented both in the number of the guarantors and the amount already guaranteed. But seeing the number of representatives from all parts of the country present to-day, he could not but think that further encouragement would be afforded by an expression of opinion from this Conference on the subject before them.

The Chairman remarked that the Society now consisted of a large union of Institutes. It was therefore desirable that they should express, as far as possible, the feelings of those whom they represented upon this great work which the Society had in hand.

The resolution was then put and carried.

The following resolution was then proposed and passed unanimously:—

"That the Institutions with advantage may, at the proper time, make arrangements for their members to visit the International Exhibition of 1862."

Upon the next question, viz.:—

XIV. "How far can the System of Book-hawking be made useful to the Libraries of Institutions?"

no opinion was expressed, and the matter dropped.

The remaining subject was as follows:—

XV. "Whether the Institutions should Promote the Formation of Local Museums; and if so, whether these Museums might not easily and with advantage be made to Represent the Productions of the Locality instead of being of the heterogeneous character often gi en to them."

Mr. Gowing said, that in Ipswich the museum had been placed under the management of the corporation, under the Local Museums Act of Mr. Ewart, and it was in the power of any locality to establish museums under the provisions of that Act, to be supported by the public rates. He alluded in high terms to the successful exertions of Professor Henslow in the formation of a museum of elementary knowledge in Ipswich.

Mr. Gaskell, M.P., mentioned that a successful museum of the products of the district had been formed in Wenlock.

Rev. Robert Maguire remarked that in London local museums were scarcely popular, on the ground of their expense and the difficulty of preserving the specimens. He mentioned some very satisfactory instances of impromptu museums in connection with conversazioni, from which the greatest enjoyment had been derived by those who attended them. If persons could be induced, on different occasions, to contribute the contents of their private collections for inspection at some central point, he thought it would be advantageous.

Mr. Blake thought there would be some difficulty in inducing Institutions to form local museums, and he questioned their utility as much as he deprecated the formation of free libraries. Museums, to be of any practical or educational value, could only be collected in the larger towns, and in such cases they were most miserable specimens of decay, and little better than large rubbish cupboards. He should be in favour of impromptu museums, such as Mr. Maguire had described.

The Chairman said two resolutions had been placed in his hands—one relating to local museums of a permanent character, and the other to impromptu museums. He thought local museums would be of no value unless they were permanent, and the specimens properly classified and labelled. In the Highgate Literary and Scientific Institution, they had cleared out their miscellaneous museum, and had substituted a very good collection of the geological products of the district. He then read the first resolution, as follows:—

"That this meeting would desire to direct the attention of Institutions in Union to the importance of holding occasional conversazioni, at which the floral, mineral, geological, and other natural curiosities, as well as specimens of antiquities and local industry possessed by the residents in the neighbourhood, should be exhibited to the public."

This was proposed by Rev. R. Maguire, and unanimously passed.

The following resolution was then proposed by Mr. Wm. Hawes, and seconded by Mr. Gaskell, M.P.

"That this meeting would desire to direct the attention of the Institutions in Union to the importance of establishing museums in their respective localities, representing in each Institution the floral, mineral, geological, and other natural peculiarities, and also the antiquities and the industry of the district."

This resolution was then put, and carried.

Mr. Gaskell, M.P., said he had great pleasure in proposing a vote of thanks to Sir Thomas Phillips and Mr. Chester, for the ability with which they had presided over the proceedings of the Conference.

Rev. Robert Maguire seconded the motion, which was passed by acclamation.

Mr. Chester, in acknowledging the compliment, said the greater share of their thanks was due to Sir Thomas Phillips. It was with great pleasure that he met the representatives of the Institutions in Union on these occasions, and he hoped that these Conferences were not unattended by some useful results. The system of examinations appeared to be making great advances. The examinations of the present year had passed off in the most satisfactory manner, and had been developed in directions which promised the most beneficial results.

The Conference then concluded.

EDUCATION OF GARDENERS.

Some correspondence has recently taken place in reference to this subject in the *Gardener's Chronicle*. In a letter to the editor, Mr. Harry Chester says:—

"I rejoice to see that the important subject of the Educa-

tion and Certification of Gardeners continues to attract attention. No subject can be more important to those who are concerned in horticulture.

* * * * * *

"The education of a gardener, as of every other human being, must of course be begun in childhood. In the schools for the children of the industrial classes a good solid foundation must be laid in elementary subjects common to all, and without any variations having reference to varieties of future callings. On that foundation must be reared a substantial structure of the special knowledge suitable to the future callings. Of that special knowledge little can be acquired, and therefore little—indeed, nothing but the merest rudiments—ought to be attempted to be taught, during the few years that the child can remain at the day-school. The education ought to be carried on afterwards at evening schools until 16, and at Institutions after 16 years of age. By "Institutions" I mean not merely Mechanics' Institutes but Institutes, People's Colleges, Evening Classes, Improvement Societies, and all other useful associations for the instruction of adults, apart from children. When, however, the school and the institution have done their best, there arises a further want of a tribunal of competent authority by which the results of their instructions may be tested and attested. How inferior would have been our great public Schools and Grammar Schools, and the Colleges at Oxford and Cambridge, if there had been no University of Oxford or Cambridge to test and attest their results! How inferior has been the condition of our Middle Schools from the want of a conection with the Universities! and how great an improvement the Universities have recently effected by the institution of their local examinations for Middle Schools! A like effort will be produced among our schools for the children, and classes when they have their own proper university to test and to attest the result of their education; in the system of Examinations which the "Society of Arts, Manufactures, and Commerce" has instituted, there are many of the essential elements, I might almost say there is the foundation, of an "University of Arts, Manufactures, and Commerce," an university which may do for the industrial classes a large and important part of what is done for the higher classes by the Universities, apart from the Colleges, of Oxford and Cambridge. The Society's system of examinations is two-fold. There are the "Previous Examinations" by Local Boards, and there are the "Final Examinations," in which papers of examination questions, set by the Central Board of Examiners in London, are worked under the supervision of the Local Boards. Where the candidates live, there the examinations, both previous and final, are held.

"Any gardener or other person who wishes to be examined for a certificate may at once ascertain, on application to the Society of Arts, whether a Local Board already exists within his reach, and if not, what steps should be taken to establish one. He will have the summer, autumn, and winter in which to prepare himself; and early in April he will undergo the "previous examination." To pass it he must be able to write and to spell well, must have a fair knowledge of English grammar and composition, must be able to work sums as far as the rule of three, and must show himself acquainted with the special subjects which he proposes to take up for the final examination early in May. He cannot take up more than four of those subjects in one year. Suppose him to begin with two or three, Arithmetic and Botany; or Arithmetic, Mensuration, and Botany. Let him not attempt too much; rather let him strive to do a little well. No amount of merely superficial knowledge, such as may be got by cramming, will entitle him to a certificate. A few accurate and sensible answers will gain a higher number of marks than a great many indifferent attempts. In Arithmetic not only the correctness of his answers, and the excellence of his mode of working them out, but the clearness and neatness of his working will be taken into account by the examiner. In Mensuration the candidates will be required to show that they can measure and estimate the work of a joiner, a bricklayer, a plumber, and other artificers. In Botany and the various branches of Horticulture it is sufficient for me tell the gardeners that Dr. Lindley is the examiner.

"I am far from desiring to suggest that the examinations of the Society of Arts are at present sufficient to meet the case of the gardeners, for example; but I am anxious to point out that, if they will cordially support the Society in its efforts for their advantage, and if the invaluable co-operation of the Horticultural Society should also be given to the Society of Arts, its system of examinations might be placed on a much broader basis than it has at present, though even at present it is very far indeed from being narrow; and might receive such developments and special applications as would leave nothing to be desired in the testing and attesting of the gardener's attainments, whether theoretical or practical, general or particular."

UNIFORM MUSICAL PITCH.

The *Daily News* says that a decision of some importance, musically speaking, has just been come to in Russia, the Emperor having ordered that the *diapason normal* of the French commission shall be adopted in the orchestras of the imperial theatres, from the 1st of September next. A sum of 45,000fr. has been awarded as an indemnity to the artistes for changing the instruments according to this decision.

ROYAL AGRICULTURAL SOCIETY.

The meeting of this society is now taking place at Canterbury. From the programme it appears that the trial yard was to be open on Wednesday last, and three following days, when the public were to be admitted to view the trials of the thrashing-machines, chaff-cutters, mills, oil-cake-breakers, and turnip cutters. The implement yard will be open on Monday next, when machinery will be exhibited at work. The judges are also to inspect the live stock, and award the prizes. At one o'clock on Monday (or as soon after as all the judges shall have delivered in their awards, of which notice will be given) the public will be admitted into the cattle-yard. Arrangements have been made for distinguishing the animals that have won the prizes immediately the judges have made their awards. The general show yard of cattle, horses, sheep, pigs, and implements will be open to the public on Tuesday next, on which day there will be a public dinner at 6 p.m. The general show yard will be open to the public on Wednesday and Thursday next. The steam cultivators will be worked publicly on land in the neighbourhood of the city during such hours as the stewards may determine, on Wednesday. A general meeting of the members will take place in the Town-hall, at 10 a.m., on Thursday.

Proceedings of Institutions.

Wenlock Agricultural Reading Society.—Olympian Class.—The Eleventh Annual Meeting of the above class will be held early in August next, on which occasion Lieut.-Col. Sir Herbert Benjamin Edwardes, K.C.B., in compliance with a requisition from the Mayor, and several of the Magistrates, Town Councillors, and other inhabitants of the borough of Wenlock, will deliver an address to the members of the class. A public luncheon will take place on the day of the games, at 12 o'clock, under the presidency of Ralph A. Benson, Esq., of Lutwyche Hall, Barrister-at-Law, President of the Wenlock Agricultural Reading Society. The following prizes will be awarded: *For Tilting at the Ring on Horses:* Prize, a Silver Cup, presented by the Right Hon. Lady Forester. Open only to

residents in the county of Salop, being subscribers of ten shillings to the games; not fewer than five to contend. Competitors to wear a loose tunic with waist belt, according to pattern; the colour to be chosen by the competitor. *For Tilting at the Ring on Ponies not exceeding 13 hands:* Prize, for the first, a Purse containing £5, subscribed by the ladies of Wenlock; for the second, £1. Open only to subscribers of 5s., residing not more than twelve miles from the Guildhall, Much Wenlock; not fewer than three to contend. *For Rifle Shooting:* To the best marksman belonging to any of the Shropshire Volunteer Rifle Corps, a Silver Cup, value £12 12s. Competitors to be subscribers of 5s. to the games, and to attend the afternoon procession in their uniform. The selection of the shooting ground to be left to the officers of the competing corps, assisted by Mr. Thomas Thursfield, Barrow, and Mr. W. P. Brookes, Wenlock. All arrangements as to the mode of competition to be decided by a majority of the officers of the competing corps, who will be requested to meet at Wenlock a short time before the games to determine such matters. The competition to take place in the morning, and the cup will be presented to the winner after the luncheon. *For a Foot Hurdle Race*, one mile, over 14 hurdles, £5; presented by the Right Hon. Lord Forester. Open to all England. The winner not to be eligible to contend in the half-mile foot race, which will take place afterwards, nor in any other foot race. Not fewer than 3 to contend. Competitors to wear a loose tunic, with waist belt, according to pattern, the colour to be chosen by the competitor. *For a Foot Hurdle Race*, half a mile, over 8 hurdles:—Prize for the first, £2; second 10s. Open only to competitors residing not more than twelve miles from the Guildhall, Wenlock. Not fewer than three to contend. *For a Flat Foot Race*, half a mile:—First, £2; second, 10s. Open only to residents within the Borough of Wenlock. Not fewer than three to contend. *For a Flat Foot Race*, 400 yards:—First, £1; second, 5s. Not fewer than three to contend. *Wheel Race:*—Winner, 7s. 6d.; second, 2s. 6d. *For a Flat Foot Race*, 300 yards, for boys under 15, residing in the parish of Wenlock:—Prizes, for the first, 4s.; the second, 3s.; the third, 2s.; and the fourth, 1s. Not fewer than five to contend. *For a Flat Foot Race*, 60 yards, for boys under 7 years of age, residing in the parish of Wenlock:—Prizes, the first, 3s.; the second, 2s.; the third, 1s.; and the fourth, 6d. Not fewer than five to contend. *Quoits:*—Winner, £1; second, 5s. *Archery:*—Winner, £1; second, 5s. *Throwing the Spear in Distance:*—Winner, 7s. 6d.; second, 2s. 6d. *Putting the Stone:*—Winner, 7s. 6d.; second, 2s. 6d. *Running High Leap:*—Winner, 7s. 6d.; second, 2s. 6d. *Running Long Leap:*—Winner, 7s. 6d.; second, 2s. 6d. *Foot Ball:*—Winning side, £2; not more than 20 on a side. *Jingling Match:*—Winner, 5s. *Cricket:*—A match will be played between the Olympian Class and some neighbouring Club the day after the games. *For the Best English Essay on the Political Importance of the Middle Classes:*—Prize, £5, presented by R. Jasper More, Esq., of Linley-hall. Open to residents in, and natives of, Shropshire. The successful competitor of last year is excluded from the competition. The essay, bearing a short motto, but not the name of the author, to be directed to R. Jasper More, Esq., Linley-hall, Shrewsbury, on or before the first day of August next. The name of the author, in a sealed letter, bearing outside a duplicate of the motto, to be enclosed in an envelope, and directed to Mr. W. P. Brookes, Much Wenlock. The letters of the unsuccessful competitors will not be opened unless the authors shall have written, at the foot of their essays forwarded to Mr. More, "To be returned if unsuccessful." Three gentlemen will be appointed to award the prize, who will give their decisions without intercommunication. *For the best Ode, with a Chorus, to the Victor in the Tilting Match, capable of being adapted to Music:*—Prize £4 for the first in merit, and £1 for the second. The ode to be directed to Mr. W. P. Brookes, Much Wenlock, on or before the 14th day of July next, with a motto, but not the name of the author; the latter to be sent, at the same time, together with the motto, in a sealed envelope, directed to Mr. Robert Horton, Much Wenlock, with the words "Olympian Ode" written outside. The prize will be awarded by three judges, as in the case of the essay. The successful essay and odes will be read, and the prizes for the same, together with the children's prizes for drawing, English history, arithmetic, writing, geography, plain sewing, and knitting, will be presented the day before the games. No person, children excepted, will be allowed to contend in any of the games, unless they join in the afternoon procession to the ground, and are subscribers of at least 1s. to the games. A silver decoration and an olive crown will be given to the successful competitors in the tilting at the ring on ponies, the rifle shooting, and the foot hurdle race of one mile open to all England. A bronze decoration and an olive crown will be given to the successful competitors in the tilting at the ring on ponies, the foot hurdle race of half a mile, and the flat foot race of half a mile.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 19th June, 1860.

344. Printed Papers—Return.
369. Military Stations (Ireland)—Returns.
178. Bills—Burial Grounds (Ireland) Act (1856) Amendment.
184. ,, Annuity Tax Abolition (Edinburgh)—(as amended in Committee and on Re-commitment).
186. ,, Stipendiary Magistrates.

Delivered June 20th, 1860.

362. East India (War Charges)—Accounts.
336. Weapons of War—Return.
387. Army, &c.—Returns.
88. Episcopal Residences, &c.—Return.
391. Dr. Macloughlin—Papers.
339. East India (Financial Measures, &c.)—Return.
173. Bills—Admiralty Court Jurisdiction (No. 2).
179. ,, Highways, Roads, &c. (amended).
189. ,, Inland Bonding.
191. ,, Trustees, Mortgages, &c.

Poor Law Board—12th Annual Report.

Delivered on June 21st, 1860.

365. Navy (Gun Vessels)—Return.
356. Flogging (Army and Military)—Return.
374. Diaries—Return.
385. Wakefield Election—Return.
328. Packet and Telegraphic Contracts—1st Report and Evidence.
185. Bills—Votes for disqualified Candidates.
188 ,, Parochial Assessments.
190. ,, Union of Benefices.

Delivered on 22nd June, 1860.

352 East India (Murza Ali Akbar)—Return.
380. Militia, &c.—Returns.
187. Bills—Spirits (amended).
192. ,, Refreshment Houses and Wine Licences (Ireland).
194. ,, Railway Cheap Trains, &c.

Delivered on June 23rd and 25th, 1860.

6 (2). Election Expenses, &c.—Further Return.
203. Civil Services Estimates—General Abstract.
398. Railway and Canal Bills Committee—7th Report.
196. Bills—Tramways (Ireland) (as amended by the Select Committee).
198. ,, European Forces (India).
193. ,, Oxford University (No. 2).
195. ,, Dealers in Marine Stores.

Second Session, 1859.

Delivered on 22nd June, 1860.

215 (1). Titles and Contents to the Sessional Printed Papers.

Delivered on 26th June, 1860.

84 (5). Trade and Navigation Accounts (31 May, 1860).
396. Suez Mails—Returns.
397. Ordnance Survey—Return.
176. Bills—Locomotive (amended).
197. ,, Professional Oaths Abolition (amended).
199. ,, Metropolitan Building Act (1855) Amendment.
200. ,, Local Taxation Returns.
201. ,, Land Clauses Consolidation Act (1845) Amendment (amended).
202. ,, Friendly Societies Act Amendment (amended).

Delivered on 27th June, 1860.

379. Loan Societies—Abstract of Accounts.

389. East India (Finance and Revenue Accounts).
203. Bills—Leith Harbour and Docks (amended).
204. „ Gas (Metropolis) (amended).
205. „ Poor Law Continuance.
France—Convention respecting the joint captures in China.
Japan—Dispatches from Mr. Alcock.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 29th*, 1860.]

Dated 24th March, 1860.

766. J. Dale, Manchester—Imp. in the preparation of a colouring matter for dyeing textile materials and fabrics, and other substances.

Dated 29th March, 1860.

814. J. Dale, Manchester—Imp. in obtaining albumen, or analogous substance, for use with pigments in calico printing, and for other purposes.

Dated 30th April, 1860.

1090. H. Hutchinson, 102, Rue Richelieu, Paris—Imp. in the manufacture of goods coated with india rubber and other gums, and in apparatus to be employed therein. (A com.)

Dated 17th May, 1860.

1214. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved carriage brake or drag. (A com.)

Dated 25th May, 1860.

1296. A. Hubart and V. Cantillon, Liege, Belgium—Imp. in the manufacture of glass casks and barrels.

Dated 7th June, 1860.

1396. T. W. Miller, H.M. Dockyard, Portsmouth—Imp in boilers or steam generators.

Dated 9th June, 1860.

1420. J. Westwood, Tredegar-house, Bow, Middlesex—Imp. in armour plates for iron ships and vessels, or forts, or batteries.
1422. W. E. Gedge, 11, Wellington street, Strand—Improved apparatus for separately collecting the divers metals of which minerals, ores, and the gangues are composed. (A com.)
1424. R. Romaine, Myddelton-square, Middlesex—Imp. in the construction of steam boilers and condensers.

Dated 11th June, 1860.

1426. F. C. Calvert, C. Lowe, and S. Clift, Manchester—Imp. in the manufacture of colouring matters.
1430. P. Salmon, Glasgow—Imp. in furnaces and in feeding steam boilers.
1432. H. Sommelet, Paris—Certain imp. in the manufacture of scissors.

Dated 12th June, 1860.

1434. J. B. Farrar and J. Farrar, Halifax—Imp. in machinery or apparatus for spinning and doubling, or twisting wool, mohair, alpaca, cotton, silk, flax, or other fibrous substances.
1436. T. C. Yates, Strangeways, Manchester—The manufacture of adjustable spikes for attaching to shoes or other coverings for the feet.
1438. R. Hyde, Kirkby, Leicestershire—Imp. in apparatus for draining stables.
1440. C. Loewenstein, 37, Crutched Friars, London—Imp. in arrangements for paying out submarine cables.
1442. A. V. Newton, 66, Chancery-lane—An improved carriage ventilator. (A com.)
1444. G. Firmin and C. Firmin, Ipswich—Imp. in the manufacture of sacking, and in apparatus for the same.

Dated 13th June, 1860.

1446. L. Pellissier, Bordeaux, France—An improved apparatus for lifting and moving blocks of stone or other heavy materials or loads.
1447. J. Lancaster, Garden Farm, Dunmurry, Belfast—Imp. in whet stones, commonly called scythe stones.
1449. W. Weston, Camden-town, and B. Price, Mile-end, Middlesex—Imp. in ovens for baking.
1450. G. H. Chatwin, Gresham-street—An imp. in the ribs of parasols and other like articles.
1451. A. V. Newton, 66, Chancery-lane—An improved construction of weighing machines. (A com.)
1452. J. J. Bowen, 136, Great Dover-street, Southwark—Imp. in soldering irons heated by gas.

Dated 14th June, 1860.

1453. G. Delauretis, 48, Frith street, Soho-square—An imp. in preventing and detecting forgery or alteration of figures in cheques, bank notes, drafts, bills of exchange, promissory notes, and other monetary bills.
1455. I. Whitesmith and J. Steven, Glasgow—Imp. in looms for weaving.

Dated 15th June, 1860.

1457. J. Dooley and J. Mawson, Dukinfield, Chester—An improved equilibrium slide valve, applicable to engines worked by steam, or other motive power.
1459. G. Davies, 1, Serle-street, Lincoln's-inn—An improved life-preserving mattress. (A com.)
1461. J. West, Birmingham—An imp. in the bowls or rollers of castors for furniture.
1463. R. A. Brooman, 166, Fleet-street—Imp. in desiccating substances, and in neutralizing or retaining any fœtid gases which may be evolved in the process. (A com.)

Dated 16th June, 1860.

1465. C. Coates, Sunnyside, near Rawtenstall, Lancashire—Imp. in the construction of breaks for carriages.
1467. J. Moule, 15, Seabright-place, Hackney road, Middlesex—An improved self-acting apparatus for precipitating and collecting from solutions metals and their salts, part of which apparatus is applicable to flushing purposes.
1469. B. Pavyer, Bartholomew-close, London—Certain new or improved machinery for "rubbing" type. (A com.)
1471. J. Hickman, Brampton Ash, Northamptonshire—Imp. in draw bars for railway carriages and trucks.
1473. W. Clark, 53, Chancery-lane—Imp. in storing and preserving grain, and in the apparatus connected therewith. (A com.)
1475. E. Stone, 46, Lime-street, London—Imp. in machinery for cutting veneers. (A com.)

Dated 18th June, 1860.

1477. J. King, Wellesbourne, and F. Southam, Eatington, Warwickshire—A new or improved rope porter, to be used in steam ploughing or cultivating.
1479. R. Dressel, Amelia-villas, De Beauvoir-grove, Kingsland-road, and A. Figge, High Holborn—Imp. in the manufacture of yeast.

Dated 19th June, 1860.

1481. J. Braby, jun., Bridgehouse-place, Southwark—Improved machinery for lifting or breaking up roads or ways, crushing clods, and scarifying or tilling land.
1483. A. R. Arrott, Saint Helens, Lancashire—Imp. in the manufacture of carbonate of soda.
1485. J. Harrison, Glossop, Derbyshire—Certain imp. in machines for spinning cotton, and other fibrous substances.
1487. R. A. Brooman, 166, Fleet-street—Imp. in locks. (A com.)

INVENTION WITH COMPLETE SPECIFICATION FILED.

1503. J. Smith, Birmingham—Imp. in the manufacture of composition jewellery and ornaments, and in cases for jewellery, photographs, and for other similar purposes.—21st June, 1860.

PATENTS SEALED.

[*From Gazette, June 29th*, 1860.]

June 29th.
2990. J. Whitworth.
2996. R. Gibson.
2998. W. Jackson.
3000. J. Eason.
2. J. Luis.
4. H. A. Dewar.
6. A. Prince.
7. S. Rowbotham.
10. J. Horridge.
14. D. Bateman & S. Bateman.
26. P. J. Worsley.
36. R. A. Robinson.
42. T. Moy.
98. J. Eunson.
124. J. Goulson.
214. W. E. Newton.
250. W. E. Newton.
428. H. Widnell.
472. F. H. Lemoine.
481. T. Lovelidge.
784. J. Church.
876. A. V. Newton.
950. W. H. Muntz.
958. T. Turner.
984. J. Willis.

[*From Gazette, July 3rd*, 1860.]

July 3rd.
25. J. Walls.
34. J. Fisher.
39. J. Knowles.
43. J. Fowler.
44. L. F. Perrier.
51. B. Bayliss.
56. J. F. Hillel.
71. A. Strauss.
72. J. Jameson.
127. G. J. Barker and T. Barker.
165. M. Rae.
193. H. J. Huggins.
203. R. Sykes and P. Sykes.
209. F. Walton.
257. W. Hartley.
617. R. Pitt.
873. C. Dusautoy.
929. T. Fry.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June 2th*, 1860.]

June 25th.
1809. A. A. Olivier.
1815. S. Nye.
June 26th.
1826. A. Spottiswoode.
June 27th.
1882. P. A. le Comte de Fontainemoreau.

[*From Gazette, July 3rd*, 1860.]

June 29th.
1817. J. Pattison.
1826. I. C. Cloet.
1839. E. B. Olofson.
1852. J. B. Meeus.
1853. J. Lockett and W. Watson.
June 30th.
1849. W. Rowan.
1850. W. Rowan.
1878. R. J. Badge.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, June 29th*, 1860.]

June 26th.
1555. J. Mason and L. Ryder.
1570. G. A. Biddell.
1636. E. Riepe.
1637. E. Riepe.

[*From Gazette, July 3rdd*, 1860.]

June 29th.
1583. R. Bradley and W. Craven.
1613. T. W. Kennard.

Journal of the Society of Arts.

FRIDAY, JULY 13, 1860.

INTERNATIONAL EXHIBITION OF 1862.

The Secretary reports that the amount of the Guarantee Fund promised up to Wednesday last, was £333,000.

SCHOOLS FOR CHILDREN AND INSTITUTES FOR ADULTS.

By Harry Chester,

Vice President of the Society of Arts, and formerly Assistant-Secretary to the Committee of Council on Education.

The following address, on National Education, was delivered on the 23rd May last, at a united meeting of the Mechanics' Institutions of Hastings and St. Leonards:—

In the term "Education" I include not merely the useful preliminary acquirements of the power of reading, and writing, and working sums, nor merely the building and furnishing of schools, nor the arts and appliances of teaching.

Education is the development and training of the human being in all his capacities, spiritual, intellectual and physical; and in National Education we ought to have no less grand an object than to develop to the greatest possible extent, and to direct to the best possible aims, the spiritual, intellectual, and physical capacities of all the individuals who compose the nation.

My purpose this evening is to treat of a few of the numerous topics which crowd into the mind when one thinks of that great master-subject, the subject of National Education.

I hope no one expects me to propound any new philosophical speculations respecting mind or education, any new theories of mental culture, any new patent contrivances for acquiring knowledge without exertion, or wisdom without thought and patient weighing of the accumulated results of experience. In the sweat of our face we shall eat bread; and in the sweat of our brains we shall acquire knowledge and wisdom. "Vincit qui patitur," *He conquers who suffers*, is true in education as in everything else. If we are to conquer Ignorance, we must conquer him by painful exertions and patient endurance, by energy, determination, and self-sacrifice. We cannot be well-informed, wise, and successful in life, if we are idle, dissipated, intemperate, frivolous, afraid of sustained exertions, or incapable of self-control. If we serve Idleness, we must bear about with us his badges, ignorance and failure. If we would enjoy knowledge and success, we must "scorn base delights, and live laborious days."

While I exalt knowledge, and the two grand powers of acquiring and of using knowledge, let me be understood always with the reservation that knowledge without charity and faith, is like a body without a soul, a life incapable of ascending to the heights where alone happiness can exist. It is no part of my duty this evening to deal, except incidentally, with those noblest portions of the great subject of Education which relate to the development and direction of the spiritual capacities of man. nor to expatiate on the beauties and pleasures of religion; but I should be sorry if they were thought to be absent from my mind when I invite you to consider how best you may provide increased motives and means for the more general and higher cultivation of those faculties which God has given to us; and which, having given them to all men He must have intended to be well employed by all men, "with usury," and neither to be misused nor to be "buried" in neglect.

I shall waste no time in arguments to establish the importance of education. On all sides its importance if not adequately appreciated, is at least loudly proclaimed. Great efforts have happily been made, in the last half-century, by Parliament, by the Universities, by voluntary associations, by public companies, and by private persons, to provide increased and improved means of education. The mainspring of this great national advance has been undoubtedly the zeal of religious congregations led by their clergy. For the education of the highest classes the old public schools and grammar schools have been reformed; new schools and colleges have been created; the ancient universities have been improved; new universities have been created; the curriculum of studies has been everywhere reformed; and education has become more practical, more liberal, and more religious. For the children of that portion of the important middle classes of society, who take their education neither at the great public schools and grammar schools, nor at the National and British Schools, something has been already done; but an immense deal still remains for us to do. They get less in proportion to what they pay for education than any other class of the community. For the children of the poor the greatest efforts have been made, and on the whole with good results. With the aid of funds supplied by Parliament, and distributed by the Committee of Council on Education, since January, 1839, the zeal of the religious congregations has caused nearly 6000 elementary schools, and 46 training schools for Schoolmasters and Schoolmistresses, to be built; and almost all the incidents of elementary education to be strikingly improved.

When the Committee of Council on Education was first created, in 1839, so little attention had been given to the planning of schools, that they were commonly erected by the village bricklayer and carpenter, by rule of thumb, without any plans at all. The organisation of schools had been little studied. A minimum education was given at a minimum cost. Babies, of eight and ten years old, were still set to teach other babies of the same age; the national infantry were still drawn up in Dr. Bell's hollow squares: writing-desks were few, scanty, and fixed to the walls; and Dr. Bell's original plan of teaching poor children to write by marking out letters with their fingers in shallow troughs of sand, has not long been abandoned. Of apparatus there was little but a few slates; of maps there was perhaps one, a meagre map of Palestine: of books there were scarcely any but the Holy Bible. In the Holy Bible, used as a primer, little children were drilled in spelling and reading; and their arithmetic was too often drawn from the same source. When the New Zealander takes up his proper position upon London Bridge, he will scarcely be able to credit the statement—and yet it is true—that, in the 19th century, a manual of arithmetic was published by a learned divine, an excellent person, for the use of National Schools, in which, in order to give to children a reverence for sacred things, the sums set were drawn from historical statements of numbers in the Holy Scriptures! "There were 12 patriarchs, 12 apostles, and 4 evangelists; add the patriarchs and evangelists together; substract the apostles, what is the remainder? "Solomon had so many wives and so many concubines; add the concubines to the wives, and state the result."

The buildings were low, thin, dingy, ill-drained, often without means of warming, often without proper conveniences; with no furniture but a teacher's desk, a few rickety forms, a rod, a cane, and a fool's-cap; the floors were almost invariably of brick—the worst kind of floor, as it is tenacious of moisture, cold to the feet, easily abraded into red dust, and soon worn into holes. There were rarely any porches or lobbies for the caps and cloaks of the children. If there were a house for the teacher, it was seldom such a house as a teacher of the present day

would like to inhabit. Now, however, all this is improved.

There are better buildings on better sites; better furniture; better books and maps, and apparatus; better teaching; better discipline; a better appreciation of education; and, best of all, a better spirit of religion pervades the whole. If our best elementary schools were but a little more practical in their working, and more in harmony with the real wants of the after-life of their scholars, they would not only be as good as any elementary schools in the world, but nearly as good as elementary schools for little children can be. We want, however, more schools; we want those that are inferior to be raised to the level of the best; we want them to be more practical, more preparatory to the real business of the life of the poor. We want more combination, less religious exclusiveness among the friends of education; not less zeal for "the faith once for all delivered to the saints," but more charitable forbearance towards dissenters from our own views of that faith, and more clearness in distinguishing the limits where our responsibility in dealing with the children of poor parents becomes absorbed in the responsibility of the parents themselves. We greatly want more local authority in education, which we cannot have till we have more local combination in education; we want less running to Parliament, and to the Government, to help us to do that which, with more local combination, we could now do very well ourselves; less pauperising of schools by the fixing of school-fees—not at the market value of education, but—at the level of the semi-pauper's means. We want a more cordial co-operation between the managers of schools and the parents of their scholars. We want opportunities of fair competition between the children that have attended our National, British, and other schools, that we may compare the results of the instruction imparted in them; and, above all, we want a far better provision of motives and means for the continuance of instruction after the children have left their elementary schools. While this last want, which represents the instruction of adults, and is intimately connected with the interests of mechanics' institutions, and similar bodies, remains unsupplied, we may talk and labour till we are tired, and every one is tired of us, about elementary education; but the people will not be educated; and their morality, their intelligence, their industry, their health and strength, their happiness and prosperity at home, and their estimation among the nations abroad, will remain below their proper level, below the level which God has given to them capacity to attain, and which He will hold us responsible for helping them to attain. I entreat, then, the friends of elementary education, the clerical and the lay promoters of schools for children, to consider whether, by the very motives which constrain them to their loving exertions for the education of the child, they ought not also to feel themselves constrained to further the instruction of adults, and to unite for that object with the promoters of mechanics' institutions.

Just reflect on the very early age at which the necessities of life compel our poor children to be removed from our National and British Schools. Under very favourable circumstances it is before twelve years of age, under less favourable circumstances it is even before ten years of age, that the bulk of our poor children are removed from school. Let us not undervalue what is there accomplished even in those brief periods of infancy: but, at best, is it more than the commencement of the education of babes? Does not by far the larger portion of the complete work of education remain to be subsequently effected? Does it not sadly sound like a mean mockery of a great idea when we apply the word "education" to processes which terminate at those early ages? The rich man commonly sends his son for the first time from home to school at the age at which the poor man's child is commonly removed for the last time from school; and, when he is thus removed, he has too often to enter at once upon the tremendous struggle for bread and life. To the rich, then, especially I would say, "Picture to yourselves your own children deprived of the blessings of education, and of systematic instruction, at that early age." You revolt from the very thought of it. Surely, then, you will do all in your power to mitigate this vast evil to others. The necessity for your help is urgent. There is an immaturity, intellectual as well as physical, which makes the ten years between the ages of five and fifteen not half so valuable for mental culture as the five years between the ages of fifteen and twenty: and you know well that, if your own child is to be a well-educated man or woman, that period of instruction must be prolonged, far beyond the age of twenty, as long as life shall last. A well-educated gentleman, that is, one who, having received a liberal education, has not only acquired a large amount of technical and exact knowledge of the learned languages and mathematics, of his own language and literature, of other modern languages, of science and of art, but has had his mind disciplined to acquire further knowledge with facility, and to employ with facility both his old and his new knowledge, is never gorged, as it were, with the acquisitions of his mind and memory. Be he steeped in business to the very lips—he will never suffer himself to be steeped in pleasure to the very lips—he will rarely lose a day without adding to his mental treasures; and whatever he may add to them will become truly his own, and will be held ever ready for use. A mind that has been well trained and exercised up to the age of fifteen or sixteen, will be enabled to acquire knowledge far more easily and profitably than before; but a mind that has been left in inactivity and stagnation in early years can scarcely be quickened at a later period; the unused faculties become incapable of use.

Sir William Sleeman, who was appointed by the Governor-General of India to make a survey of the province of Oude in 1848, has published a report containing a story of the suckling of children by she wolves, which, whether a true story or a fable, is calculated to illustrate this point. The story is certainly very extraordinary. The inhabitants of Lucknow and its neighbourhood have a terrible superstition about wolves. Their superstitious dread of those animals is such that no native dares to injure a wolf; and the consequence is that they have become horribly bold as well as sly. They prowl about the huts and tents, and carry off large numbers of children. One day a trooper, riding in a wild spot near the Goomtee river, saw a large female wolf, with two small wolves, and a small black boy, emerge from a hole in a cliff, and go towards the river. He followed them. The boy went on all fours like the wolves. They reached the water and drank; the boy putting his face to the water, and lapping it like his companions. Presently they saw the trooper, and retreated. He endeavoured to intercept the boy, but was unable to catch him, as he galloped away on all fours. The trooper went to the nearest village and gave the alarm; and, next morning, a party proceeded to the spot with suitable tools to rescue the child. They came to the hole, ascertained that the animals were there, and began to dig them out. First the she wolf, and then the young wolves, bolted and were allowed to escape; then the little boy bolted and was caught. He acted in all respects like a young wolf, biting, scratching, snarling, barking, and struggling violently to escape. His parents recognised him by some mark. With great difficulty he was secured, and bound, and dragged to the village, trying to bolt into every hole that they passed, and snarling and snapping at every one. He lived for two years; but was never in the least tamed. When cooked food was offered him, he turned from it with disgust. When raw meat was offered to him, he seized it with avidity, placed it under his paws (they can scarcely be called hands) on the ground, and tore it with his teeth as a dog or a wolf would have held and torn it. He never spoke till the day of his death, when he once asked for water. The discovery of this child led to further searches, and not fewer than seven children were thus discovered and res-

cued. None of them was more than eight years old; and not one of them was ever tamed or restored to the condition of humanity.

Passing, however, from Sir William Sleeman, let us remember the words of Solomon,—we should train up a child in the way that he should go. We must commence the development of faculties, and the creation of habits, at the earliest possible period. The mind of the infant in the nursing mother's arms must be acted on by attention, tenderness, and firmness. If we wish our children to be true and loving, we must train them to truth and love, not only by precept but by the influence of our own truth and love, from their infancy; but, if we wish them to have healthy minds in healthy bodies, we must be more ready in their earliest years to develop the latter than the former; and if, in our present system of educating poor children, we cram into their immature minds as much knowledge, the memory of as many facts, as possible, in an inadequate period, we run a very fearful risk of ultimately dwarfing both the physical and intellectual powers of the great majority of the individuals who compose our nation. Are you conscious of the presence of this risk? If so, you will certainly seek for the means of averting it; and you will act on the maxim that in the elementary schools of childhood the mere foundations of education are to be laid; and that the complete structure of education must be reared patiently, year after year, in the progressive instruction of the adult. It is thus that we deal with our own children, preferring for them a system of patient preparation for many full and rich harvests hereafter, rather than a hasty forcing for immediate fruit.

I assume that you wish the people in general to be really educated according to their stations in life; and that, therefore, you cannot rest contented with what has been already effected in the elementary schools. That which is painfully and expensively acquired at your Infant, National, and British Schools, in the brief spring of the tender school age, passes from its first incipient success, while the impressions of the school are fresh, to ultimate failure, when those impressions are obliterated, rapidly obliterated because neither deepened nor renewed, during the critical periods through which life passes between the ages of ten and fifteen, and the ages of fifteen and twenty. What a waste of public and private funds is here! What disappointment of the hopes of parents, and of the prospects of the children! How can this waste and these disappointments be prevented? How can you prevent them? By providing means and motives for the continuance of instruction after the children have left their schools; by helping to maintain evening schools for elder children, and institutes for adults. I might appeal to you on behalf of Institutes, merely because they tend to increase the well-being of the nation by increasing the intelligence of individuals, and thus fulfilling the gracious design of our Creator, who has endowed them with faculties manifestly designed to be developed; but I am anxious to put before you also some of the other grounds on which I think that these institutions are entitled to your support. Let us think for a moment of the awful responsibilities which are attached to the employment of leisure; and I beg you to bear with me while I ask you what you think might have been the character of your own leisure, if you had had an uncultivated mind, an inability to read with facility, to converse on intellectual topics, to appreciate external nature, the objects and revelations of science, the fascinations of art, the interest of inventions, the attractions of social and political life? All persons must have some leisure more or less; and it is of the most momentous consequence to their spiritual and physical health that they should have means of innocently and beneficially employing their leisure. I rejoice heartily in the belief that, in this country, the leisure of the many is now likely to be increased. The advance of the movement respecting holidays, half holidays, the early closing of shops, and the provision of innocent amusements, and manly health-giving exercises and games, is inseparable from the advance of education, intimately affecting no only the physical but the intellectual hearth and strength and the moral and religious welfare, of the people; and I hope that all who are not hostile to the complete development and right direction of the spiritual, intellectual, and physical capacities of the individuals who compose the nation, will be careful to do their shopping in good time, to avoid giving orders for work that must be executed with unnecessary haste, and to allow their dependants a reasonable portion of leisure, with opportunities and means for employing it with advantage.

Let us now glance at our subject, in a national point of view, with reference to "arts, manufactures, and commerce;" and let us see why the Society of Arts, through its union of institutes, promotes the instruction of adults. The "Society for the Encouragement of Arts, Manufactures and Commerce," commonly called for shortness the "Society of Arts," was established in 1783; is incorporated by Royal Charter; and has an illustrious President, H.R.H. the Prince Consort. Everything that concerns the arts fine and industrial, everything that concerns artists and artisans, everything that concerns manufactures and commerce, in a word everything that concerns industry and the industrial classes, the millions engaged in the upper, middle, and lower walks of arts, manufactures, and commerce,—concerns this Society. The Great Exhibition of the industrial works of all nations in 1851 was originated by the Society of Arts; and it is now preparing for the International Exhibition of 1862.

If you reflect for a moment, you will see that an exhibition of the works of the industry of different nations must be in effect an exhibition of the results of their industrial instruction; that is to say, an exhibition of the manner and degree in which their national education has affected their arts and manufactures, leaving them, on the one hand, rude, tasteless, and empirical, or displaying in them, on the other hand, the results of refinement and skill, a correct taste, an elevated art, and a true science. The Exhibition of 1851 was eminently a faithful exponent in these particulars; and one of its very best effects was the wide-spreading of a conviction among statesmen and men of business, that, to maintain the arts, manufactures, and commerce of the United Kingdom in their proper condition of ascendancy in the great competition of nations, the education of the people must be improved in art and in science, as well as in literature and religion. And that conviction has borne its fruits in a great stimulus given to the instruction of adults, in the systematic applications of science to the processes of manufactures and the wants of daily life, and especially in the remarkable improvement of those branches of manufacture into which the art of design essentially enters. One cannot walk through the streets of London, I might almost say, through the streets of any town or village in the kingdom, without seeing in the shop-windows abundant proofs of the striking improvement in taste which our manufacturers have acquired since the Great Exhibition of 1851; and this improvement is wholly the result not of chance, nor of nature, but of art, that is education.

We have got rid (I hope) for ever of the fallacy that we may over-educate the people. We cannot over-educate the people: we may instruct them in things of little importance, to the exclusion of things of the greatest importance; but the conditions of their daily life make it impossible for us to instruct them over much; and in order that they may be instructed in the right subjects, we shall do well in the long run to leave the selection as far as possible to their own judgment, taking care that any scheme of secondary and advanced instruction, which may be offered to adults of the industrial classes, shall be as liberal and comprehensive as possible. A solid foundation in the elements of education—reading, writing, and arithmetic—must first be laid: but afterwards, one might say that there is no subject of study which may not be so studied as to effect improvement in the execution of the duties of the daily life, whatever those duties may be.

Duties are well executed, generally, in proportion to the intelligence and fidelity of him who executes them; and even studies which have no direct relation to a man's peculiar calling, may improve his performances in that calling, not only by the increase of his intelligence, of his mental power, which results from the exercise of his mind in study, but also by the disciplinal effect produced on his moral character by the patience, the perseverance, the self-restraint, which are inseparable from sustained study, and also by that loosening of prejudices which always follows the entrance of enlarged knowledge into the mind of a man.

When the Duke of Wellington, many years ago, was asked to approve of a scheme for the education of the army, he said, "The Sappers and Miners are the best educated corps in the army. An army of Sappers and Miners would be the very best army that the world ever saw—I approve of the scheme." We have heard it declared on high authority that the Volunteer Riflemen become more expert at drill and shooting in one quarter of a year than the recruits of the regular rifles in one year and a quarter. The reason is obvious—our volunteers are of the same race as the regulars, but very much better educated. It is art, *i.e.* education, and not nature, which has made this great difference between them; and these examples of a smart intelligence in drill, and in the expert use of the rifle, are fair examples and types of the improvement which education may effect in the performance of every kind of physical exercise and mechanical operation. There is no work in arts or industry in which (*cæteris paribus*) the educated man will not surpass his uneducated brother: and one is lost in admiration of the pitch of happiness and comfort, greatness and glory, to which our country might be brought if all were done that might easily be done and ought to be done, to develop the intelligence of our countrymen in general as the intelligence of the Sappers and Miners has been developed. We want, however, not only intelligent minds, but strong and healthy bodies; and these also we may certainly have if we spread a knowledge of the laws of health, and if we educate the physical frame by well regulated drilling in childhood, and by manly games and exercises in childhood and in after life.

If all the boys and girls in our elementary schools were regularly drilled, the health, strength, and growth of the population would be strikingly improved. The loutishness of our poor men and women would disappear. Our young men would be better grown, better set up, more robust, active and handy, and much better fitted to take afterwards, if need be, the technical drill of the army, or of the militia, or of the volunteer rifles. Our young women, also, would be healthier and more shapely, and better mothers of children.

The drill of the school should be systematically followed up by the games and exercises of the institutions; but of this I will speak more fully by and by.

(*To be continued.*)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 30th annual meeting of this Association commenced on Wednesday, 27th of June, at Oxford. The Council met at 10 o'clock, in the Clarendon Building, and at 1 o'clock the General Committee met at the Convocation House to receive the Report of the Council, transact the general business, and appoint the President, Vice-Presidents, and Officers for the different sections.

The first General Meeting of the Association was held in the Sheldonian Theatre, at 4 o'clock, when the President, His Royal Highness the Prince Consort entered the Theatre, attended by Earl Spencer, Major-General the Hon. C. Grey, and Lieut.-Col. the Hon. D. De Ros, and accompanied by the Earl of Derby, Chancellor of the University, and Dr. Jeune, the Vice-Chancellor.

His Royal Highness, on taking the chair, said, "I rise in order to resign into your hands the honourable office which you have entrusted to me during the past year, and to thank the Council and the Secretaries for the zealous and efficient manner in which they have supported me and furthered the objects of the Association. I can only express a hope that the interests of science have not suffered during my stewardship. My last and pleasing duty is to introduce my successor, Lord Wrottesley; his name is so familiar to all men of science, his merits are so well known, and by your having unanimously elected him as President for the year, you have afforded such a convincing proof of it, that it is unnecessary for me to say more than that I feel assured that his services will be appreciated and secure for him the utmost respect. In conclusion, I beg to assure you that it affords me the greatest gratification to resign my office into such good keeping.

The Prince Consort then vacated the President's chair in favour of Lord Wrottesley, who delivered the opening address.

On Thursday, the 28th, the business of the Sections commenced.

THURSDAY, JUNE 28th.

Section A.—Mathematical and Physical Science. (Convocation House.)

President.—Rev. B. Price, M.A., F.R.S., Professor of Natural Philosophy, Oxford.

The President of the section briefly addressed it on taking the chair.

1. By the late Professor Baden Powell: Report on Observations of Luminous Meteors, 1859-60. Prepared by James Glaisher, Esq., F.R.S. With observations on luminous Meteors, by R. P. Greg; and on the luminous tails of Meteors, by M. Schmidt.
2. J. A. Broun: On the velocity of Earthquake-shocks in the laterite of India.
3. J. A. Broun: On the Magnetism of Certain Indian Granites.
4. Patrick Cody: On the Trisection of an Angle by Plane Geometry.
5. Mr. Claudet: On the Principles of the Solar Camera.
6. Mr. Claudet: On the Means of Increasing the Angle of Binocular Instruments, in order to obtain a stereoscopic effect in proportion to their magnifying power.
7. Rev. T. Rankin: On Meteorological Observations for 1859, made at Huggate, East Riding, Yorkshire.
8. Rev. T. Rankin: On the Different Motions of Electric Fluid.

Section B.—Chemical Science. (Museum.)

President: B. C. Brodie, M.A., F.R.S., Professsor of Chemistry, Oxford.

1. Mr. Symons exhibited some forms of Alkalimeters, suggested by Mr. Wiers.
2. J. J. Coleman:—On some Remarkable Relations existing between the Atomic Weights, Atomic Volumes, and Properties of the Chemical Elements.
3. Dr. Bird:—On the Deodorization of Sewage.

Section C.—Geology. (Museum.)

President: Rev. A. Sedgwick, M.A., F.R.S., Prof. of Geology, Cambridge.

1. Opening Address by the President.
2. Professor Phillips: On the Geology of the Vicinity of Oxford.
3. J. F. Whiteaves, Esq., F.G.S.: On the Invertebrate Fauna of the Lower Oolites of Oxfordshire.
4. Edmund Hall, Esq., F.G.S.: On the Blenheim Iron Ore, and the thickness of the formations below the Great Oolite at Stonesfield.
5. Rev. P. B. Brodie, F.G.S.: On the Stratigraphical position of certain species of Coral in the Lias.
6. Rev. H. B. Tristram.—On the Geological characters of the Sahara.

7. Rev. J. B. P. Dennis, F.G.S.:—On the mode of the flight of the Pterodactyles of the Coporolite bed near Cambridge.

Section D.—Zoology and Botany. (Museum.)

President.—Rev. Professor Henslow, F.R.S., &c., Professor of Botany, Cambridge.

1. George Ogilvie, M.D.: Report on Dredging North and East Coast of Scotland.
2. Rev. P. P. Carpenter: On the present state of Natural History in the United States of America.
3. Professor Daubeney: Remarks on the Final Causes of the Sexuality of Plants; with particular reference to Mr. Darwin's work, "On the Origin of Species by Natural Selection."
4. Professor J. Ray Greene: Report on British Medusidæ.
5. John Hogg, F.R.S.: On the distinctions between Plants and Animals; and on a Fourth Kingdom of Nature.
6. J. O. Westwood, M.A.: On a Lepidopterous Parasite on *Fulgora caudelaria.*

Sub-section D.—Physiology. (Museum.)

President: Professor Rolleston, M.D., F.L.S.

1. The President's Address.
2. Professor Carus: On Leptocephalidæ, their Anat omy and Systematic Positions.
3. Dr. Edward Smith, F.R.S.: The action of tea and alcohol contrasted.
4. Sir Charles Grey: On Asiatic Cholera.
5. M. Garner, F.R.S.: On the function of the Spinal Cord and its Morbid Changes.

Section E.—Geography and Ethnology. (Divinity School.)

President: Sir R. I. Murchison, G.C.St.S., D.C.L., F.R.S., V.P.R.G.S., Director General of the Geological Survey of the United Kingdom.

1. The President: Sir R. Murchison's Address.
2. Captain Sherrard Osborn, R.N., F.R.G.S.: On the formation of Oceanic Ice in the Arctic Regions.
3. Captain Parker Snow: On the Lost Polar Exhibition and Possible Recovery of its Scientific Documents.
4. John Crawford, Esq., Pres. Ethn. Soc.: On the Influence of Domestic Animals on the Progress of Civilization (Birds).

Section F.—Economic Science and Statistics. (Schools.)

President: Nassau W. Senior Esq., M.A., late Professor of Political Economy, Oxford.

1. The President: Opening Address.
2. Frederick Purdy: On the Systems of Poor-Law Medical Relief.
3. Edwin Chadwick, C.B.: On the Physiological as well as Psychological Limit to Mental Labour.

Section G.—Mechanical Science. (Schools.)

President: W. J. Macquorn Rankine, LL.D., F.R.S., Professor of Engineering, Glasgow.

1. Professor James Thomson, of Belfast: Interim Report on the Guaging of Water.
2. Report of the Committee on Steam-ship Performance.
3. Admiral Moorsom: On the Performance of Steam Vessels.
4. P. W. Barlow, F:R.S.: On the Mechanical Effects of Combining Suspension Chains and Girders, and the Value of the Practical Application of this System (illustrated by a Model).

In the evening there was a Conversazione, with Experiments, in the University Museum.

FRIDAY, JUNE 29th.

Section A.—Mathematical and Physical Science.

1. Admiral Fitzroy: On British Storms, with large diagrams.
2. M. Herman Von Schlagintweit: General Abstract of the results of Messrs. de Schlagintweit's Magnetic Survey of India, with three charts.
3. Mr. J. A. Brown: On a Magnetic Survey of the West Coast of India.
4. Mr. Du Boulay: Observations on the Meteorological Phenomena of the Vernal Equinoctial Week.
5. Sir D. Brewster: On some Optical Illusions connected with the Inversion of Perspective.
6. Dr. Gladstone: On the Chromatic Properties of the Electric Light of Mercury.
7. Dr. Gladstone: On his own Perception of Colours.
8. Mr. Ball: Communication of Meterological Observations by Alpine travellers.
9. Rev. S. Earnshaw: On the Velocity of the Sound of Thunder.

Section B.—Chemical Science.

1. Dr. Franklin and Mr. Duppa: On a new Organic Compound containing Boron.
2. Professor Rowney: On the Analysis of some Connemara Minerals.
3. W. R. Grove: On the Transmission of Electrolysis across Glass.
4. Professor Rowney: On the Composition of Jet.
5. Dr. Hermann Sprengel: On a New Form of Blowpipe for Laboratory Use.
6. Professor Voelcker: On the Occurrence of Poisonous Metals in Cheese.
7. T. Scoffern: On Waterproof and unalterable Small-arm Cartridges.
8. Warren De La Rue and Dr. Hugo Miller: On the Isomers of Cumol.
9. Warren De La Rue and Dr. Hugo Miller: On a New Acetic Ether occurring in a Natural Resin.
10. Dr. W. A. Miller: On the Atomic Weight of Oxygen.

Section C.—Geology.

1. Dr. Daubeny: Remarks on the Elevation Theory of Volcanos.
2. T. Sterry Hunt, Esq.: Notes on some points in Chemical Geology.
3. W. Pengelly, Esq.: On the Geographical and Chronological Distribution of Devonian Fossils in Devon and Cornwall.
4. Dr. Wright: On the Avicula Contorta Bed, and Lower Lias in the South of England.
5. Joseph Prestwich: On some New Facts in relation to the Section of the Cliff at Mundsley, Norfolk.

Section D.—Zoology and Botany.

1. Professor Buckman: Report on Experiments on the Alteration of the Specific Forms of Plants by Culture.
2. Rev. H. H. Higgins: On some Specimens from the Pathological Collection of Shells by the late Mr. Gaskorn.
3. J. Gwyn Jeffreys, F.R.S.: Exhibition of Opercular Monstrosities of *Buccinum undatum.*
4. R. Dowden (R.): On a Plant poisoning a Plant.
5. Dr. C. Dresser: On Abnormal Forms of *Passiflora cœrulea.*
6. G. Ogilvie, M.D.: On the Hard Tissues of Fern Stems.
7. J. Gwyn Jeffreys, F.R.S.: On the British *Teredines* or Ship-worms.
8. Professor Van der Hoeven: Some Observations on the *Teredo navalis,* and the mischief caused by it in Holland.
9. Dr. E. Perceval Wright: Exhibition of a Fresh-water *Teredo.*

Sub-section D.—Physiology.

1. Dr. Lewis: On a Hydro-spirometer.
2. John Lubbock, Esq., F.R.S.: On the Development of Buccinum.
3. Dr. Michael Foster: Contributions to the Theory of Cardiac Inhibition.
4. Professor Huxley, F.R.S.: On the Development of Pyrosoma.
5. Professor Beale, F.R.S.: On the Ultimate Arrangement of Nerves in Muscular Tissue.
6. Dr. C. Kidd: On the Nature of Death by Chloroform.
7. Dr. E. R. Harvey, M.A., M.B.: An Experimental Inquiry into the Mode of Death produced by Aconite.

Section E.—Geography and Ethnology.

1. Dr. D. Livingstone: Latest Discoveries in South-Central Africa.
2. Mr. Consul Petherick, of Khartum, in Upper Egypt: On his proposed Journey from that place to meet Captain Speke, on or near the Lake Nyanza of Central Africa.
3. Mr. T. Wright: On the Excavations on the site of the Roman City of Uriconium, at Wroxeter.
4. Mr. W. Lockhart: On the Mountain Districts of China, and their Aboriginal Inhabitants.
5. Dr. Macgowan, U.S.: History of the *Ante* Christian Settlement of the Jews in China.

Section F.—Economic Science and Statistics.

1. Henry Fawcett, M.A., F. Trinity Hall, Cambridge: Dr. Whewell on the Method of Political Economy.
2. Rev. James Booth, LL.D., F.R.S.: On the True Principles of an Income Tax.
3. Henry Roberts, F.S.A.: Notes on various Efforts to Improve the Domiciliary Condition of the Labouring Classes.

Section G.—Mechanical Science.

1. Mr. Barlow's Paper on combining Suspension Chains and Girders was discussed.
2. Calcott Reilly: On the Longitudinal Stress of the Plate Girder.
3. Walter Hall: On the Manufacture of Submarine Cables (illustrated by a model and specimens).
4. Werner and C. W. Siemens: On a New Process of covering Submarine Conductors with India-rubber or its Compounds (illustrated with a machine).
5. William Simons: On Improvements in Shipbuilding.
6. The Earl of Caithness: On Road Locomotives (a road locomotive was shown in action in the streets).
7. J. Elder: On a Cylindrical Spiral Boiler.

At 4 o'clock, in the Theatre, the Rev. Professor Walker, M.A., F.R.S., delivered a Lecture on the Physical Constitution of the Sun, and in the evening, a Conversazione, with Experiments, took place in the University Museum, at half-past 8.

SATURDAY, JUNE 30.

Section A.—Mathematical and Physical Science.

1. Professor W. Thomson: Report of Committee appointed to prepare a self-recording atmospheric electrometer for Kew, and portable apparatus for obtaining atmospheric electricity.
2. E. Vivian, M.A.: Results of self-registering Hygrometers.
3. Dr. Booth: On the relations between hyperconics and elliptic integrals.
4. Mr. J. A. Broun: On a new induction dip circle.
5. Mr. W. R. Birt: On the forms of certain lunar craters indicative of a peculiar degrading force, with diagrams.
6. Mr. W. R. Birt: On atmospheric waves, with diagrams.
7. Sir D. Brewster: On microscopic vision and a new form of microscope.
8. Canon Moseley: On the motion of glaciers.
9. Professor Maxwell: On an instrument for exhibiting any mixture of the colours of the spectrum.
10. Mr. A. Cayley: On curves of the fourth order having three double points.
11. J. S. Glennie: On physics as a branch of the science of motion.

Section B.—Chemical Science.

1. Dr. Gladstone: Chemical notes on (1) Creasote; (2) a compound of Molybdenum, Chlorine, and Fluorine; (3) the diffusion of salts in solution as bearing evidence of their reciprocal decomposition.
2. Dr. Lyon Playfair: On the representation of neutral salts on the type of a neutral peroxide $H\,O_2$, instead of a basic oxide $H_2\,O_2$.

Section C.—Geology.

1. Sir R. I. Murchison: To exhibit a New Geological Map of Oxford.
2. Dr. Geinitz: On Snow Crystals observed at Dresden.
3. Dr. Geinitz: On the Silurian Formation in the district of Wilsdruff.
4. Professor Harkness: On the Metamorphic Rocks of the North of Ireland.
5. Capt. Woodall: On the Intermittent Springs of the Chalk and Oolite in the neighbourhood of Scarborough.
6. Dr. Anderson: Report on the Dura Den Excavations.
7. M. A. Favre: On Circular Chains in the Alps.
8. C. Moore: On the contents of three square yards of Triassic Drift.
9. Rev. G. N. Smith: On the Osseous Caves of Tenby.

Section D.—Zoology and Botany, including Physiology.

1. Dr. Kinahan, F.L.S.: Report on Dredging in Dublin Bay.
2. J. O. Westwood, M.A.: On an Insect hitherto referred to three different orders.
3. Rev. MacAndrew, F.R.S.: Report of the General Dredging Committee.
4. Dr. C. Collingwood: On recurrent Animal Form, and its influence on systematic Zoology.
5. Professor Draper, M.D., New York: On the intellectual development of Europe, considered with reference to the views of Mr. Darwin and others, that the progression of Organisms is determined by law.

Sub-Section D.—Physiology.

1. Dr. Gibb: On Saccharine formation in the Breast.
2. Archibald Maclaren, Esq.: On the influence of Systematised Exercise on the Expansion of the Chest.
3. Robert Garner, Esq.: On the Structures of the Lepadidæ.

Section E.—Geography and Ethnology.

1. M. Pierre de Tchihatchef: On the Geographical distribution of Plants in Asia Minor.
2. Dr. Rae: On the Aborigines of the Arctic and Sub-Arctic Regions of North America.
3. Capt. John Palliser, F.R.G.S.: On the Course and Results of the British North American Exploring Expedition, under his command in the years 1857-8-9.
4. Lieut. Edward Schlagintweit: On the Tribes composing the population of Morocco.
5. Mr. R. Cull, F.S.A.: On certain Remarkable Deviations in the Stature of Europeans.

Section F.—Economic Science and Statistics.

1. Henry Fawcett, M.A., Fellow of Trinity Hall, Cambridge: On Co-operative Societies, their Social and Political Aspect.

2. William Newmarch: On some suggested Schemes of Taxation, and the difficulties of them.
3. Edwin Chadwick, C.B.: On the Economical results of Military Drill in popular Schools.
4. Dr. Michelsen: Serfdom in Russia.

Section G.—Mechanical Science.

1. J. Elder's paper on a Cylindrical Spiral Boiler was discussed.
2. E. A. Cowper: On a New Mode of obtaining a Blast of very High Temperature in the Manufacture of Iron.
3. Wm. Fairbairn, F.R.S.: On the Density of Saturated Steam, and on the Law of Expansion of Superheated Steam.
4. William Froude: On Giffard's Steam-jet Feed Apparatus.
5. Professor Hennessy, F.R.S.: Suggestions relative to Inland Navigation.

MONDAY, JULY 2.

Section A.—Mathematical and Physical Science.

1. Prof. Walker: Report of the Committee on Balloon Ascents for Scientific purposes.
2. Dr. Booth: On a new Geometrical method for establishing the theory of Conic Sections.
3. Dr. Booth: On an improved Instrument for describing Spirals; invented by Henry Johnson.
4. Sir D. Brewster: On the influence of Small Apertures on Telescopic vision.
5. Dr. Lee: Prospectus of the Hartwell Variable Star Atlas, with six specimen proofs.
6. Dr. Hincks: On some recorded Observances of the Planet Venus in the Seventh Century, B.C.
7. Prof. Hennessy: On the Principles of Meteorology.
8. Prof. Hennessy: On the possibility of studying the Earth's Internal Structure from phenomena observed at its surface.
9. Prof. Peirce: On the Physical Constitution of Comets.
10. Prof. Peirce: On the Dynamic condition of Saturn's Rings.
11. Professor Sylvester: A generalization of Poncelet's Theorem for the Linear Representation of Quadratic Radicals.
12. M. Robert de Schlagintweit: On Hypsometers, and their comparison with barometers at great heights.
13. Professor Jellett: On a new Analysing Prism.
14. B. Stewart: On some recent extensions of the Theory of Exchanges.
15. Mungo Ponten: Further researches regarding the laws of Chromatic dispersion.

Section B.—Chemical Science.

1. Mr. Buckton: On some reactions of Zinc-ethyl.
2. Dr. Von Bose: Remarks on the Volume Theory.
3. Dr. Andrews: On Ozone.
4. Prof. Brodie: On the Quantitative Estimation of the Peroxide of hydrogen.
5. A. Vernon Harcourt: On the Oxidation of Potassium and Sodium.

Section C.—Geology.

1. Professor Jukes: On the Igneous Rocks interstratified with the Carboniferous Limestone of the Basin of Limerick.
2. Rev. P. B. Brodie: On the Stratigraphical position of certain species pf Corals in the Lias.
3. Rev. W. Lister: On some Reptilian foot-prints from the New Red Sandstone North of Wolverhampton.
4. Rev. Prof. Sedgwick: On the Geology of the neighbourhood of Cambridge and the fossils of the Upper Green sand.
5. Rev. W. V. Harcourt: On the effects of Long continued Heat—shewn in the iron furnaces of the west of Yorkshire.
6. Prof. Rogers: On some phenomena of metamorphism in coal in the United States.

Section D.—Zoology and Botany.

1. Dr. Ogilvie: On the Woody Fibres of Flowering and of cryptogamic plants.
2. J. Price: On Cydippe.
3. Dr. Daubeny: Remarks on Equivocal Generation.
4. Frank T. Buckland: On the Acclimatisation of Animals, Birds, &c., in the United Kingdom.
5. Dr. Verloren: On the effect of Temperature and Time in the Development of certain *Lepidoptera*.
6. H. T. Stainton: On some peculiar forms amongst the larvæ of the *Micro-Lepidoptera*.
7. Lovell Reeve: On the *Aspergilla*, or watering-pot moluscs.
8. Dr. C. Dresser: On the morphological laws in plants.

Sub-Section D.—Physiology.

1. Prof. Corbett, M.D.: On the Deglutition of Alimentary Fluids.
2. Arthur E. Durham, Esq.: An experimental inquiry into the Nature of Sleep.
3. Prof. Van der Hoeven: Some remarks on the Anatomy of Potto of Borneo Perodicticus Bennettii.
4. Dr. R. McDonnell: On sugar and amyloid substance in the Animal Economy.
5. Prof. J. R. Greene: A word on Embryology with reference to the constitution of the sub-kingdoms of animals.
6. Prof. Carus: On the value of development in Systematic Zoology and Animal Morphology.

Section E.—Geography and Ethnology.

1. John Crawfurd, Pres. Eth. Soc.: On the Aryan or Indo-Germanic theory of races.
2. Col. Shaffner, N.S.: On the Geography of the proposed Communication between England and America *via* the Faröes, Iceland, and Greenland.
3. Rev. Dr. Booth: On a Deep Sea Pressure Gauge; invented by Henry Johnson.
4. Capt. M. H. Synge, R.E.—On the proposed Communication between Atlantic and Pacific *via* British North America.
5. Professor Ferdinand von Hochstetter (Vienna), Geologist of the Austrian Novara Expedition: A new Map of the Interior of the Northern Island of New Zealand, constructed during the Inland Journey in 1859.
6. Rev. Dr. Hincks: On some Ethnological Boulders, and their probable origin.
7. Mr. R. Cull: On the existence of a True Plural of a Personal Pronoun in a living European Language.

Section F.—Economic Science and Statistics.

1. J. J. Fox: On the Province of the Statistician.
2. Richard Dowden: Local Taxation for Local Purposes.
3. Miss Carpenter: Statistics of Schools for neglected Children.
4. John Hitchman: On Sanitary Drainage of Towns.

Section G.—Mechanical Science.

1. Capt. Blakeley: On Rifled Cannon.
2. David Chadwick: On Water Meters.
3. B. W. Richardson, M.A., M.D.: Suggestions for an Electro-magnetic Railway.

At 2 o'clock a Convocation of the University was held in the Sheldonian Theatre, at which the Franklin Prize Poem was recited by Mr. Vidal, of Trinity College, the author, and the Degree of D.C.L. was conferred on the Lord Wrottesley, M. De La Rive, and Professor Sedgwick. At three o'clock, the General Committee met, Lord Wrottesley in the chair, for the purpose of fixing the place of meeting next year, electing the President, and for other business connected with the Association. Manchester was chosen as the place where the Association will meet next year; and Wm. Fairbairn, F.R.S., was unanimously elected to fill the office of President. On the same day, at

4 o'clock, in the theatre, Capt. Sherard Osborn, R.N., delivered a Discourse on Arctic Discovery. In the evening, a Conversazione, with Experiments, took place in the University Museum, at half-past 8, when, amongst other things, Mons. Serrin's automatic apparatus for the electric light was shown in action.

TUESDAY, JULY 3.

Section A.—Mathematical and Physical Science.

1. Werner and C. W. Siemens: Outline of the Principles and Practice involved in dealing with the Electrical Conditions of Submarine Electric Telegraphs.
2. Rev. S. Earnshaw: On the Triplicity of Sound.
3. R. Thomas: On Thin Films of Decomposed Glass found near Oxford.
4. Sir D. Brewster: Notice respecting certain Phenomena of Crystallisation and Polarization in Decomposed Glass.
5. Professor Peirce: On the Motion of a Pendulum in a vertical plane when the point of suspension moves uniformly on a circumference in the same plane.
6. Henry Draper, M.D.: On a Reflecting Telescope for Celestial Photography, now erecting at Hastings, near New York; communicated by Professor Draper.
7. Henry J. S. Smith: On the Solution of Linear Indeterminate Equations in Whole Numbers.
8. Professor Maxwell: On the Results of Bernoulli's Theory of Gases as Applied to their Internal Friction, their Diffusion, and Conductivity for Heat.
9. Professor W. B. Rogers, Boston: Experiments and conclusions on Binocular Vision, and some Experiments on some of the Phenomena of Electrical Vacuum Tubes.
10. Professor Lindelof: On Caustic Surfaces.
11. Dr. Brennecke: On some Solutions of the Problem of Tactions by Appollonius of Perga, by means of modern Geometry.
12. Sir W. Snow Harris: On the Exhibition of Electrical Force.

Sub-section A.

1. Captain Maury: On the climate of the Antartic Regions, as indicated by Observations upon the Height of the Barometer and Direction of the Winds at Sea; and a Letter on Antarctic Exhibitions.
2. M. Verdet: On the Dispersion of Planes of Polarization produced by Magnetism.
3. J. A. Broun: On the Diurnal Variations of the Magnetic Declination at the Magnetic Equator, and the Decennial Period.
4. J. A. Broun: On Certain Results of Observations in the Observatory of H.H. the Rajah of Travancore.
5. J. Park Harrison: On the Similarity of the Lunar Curves of Minimum Temperature in 1859, at Utrecht and Greenwich.
6. Rev. A. Weld: Results of ten years' Meteorological Observations at Stonyhurst.
7. G. T. Symons: Results of an Investigation into English Thunderstorms during 1857-8-9.
8. M. Serrin: 1° Régulateur automatique de lumière electrique. 2° Pile à Sulfate de Plomb de M. Edmond Becquerel. 3° Phosphorescence de M. Edmund Becquerel.
9. Captain Parker Snow: On Practical Experience of the Law of Storms in each quarter of the Globe.
10. Professor W. Thomson: Notes on Atmospheric Electricity.

Section B.—Chemical Science.

1. J. J. Coleman: Note on the Destruction of the Bitter Principle of Chyraitta by the Agency of Caustic Alkali.
2. J. B. Lawes, F.R.S., and Dr. J. H. Gilbert: On the Composition of the Ash of Wheat grown under various circumstances.
3. Dr. Thudichum: On Thiotherine, a Sulphuretted Product of Decomposition of Albuminous Substances.
4. Dr. W. Wallace: On the Causes of Fire in Turkey-red Stoves.

Section C.—Geology.

1. Professor Sedgwick: On the Geology of the Vicinity of the Neighbourhood of Cambridge, and the Fossils of the Upper Green-sand.
2. Professor Ferdinand Von Hochstetter: Some Observations upon the Geological Features of the Volcanic Island of St. Paul in the South Indian Ocean, illustrated by a model in relief of the island made by Capt. Cybulz of the Austrian Artillery.
3. Professor Ferdinand Von Hochstetter: Remarks on the Geology of New Zealand, illustrated by geological maps, drawings, and photographs.
4. Rev. J. C. Clutterbuck: On the Course of the Thames from Lechdale to Windsor, as ruled by the geological formations over which it passes.
5. Alphonse Gages: On some Transformations of Iron Pyrites in connection with Fossil Remains.
6. William Molyneux: Remarks on Fossil Fish from the North Staffordshire coal fields.
7. W. Powrie (communicated by Sir R. I. Murchison): On the old red sandstone and its Fossil Fish in Forfarshire, with an account of the fish by Sir P. Egerton.
8. Sir P. Egerton: On a New Form of Ichthyolite discovered by Mr. Peach.
9. Baron Francisco Anca: On Two newly-discovered Caves in Sicily, containing worked flints.
10. E. Hull: To Explain the six-inch Map of the Geological Survey.
11. Rev. W. Symonds: On the Selection of a peculiar Geological Habitat by some of the rarer British Plants.
12. Rev. W. Mitchell and Professor Tennant: On the Koh-i-noor previous to its cutting.
13. Dr. W. S. Lindsay: On a recent volcanic eruption in Iceland.
14. Sir D. Brewster: Details respecting a nail found in Kingoodie quarry.
15. J. A. Knipe: On the Tynedale coal field and whinsill.
16. Rev. J. Dingle: On the corrugation of strata in the vicinity of mountain chains.
17. J. Price: On Slikensides.
18. Dr. Hector: Notes on the Geology of Captain Palliser's route across the Rocky Mountains.

Section D.—Zoology and Botany, including Physiology.

1. Dr. Collingwood, F.L.S.: Notes on the *Nudibranchiata* of the Mersey and Dee.
2. Dr. Collingwood, F.L.S.: Remarks on the respiration, &c. of the Nudibranchiate *mollusca*.
3. P. Lutley Sclater, F.L.S.: On the geographical distribution of vertebrates.
4. Maxwell J. Masters: On abnormal variations in plants.
5. Rev. A. R. Hogan, A.M.: A notice of the British well-shrimps.
6. Rev. the President: On the supposed germination of mummy wheat.
7. J. O. Westwood, A.M.: Notes on mummy beetles.
8. C. Peach: On the statistics of the herring fishery.
10. Dr. E. Perceval Wright, F.L.S.: Notes on *Tomopteris onisciformis*.

Sub-division D.—Physiology.

1. M. Ollier: To exhibit specimens illustrating the Artificial production of Bone and Osseous Grafts.
2. Dr. C. B. Radcliffe: Experiments on Muscular Action from an Electrical point of view.
3. Professor Beale, F.R.S.: On the Ultimate Arrangement of Nerves in Muscular Tissue.

4. Dr. B. W. Richardson: On the influence of Oxygen in Animal bodies.
5. Dr. Thudicum: On the Physiological relations of the Colouring Matter of the Bile.

Section E.—Geography and Ethnology.

1. Capt. Sir Edward Belcher, R.N., C.B.: On the manufacture of Stone Hatchets and other Implements by the Esquimaux, illustrated by native Tools, Arrow-heads, &c.
2. Dr. James Hunt: On the Antiquity of the Human Race.
3. T. W. Atkinson: On the Caravan routes from the Russian Frontier to Khiva, Bokhara, Kokhan, and Yarkand, with suggestions for opening up a Trade between Central Asia and India.
4. Capt. Cifulz (Imperial Austian Artillery): To exhibit Relief Models of the Alps, &c.
5. Dr. Robert Knox: On the Origin of the Arts, and the influence of Race in their development.

Section F.—Economic Science and Statistics.

1. E. Jarvis (Boston. U. S.):—On the System of Taxation prevailing in the United States.
2. H. J. Kerr Porter, M.R.I.A.: Some hints for the Building of Cottages for Agricultural Labourers.
3. J. M. Mitchell: On the Statistics of the Herring Fishery on the British coasts.

Section G.—Mechanical Science.

1. William Fairbairn, F.R.S.: Experiments to determine the effect of vibratory action and long continued changes of Load upon wrought-iron Girders.
2. Admiral Tayler: A novel means to lessen the frightful loss of life round our exposed coasts, by rendering the element itself an inert barrier against the power of the sea; also a permanent deep water harbour of refuge by artificial bars.
3. Geo. F. Train: On Street Railways as used in the United States (with a model.)
4. S. W. Silver: On the character and comparative value of Gutta Percha and India Rubber employed as Insulators for Subaqueous Telegraphic wires.
5. John Fisher: On an Atmospheric Washing Machine.

In the evening the University Museum was thrown open, at half-past Eight o'clock, for the exhibition of Microscopes and Microscopical Objects.

WEDNESDAY, JULY 4.

Section A.—Mathematical and Physical Science.

1. Rev. T. P. Kirkman: On the roots of substitutions.
2. Patrick Aidie: Description of a new reflecting instrument for angular measurements: and of another for measuring actual distances.
3. W. Ladd: Improved form of air pump for Philosophical Experiments.
4. Mr. Stoney: On rings seen in fibrous specimens of Calc spar.
5. R. Dowden: On the effect of a rapid current of air.
6 Hon. W. Bland, N. S. Wales: On an atmotic ship.
7. J. S. Glennie: A general law of rotation, applied to the planets.
8. Rev. T. Rennison: A new proof of Pascal's theorem.
9. John Smith, Perth: On the Chromascope.

Section E.—Geography and Ethnology.

1. T. W. Atkinson: On the caravan route from Yarkand to Mai-ma-tchin, with a short account of this town, through which the trade is carried on between Russia and China.
2. Prof. Jarrett: On alphabets, and especially the English; and on a new method ot marking the sound of English words without change of orthography.
3. Dr. R. G. Latham: On the Jacwings, a population of the 13th century, on the frontiers of Prussia and Lithuania.
4 Rev. Prof. Graves: On the arrangement of the Forts and dwelling places of the ancient Irish.
5. Daniel A. Lange: Brief account of the progress of the works of the Isthmus of Suez Canal.
6. Dr. J. Rae: On the formation of icebergs and their action, as observed in the Hudson Bay and Straits.
7. Vicente Hurtado: On the geographical distribution, and trade in the Cinchona.
8. M. Robert von Schlagintweit: Remarks on some of the Races of India and High Asia (in connection with casts exhibited).
9. J. Mickie: Cruise in the Gulf of Pe-che-li and Leotung (China).
10. D. May, R.N.: Journey in the Yoruba and Nupè countries.

The concluding meeting of the Association was held in the Theatre, at 3 o'clock, when the proceedings of the General Committee, and the grants of money sanctioned by it, were stated.

DEEP-SEA THERMOMETER.

An instrument designed for the determination of the temperature of the sea at considerable depths, has been invented by Mr. Henry Johnson. It consists of a small bar of metal, composed of two or more thin bars of metals which expand or contract in different ratios with change of temperature, and which bars are soldered together, or well rivetted. One end of the bar is fixed to a plate of metal; the other end is free, but is kept in its position by springs. The lateral motion of the free end of the bar with the variation of temperature is sufficient to move slightly a small wheel. On the reverse side of the plate of metal is a scale of degrees of temperature, and a hand, fixed to the axle of the wheel which is moved by the end of the bar, pushes one of two pointer hands, between which it is placed, to the proper degree of temperature. The pointers are elastic, and press upon the scale so as to remain where they are placed, and thus record the greatest change of temperature. When the instrument is laid upon one of the edges, or narrow sides, a variation of the moving hand of one or two degrees of temperature may be observed, and which is probably caused by the weight of the bar, but no correction on this account will be required unless the bottom has been reached. Although made entirely of metal, some care will be required in the use of this thermometer, as a blow against the side of the surveying ship that would break a glass thermometer, would cause a lateral motion in the bar, and derange the position of the pointers. This thermometer may be adapted to the measurement of higher rates of temperature, by reducing the length of the hands, and including in the same width of plate a greater number of degrees, or by using a wider plate of metal. A much more open scale is obtained by adopting the lateral motion of the end of a compensation bar, than could be obtained by the direct expansion of bars of a single metal. In a bar 10 inches long, at 60° Fah., immersed in water at 160°, the motion is about $\frac{1}{8}$th of an inch, 1 part in 80. It appears, from a table a table of expansion given in Fownes' "Manual of Chemistry," that the direct expansion of metals under change of temperature, from 32° to 212°, varies from $\frac{1}{333}$ to $\frac{1}{1167}$.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 6th*, 1860.]

Dated 24th April, 1860.

1022. E. Gatwood, Holmer, near Hereford—Imp. in fixing or securing the rails in cast iron or other chairs at joints and intermediate places in permanent ways.

Dated 16th May, 1860.

1201. D. S. Agata, Lisbon—An improved disinfectant.

Dated 21st May, 1860.

1242. J. Copcutt, 26, Kirby-street, Hatton-garden—Imp. in manufacturing gas and carbon, or lampblack, in one of the same apparatus, and in the apparatus employed therein, and for means and apparatus for rendering the gas applicable for lighting of ships, lighthouses, mines, and all other places where gas can be used.

1241. S. Crompton and W. Robertson, Manchester—A new mode of economising water passing through canals, when such water is used for dragging boats or otherwise.

Dated 30th May, 1860.

1330. T. Gordon, 41, King-street, Soho, Westminster—Imp. in ink-stands.

Dated 5th June, 1860.

1374. G. Fletcher, Farnham-place, Southwark—Imp. in the apparatus for regulating the draft in the tubes of multitubular boilers. (A com.)

1378. A. J. Pereira de Carvalho, 61, Moorgate-street, London—Imp. in beams, applicable in the construction of bridges and other structures, and also for the floors and ceilings of houses.

Dated 6th June, 1860.

1384. S. Schuhman and G. Harrison, Burnley, Lancashire—Imp. in machinery or apparatus for spinning, doubling, and winding fibrous materials.

1385. E. T. Hughes, 123, Chancery-lane—Imp. in coating or plating the faces of printing type and stereotype plates. (A com.)

Dated 12th June, 1860.

1439. P. Fromont, Chatelinau, Belgium—Imp. in machinery for the ascending and descending in pits or mines of workmen, waggons, carriages, and materials.

Dated 13th June, 1860.

1448. W. Spence, 50, Chancery-lane—Imp. in the mode of and apparatus for reducing silicious substances to a fluid state. (A com.)

Dated 14th June, 1860.

1456. E. Sparkhall, Cheapside, London—Imp. in producing certain designs and patterns upon cloth or textile fabrics, in order to procure certain effects in garments made therefrom.

Dated 15th June, 1860.

1460. I. Mackrow, Woodstock-road, Poplar—Imp. in alarum locks and latches.

1462. Capt. C. P. Coles, R.N., United Serivce Club, Pall-mall—Imp. in iron-cased ships of war.

1464. W. Harding, Rutland-terrace, Forest-hill, Kent—Imp. in breech-loading fire-arms.

Dated 16th June, 1860.

1466. M. Myers, M. Myers, and W. Hill, Birmingham—Certain imp. in holders and connectors for holding papers and fancy wares, exposed for sale or for private use.

1468. W. Dray and R. Gardiner, Farningham, Kent—Imp. in reaping and mowing machines.

1470. E. Deane, Arthur-street East, London-bridge, and Capt. W. D. Marsh, R.E., 11, James-street, Middlesex—Imp. in kitchen ranges or apparatus for cooking.

1472. C. Henderson, Leicester—Imp. in flooring and bench cramps.

Dated 18th June, 1860.

1476. T. Kershaw, Baker-street, Portman-square—Imp. in apparatus for imitating various fancy woods, marbles, granites, and stencillings.

1478. H. Nicholson, Drake-street, Rochdale—A new and improved cricket and playing ball.

1480. T. W. Keates, Chatham-place, Blackfriars, London—An improved mode of separating carbonic acid gas from the gaseous products derived from the distillation of peat and other vegetable matter.

Dated 19th June, 1860.

1482. A. B. Childs, 481, New Oxford-street, Middlesex—Imp. in the manufacture of a portable pocket match safe. (A com.)

1486. J. Walker, City-road, Middlesex—Imp. in mills or machinery for expressing juice from the cane and other like vegetable substances.

1488. J. J. Welch, Cheapside—Imp. in neck-ties, scarfs, and cravats.

Dated 20th June, 1860.

1489. W. Kendall and G. Gent, Salford—Imp. in machinery or apparatus for making gas burners.

1491. W. W. Sleigh, 49, Myddelton-square, Middlesex—The neutralific motive power engine.

1492. G. Hinton, Birmingham—Imp. in cupola furnaces.

1494. H. Wimball, Aldermaston, Berkshire—Imp. in machinery or apparatus for making bricks, tiles, and drain pipes.

1495. H. Hart, Cambridge-villas, South-street, Greenwich—Imp. in machinery or apparatus for cutting and shaping metals and other substances.

1496. E. B. Webb, 34, George-street, Westminster—Imp. in breakwaters and piers.

1497. H. F. Biron, Chipping Campden, Gloucestershire, and R. Fell, 16, Albion-place, Walworth, Surrey—An improved vertical paddle wheel.

1498. F. C. Simons, late Captain in the Bengal Artillery—Imp. in ordnance.

1499. R. Bodmer, 2, Thavies-inn, Holborn—Imp. in machinery for washing textile fabrics. (A com.)

1500. F. Preston, Manchester—Certain imp. in machinery for cutting files and rasps.

1501. A. Corroyer, Orchard street, Bloomsgrove, and M. Barton, Nottingham—A new or improved washing machine with the machinery or apparatus employed therein.

Dated 21st June, 1860.

1505. D. Lee and A. Welsh, Leeds—Imp. in means or machinery for preparing and polishing marble.

1507. W. Baker, Sheffield—Imp. in the process of softening and purifying lead.

1509. W. Reade, Hibernia-chambers, Southwark, Surrey—Imp. in apparatus for singeing and preparing the skins of pigs previous to curing.

1511. H. B. Stevenson, Alfred-street, Bedford-square—Imp. in apparatus for propelling and in other rotary apparatuses.

1513. W. Buckwell, Phœnix Stone Works, East Greenwich—Imp. in moulding blocks, slabs, pipes, and other articles, and in the apparatus to be employed therein.

Dated 22nd June, 1860.

1515. W. Morris, 89, Minories, London, and H. Mapple, Child's-hill, Hampstead, Middlesex—Imp. in apparatus for electric clocks and telegraphs.

1517. W. Howells, St. Catherine-street, Carmarthen, South Wales—A portable window platform.

1519. W. E. Gedge, 11, Wellington-street, Strand—Imp. in saddlery and harness. (A com.)

1521. W. Macfarlane, Glasgow—Imp. in water-closets, and sewerage and sanatory apparatus or appliances.

1523. N. Grattan, 24 South Mall, Cork, Ireland—Imp. in gilding steel and other metals.

1525. J. Dewton, New Lenton, Nottinghamshire—Imp. in bobbin net or twist lace machinery.

Dated 23rd June, 1860.

1527. J. Ramsbottom, Crewe, Chester—Imp. in supplying the tenders or tanks of locomotive engines with water.

1529. J. Joyce, Birmingham, and A. Morley, Hinckley, Leicestershire—A new machine or improved mechanical arrangements, or combinations for the manufacture of stockings, vests, and other articles of hosiery.

1531. R. Jobson, Dudley, Worcestershire—Imp. in moulding articles of earthenware or porcelain.

1533. R. A. Boyd, Southwark, Surrey—Imp. in singeing or burning the hair off pigs.

1537. E. Gatwood, Holmer, near Hereford—Imp. in making wheels, applicable to railway carriages and locomotive engines.

Dated 25th June, 1860.

1539. D. C. Dinsmore, Boston, U.S.—Imp. in machinery for splitting leather, and cutting the heels of boots and shoes.

Patents Sealed.

[*From Gazette, July 6th*, 1860.]

July 6th.

50. J. Hawkins & C. Hawkins.
57. G. Beningfield.
58. P. Czugajewicz.
60. J. A. Coffey.
61. W. H. Thornthwaite.
64. M. Vergnes.
67. W. T. B. Allday.
70. W. Cotton.
76. O'Donnell Grimshaw.
80. A. West and J. Robinson.
82. C. De Bergue.
92. E. Harrison and J. Scott.
100. M. A. F. Mennons.
240. J. H. Johnson.
326. W. E. Newton.
534. A. Melville.
808. A. Pentzlin.
902. H. Spence and J. G. Spence.
1000. W. Butlin.
1108. J. Gardner.
1126. W. Hunt.

[*From Gazette, July 10th*, 1860.]

July 7th.

55. J. W. Wilson.

May 10th.

63. S. Isaac.
83. E. Ferrier.
89. R. Burley.
96. J. Goddard.
97. J. Musselwhite.
111. A. M. Rendel.
129. A. Chaplin.
133. J. B. Berger.
152. H. Walker.
171. E. L. Gatellier.
174. C. H. Reed.
245. W. Tait.
277. W. H. Tooth.
288. R. Bodmer.
402. W. E. Newton.
452. W. E. Newton.
614. W. E. Newton.
1150. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, July 6th*, 1860.]

July 2nd.

1855. A. A. Croll.

July 3rd.

1873. F. C. Hills.
1896. J. J. H. Brianchon.

[*From Gazette, July 10th*, 1860.]

July 5th.

1930. J. Chanter and D. Annan.
1962. W. H. Gaunilett.

July 6th.

1886. W. Smith.
1888. R. A. Brooman.
1889. W. Burgess.
1894. G. Green.
1938. H. Lamy.

July 7th.

1960. T. Ashton.

[*From Gazette, July 10th*, 1860.]

July 5th.

1634. J. Parkes and W. H. Parkes.

July 6th.

1669. W. Needham and J. Kite.

July 7th.

1650. G. Dalton.

Journal of the Society of Arts.

FRIDAY, JULY 20, 1860.

INTERNATIONAL EXHIBITION of 1862.

The Secretary reports that the Guarantee Fund now amounts to £336,550. The Council have received a letter from the Commissioners for the Exhibition of 1851, stating that they are willing to appropriate a portion of their estate at South Kensington for the International Exhibition of 1862 rent free; to vest in the Society of Arts, at a moderate rent, the site of the permanent buildings proposed to be erected on a part of the ground, provided the sum of £50,000 is expended in their erection, and to reserve the remainder of the ground for an International Exhibition in 1872, provided £10,000 be paid the Commissioners out of the profits of the Exhibition of 1862.

SCHOOLS FOR CHILDREN AND INSTITUTES FOR ADULTS.

By Harry Chester,

Vice President of the Society of Arts, and formerly Assistant-Secretary to the Committee of Council on Education.

(*Concluded from page* 648.)

We have arrived at a period when science is sufficiently advanced to make it apparent that everywhere, in all employments, there is a need of an increase of knowledge and skill. In our fields and gardens, in our manufactories, mines, army, navy, merchant marine, fisheries, counting-houses, shops, schools, houses, amusements, the want of an increased intelligence is everywhere felt. In Mr. Buckle's remarkable introduction to the "History of Civilisation," he suggests the theory, that most great mischiefs are done by religious persons ignorant of political economy. Religion, he argues, makes a man earnest and active; and the mistakes of ignorant earnestness and activity are productive of evil almost in proportion to the desire to produce good. Without adopting this theory, we must say, that ignorance of political economy is a terrible evil, making statesmen mischievous, on a great scale, when they pass bad laws for "protection," and other follies, and the mechanic or labourer mischievous, on a smaller scale, when they engage in unnecessary strikes, interfere with the absolute freedom of labour, destroy machinery, or burn hayricks. It is our duty as citizens and Christians to acquaint ourselves and others with those great, natural, permanent, invincible, and economical laws, by which society is as certainly governed, and the results of national and individual actions are as certainly determined, as this planet is governed by the great physical laws, and as our souls are governed by the great spiritual laws, which are all alike the expressions of the will and design of the Creator. How can we work out His will, the good of His creatures, if we are unable to distinguish the true from the false theories of political and social economy, if we know not, from experience and induction of principles, what will be the tendency of any given course of political and social conduct? The wonderful scheme of creation, so far as we are at present permitted to understand it, admonishes us to cultivate human faculties to the utmost, in order that we may possess the good and escape the evil that are everywhere combined in this world, and cannot be resolved by ignorant minds; that we may prevent preventible diseases and accidents; may bend the great powers of nature to our use and enjoyment; may be perpetually discovering, inventing, applying, and conforming ourselves to God's laws, not only in things spiritual, but in all things physical and metaphysical. As He has given to us, once for all, a revelation of spiritual truth, He might also have given to us, once for all, a revelation of all natural truth, of all the phenomena and laws of physical and political science. But this was not His will. He has so constituted the human mind, that it shall be ever progressive in the discovery of the truths of nature and politics. He has shrouded them in mystery, impenetrable by ignorant or careless observers; but penetrable, gradually, by the inquiries of intelligence, informed, patient, thoughtful, and self-controlled. He has surrounded us on all sides by a great network of inflexible, natural, and economical laws, whose operation we not only cannot escape, but cannot even comprehend, without the well-informed and highly-cultivated intelligences of a vast number of minds; and He has given to us the strongest possible motives for striving to comprehend those laws, for we find that they damage us whenever we mistake them, and help us when we conform to them. The elements of our security are everywhere combined with the elements of our destruction; nourishment and poison co-exist in the same substances; matters, fatal to life under one form, sustain life and produce beauty and health under other forms. Everywhere in this world evil is mixed with good; but is by intelligence separable from good, or capable of being neutralised so as to be no longer evil.

It is not, then, for the poor alone, that we need an improved and extended education. It is needed equally, if not in a greater degree, by the highest class, and by the classes intermediate between the two extremes of society. There is no kind of business in which a merchant, a manufacturer, a shopkeeper, a farmer, and those in their employment, can be engaged, that would not be better carried on by those who had a knowledge than by those who were ignorant of the science or sciences on which the processes of their business must ultimately rest; and there can be no one who would not be happier and better for having some definite object of favourite pursuit connected with literature, science, or art, by which to occupy his hours of leisure.

What I have said in reference to men is equally true in reference to women. There is just now among the benevolent an active movement, having for its object the more general and better remunerated employment of women. Now the root of this matter also lies in education—the education of women. The degree and value of the employment which they can obtain must be regulated by their qualifications; in other words, by the results of their education; and, if you wish to bring lucrative employment more generally than at present within their reach, you must enhance their qualifications by improving their education; and you may effect this improvement by providing for them, first, increased means of instruction of a better and more practical character, and, secondly, that which has long been found necessary in the education of men, a suitable tribunal which shall test and attest their attainments.

I do not believe that women, any more than men, are employed less, or paid worse, than they deserve, according to their market value. It is easier for governesses, really well-educated and otherwise highly valuable, to obtain adequate employments, than for employers, willing to offer the highest inducements, to obtain really well-educated and otherwise highly valuable governesses. We shudder when we hear of miserable pittances, and miserable treatment, offered by the vulgar rich to delicate young ladies desiring to be governesses; but we have scarcely a frown for the deficiencies which too often render those young ladies unequal to the important and sacred office which they desire. We hear complaints from

strong-minded ladies that in England women are not employed, as in France and elsewhere, as bookkeepers and clerks in countinghouses, and as attendants in shops; but, not to mention that in France the conscription of 600,000 able-bodied men imposes upon Frenchwomen much field labour and other drudgery from which Englishwomen are happily free, it has not been made clear whether the would-be bookkeepers understand bookkeeping, are quick at accounts, and can write a round, clerkly hand; nor whether the would-be shopwomen have generally their wits about them, can readily calculate quantities, and make out rapidly a correct and readable bill. The market for bookkeepers, clerks, and attendants in shops is perfectly open; and, as the labour of women, if equal in quality to the labour of men, is very much cheaper, we may be sure that, if the qualifications were equal, the fair sex would be preferred by many employers. We hear also of the poor needlewomen; and their sad "Stitch, stitch, stitch," for a pittance insufficient to keep body and soul together, is associated with many painful thoughts. But what think we of the miserably rude quality of their work, of their inability, through defective education, to do any work really remunerative? Again, we hear of the unfortunate condition of female servants, of the low wages for the maid of all work, and of aged servants dying in crowds in the workhouses of the wealthiest parishes in the metropolis; but we do not always hear of the ignorance, the awkwardness, the inability to do the plainest and most necessary needlework, the untruthfulness, the dishonesty, showing itself not only in picking and stealing, but in fraudulent collusions with tradesmen, which cause some of those women to lose their places, and to descend instead of ascending in the scale of service; nor of the cases in which, having left their places to marry or to enter into some business not understood, they have failed in that business, and lost all that they had saved in service. I am not saying that for such evils there are no remedies; but I believe that, so far as the evils are capable of remedy, the remedy is improved education, education religious and far more complete, and practical, and useful, than women of any class can now obtain.

The foundation of all improvements in the education of either sex must be laid where systematic instruction commences, in the Elementary Schools. They must be conducted on a more natural and healthy system. They must lose much of their present character of forcing houses, which are dangerous alike to the spiritual and moral life, to the future intelligence, and to the physical health. When there is less hasty cramming, there will be a better digestion and assimilation of mental food. Fewer things will be taught to little children, but more things will be really learnt by them; and their powers of learning, understanding, and reasoning, will turn out to be far stronger in later years. I am not for placing limits to what shall be learnt. There is good in learning almost anything, if it is really learnt so as to be understood and reasoned on; but there is no good, rather there is much harm, in trying to teach too much at once, more than can be really learnt, in cramming into the heads of either teachers or children crude heaps of indigestible matter, which are just as hurtful there as crude heaps of indigestible matter are hurtful when taken into stomachs. To realise the desired reforms, however, we must not stint the education of the industrial classes; we must spread it over a longer period; we should endeavour to induce the parents to keep their children somewhat later at school; and we must provide systematically and effectually for the continuance of their instruction afterwards, in evening schools for boys and girls up to sixteen, and in institutes for adults.

You will see (I hope) that throughout this Address I am endeavouring to bring into view the relations, the perfectly natural and mutually beneficial relations, which ought to be felt to subsist between the promoters of elementary schools for children and the promoters of institutions for adults. The school is a necessary antecedent to the institution; and the institution is a necessary complement to the school. Neither can flourish if the other fails. For the child we must have the school. For the adult, who naturally does not like to be mixed up with children in a school, we must have something different and apart from the school; we must have the institution. What sort of an institution should we have?

Dr. Birkbeck invented the Mechanics' Institute; a good invention, but not perhaps the best possible name for an institution the majority of whose members are seldom mechanics. On that type, with more or less variation from it, an immense numbers of institutions has been established under various titles, such as literary and scientific institutions, athenæums, lycæums, peoples' colleges, mutual instruction societies, Christian associations, recreation societies, and the like.

An institute ought, I think, to include all grades of society, and to have a very open and popular constitution. A portion, but only a portion, of the governing body should be annually changed. The business, especially the pecuniary business, must be transacted in the most business-like spirit, and with unfailing regularity. Clear records of all transactions must be kept. The accounts must be regularly and candidly stated, strictly examined by the auditors and committee, and published in a form which cannot fail to convey, even to those who have no other knowledge of the affairs of the institution, a complete view of its financial state. If these conditions of public confidence are not observed, disrepute and weaknes will inevitably ensue. Care must be taken by strict rules to prevent the institution from being troubled by theological or political controversies; but of course these rules must not be so framed as to exclude newspapers (which, if a man never reads, he is unfit for the duties, and therefore for the privileges, of citizenship) nor books treating of theology and politics. I do not think it well to be over squeamish about the characters of books—irreligious books and absolute trumpery I would of course exclude; but I have little faith in that kind of exclusive reading which some excellent persons desire to confine to what is called "improving" works, unless it be granted that all books of a manly character, free from impiety and filth, and taken in sufficient quantity, are entitled to be called "improving." There should be of course a comfortable reading room, and a circulating library from which books may be taken to be read at home. There must be lectures to instruct and amuse, and concerts to delight and soften. There ought to be open committees of social science to elicit and diffuse useful information concerning health, education, and other common points of political, social, and domestic economy; there ought to be a museum, not of miscellaneous objects, like a pawnbroker's shop, but a well arranged and carefully and fully labelled collection, illustrating the natural history, the trade, and the antiquities of the district. There ought also to be periodical exhibitions of objects of art and industry. Classes for the discussion of suitable subjects under the guidance of a competent moderator; readings of Shakspeare and other standard authors; innocent amusements, such as chess and draughts, fencing and single-stick for indoors; and for out-of-doors gardening, cricketing, leaping, swimming, boating, and other manly and invigorating games; tea parties of course and excursions occasionally; and (I should say) tea and coffee, and their edible accompaniments, every evening if it be possible to provide them. Care must of course be taken that the amusements may not inconvenience the readers. Above all, and as the foundation of all success, all real utility, there must be classes for systematic instruction under competent paid teachers.

You have found it very difficult, if not impossible, to establish and maintain such classes. The same difficulty has been experienced elsewhere. It has been a common complaint that the classes have not been attended by numbers sufficient to uphold them. Do we wonder at this failure on the part of the institutes to maintain the character of places of serious instruction? I rather wonder

that the failure has not been more complete. There have always been a few heroes—I honour them as truly heroic—who, with the advantages neither of regular teaching, nor of the emulation of their fellows, nor the encouragement of the learned and wise, perhaps, indeed, sometimes under the distrust of the good, "scorning delights," the mis-called delights, of sensual indulgence, have pursued the paths of self-instruction and self-improvement, taking opportunities and making opportunities for "self-help," profiting by lectures and libraries, and accomplishing results which have surprised us while they won our admiration; but man is not commonly cast in the heroic mould; and we have no right to expect from the poorer classes of society a heroism which we certainly do not generally find in the higher classes. If we really wish the people to be educated, we must provide for their education on principles applicable to ordinary humanity; their period of instruction must be prolonged far beyond the period of their possible attendance at the day school; and, in order that after their "fair day's work" they may be encouraged to devote a reasonable portion of their evenings to instruction, we must provide for them suitable places, with convenient appliances, where they may be well taught by competent teachers; and we must add such inducements as are freely held out to the higher classes, the inducements of honourable emulation, ambition, and the hope of advancement. In short, we must provide temptations analogous to the competitive examinations, honours, prizes, scholarships, and fellowships, which provoke the energies of youth in our public schools, grammar schools and universities; and we must make success in education accompanied by good character, an essential pre-requisite for admission to the public service, and a passport to preferment in all the ordinary walks of life.

The Society of Arts, which has endeavoured, by its Union of Institutes, to strengthen those bodies in the exercise of all their functions, has not overlooked their difficulties and wants in respect of classes; and, I rejoice to add, has taken measures which, in every place where they have been fairly tried, have given life and utility to the classes, and been crowned with signal success.

The Society has provided a system of annual examinations, certificates, and prizes, which I will now briefly explain.

The Society has appointed a Board of twenty-five paid Examiners, men of great experience, connected with universities, and not excelled, even if equalled, in reputation by any other Board of Examiners in the kingdom. To co-operate with this Board, "Local Boards" are appointed by the Institutions in Union with the Society, wherever this co-operation is desired. Annually, in April, each "Local Board" holds in its own locality a "Previous Examination" of all those persons, not under sixteen years of age, who desire to compete for the prizes, and to obtain the certificates of the Society's Central Board of Examiners. The "Previous Examinations" test the ability of the candidates to write, spell, and do simple sums, and ascertain that they have a reasonable knowledge of the subject or subjects in which they seek to be examined by the Central Board. This straining out, or sifting of the candidates having been completed, all those who have passed it successfully, that is, to the satisfaction of the Local Boards, are invited to attend on certain evenings in May, to undergo the Final Examinations. These are managed entirely by papers, prepared by the Society's Examiners, printed, and sent down to the Local Boards. Those Boards superintend the working of the papers, and are responsible for seeing that there is fair play, no copying from other candidates, no use of cribs, nor other tricks. The most careful precautions, and the utmost strictness, are observed to secure perfect fairness. When the answers to the printed examination questions have been written by the candidates, their papers are at once sealed up, and returned by the Local Boards to the Society of Arts; the Society's Examiners award the certificates and the prizes; and these are conveyed, through the Local Boards, to the successful candidates. The certificates are of three grades. There is a prize of £5 and £3 for each of the twenty-five subjects. You will see that, while the members and pupils of the Institutes in all parts of the United Kingdom have thus an opportunity of engaging in an honourable competition for what I may call degrees, with persons of their own class in life, before an impartial and dignified body of literary and scientific examiners, none is required to leave the neighbourhood of his home, and the scene of his daily occupation. He has not to seek his university; it comes as it were to his own doors. The examinations are so far competitive that each candidate is credited by the examiners with the number of marks that his answering entitles him to. A hundred marks is the maximum number that can be assigned to a paper; seventy-five marks entitle the candidate to a certificate of the first-class; fifty marks entitle him to one of the second class; thirty-five marks to one of the third class; and anything below thirty-five entitles him to be "plucked." The prizes for every subject are awarded to those who obtain the best, and the second-best number of marks in the first class; but we exclude from the competition for the prizes (though not for the certificates) all graduates and undergraduates of the Universities, all certificated teachers and pupil-teachers, and members of the learned professions. To each Institution whose candidate obtains a prize of £5, a prize of the same amount is given, if the candidate has been instructed at the Institution in the subject for which he gets his prize. The examinations are open to women exactly on the same terms as to men.

The examinations were first held in 1856, at the house of the Society of Arts, Adelphi, London. In 1857, they were held there and at Huddersfield. In 1858, at thirty-nine places in England and Wales. In 1859, at fifty-four places in England, Wales, Scotland, and Ireland; and in this year they have just been held in the sixty-three places following:—Aberdeen, Ashbourne, Ashford, Barnet, Belfast, Berkhampsted, Birmingham (two Boards), Blackburn, Blandford, Bradford, Bristol, Bury, Canterbury, Carlisle, Carshalton, Chelmsford, Darlington, Devonport, Glasgow (three Boards), Halifax, Haley-hill, Hertford, Hartlepool, Hitchin, Holmsforth, Hamworth, Leeds (two Boards), Leicester, Liverpool, Lockwood, London (five Boards), Louth, Lynn (King's), Macclesfield, Manchester, Middlesborough, Newbury, Newcastle-on-Tyne, Oldham, Pembroke Dock, Portsmouth, Richmond, Rotherham, Selby, Sheerness, Stourbridge, Shipton, Wakefield, West Bromwich, Waterford, Wigan, Wirksworth, Wolverhampton, and York.

They will be held next year, and subsequently, in every place in the United Kingdom where the proper arrangements can be made by the managers of the Institutions, and by the other friends of education. Those arrangements are simple and easily made; and wherever they have been made, they have succeeded; life has been given to the Institutes, and especially to their classes. Classes now flourish in many a place where formerly they could not exist. Friends of education, who had previously held aloof from the Institutions in their neighbourhood, have joyfully joined them, seeing that they were really useful. Humble hardworking students have been encouraged and rewarded. Conceit has now and then been abated. A spirit of honourable emulation has been excited and fostered. The certificates have proved passports to many appointments; and young men destined to be sent half educated into business, at an early age, have so proved themselves, through the examinations, to be the possessors of superior talents, that their parents have been encouraged to send them to a university to complete their education.

The certificates have been taken by persons in widely different stations of life, *e.g.*, merchants and tradesmen of all kinds and their sons; clerks in great number; book-keepers; shopmen and artisans of all kinds; farmers; teachers, male and female, including governesses for the

higher classes; architects; engineers; mechanics in abundance; labourers not a few; and lads various. In 1858, the first prize in Latin was taken by a butcher at Sheffield, a member of the People's College there; three first prizes in arithmetic, algebra, and mensuration, were taken by a working engineer, aged eighteen, in the dockward at Portsmouth, a member of the Watt Institute at Portsea; two first prizes in chemistry and botany, by a worker in a chemical laboratory, a member of the Evening Classes at Crosby Hall, in London; two first prizes in descriptive and physical geography, by a draper, member of the Mechanics' Institute at Banbury; a first prize in English history, by a book-keeper, member of the Mechanics' Institution at Leeds; and a first prize in English literature, by a bank cashier, member of the People's College at Sheffield. In the same year, a carter on the Prince Consort's farm, by obtaining a certificate, saved all Windsor from complete failure in the examinations. The appendices to the programmes of the examinations for 1860 and 1861, contain calendars of the names, ages, institutions, callings, and subjects of examination, of all who obtained prizes or certificates in those years.

In addition to the certificates and prizes, the Council of the Society of Arts has been enabled, by the wise liberality of the late Mr. John Wood, of Earl Granville, Viscount Palmerston, and the Earl of Derby, to give annually to some of the most successful candidates nominations to compete for appointments in the public service. Every one thus nominated by the Council has succeeded in obtaining the appointment for which he competed. On this topic I have only time to say, that in my opinion appointments to the public service, on the ground of patronage, ought to give place absolutely to appointments on the ground of superior fitness, proved by competitive examinations and inquiries into character; that the system of patronage is not only unjust to the service, and to those who are excluded from it by their want of influence with the fortuitous possessors of office, but also has a tendency to corrupt both members of Parliament and their constituents. My experience of the public service extends over more than thirty-two years, spent in the Privy Council Office, and having seen in action both the principles of patronage and of competitive examination, I entirely prefer the latter.

In determining the mode in which a service shall be recruited, the good of that service must be the paramount object; and, if the mode of recruiting by competitive examination were not the best possible for the Civil Service itself, it would be wrong to adopt that mode on the grounds of any benefits that it might confer elsewhere, *e.g.*, on the constitutional institutions of the country. But, believing this mode of recruiting to be the best possible for the Civil Service itself, I rejoice to see in it also a great boon and encouragement to education. We are too much in the habit of making the possession of property the type of a man's fitness in the eye of the law to exercise valuable privileges; and I anticipate excellent effects from the public recognition of education as a test of qualifications for office.

I revert now for a moment to the subject of Amusements, because I am convinced that its great importance demands far more attention than it commonly receives. The want of a sufficient supply of amusement is a natural want, and wherever it fails to be supplied, nature resents the failure. A people without innocent amusements must be dull and degraded in mind and body, and is frequently morose and brutal. If the means of healthy, innocent amusement are not provided, unhealthy, injurious amusements will be taken, not because they are preferred, but because they are easily accessible. In such a state of society as ours, I know not how a sufficient supply of well-regulated, healthy amusements is to be had by the people, if there be not some organised body in each neighbourhood charged with the duty of providing it, and of bringing it within the reach of the poor. The proper body for such a purpose seems to me to be a body connected with education, for I regard the amusement of a people as an essential part of their education, and I strongly recommend the Committees of the Institutions, and also the Local Boards, to assume the functions of purveyors of healthy games and of exercises of strength and skill for the industrial classes of all ages in their several localities.

I have suggested the establishment of classes for discussion under the guidance of a competent moderator; and as considerable doubts have recently been expressed as to the tendency of such classes, whether it is useful or hurtful, I will point out certain conditions which, I think, ought to be observed where classes of this kind are established.

The chairman, or moderator, of your discussion class should be a well-educated man, not very young, courteous, prompt, just, and decisive. At least two members of the class should concur to propose a subject for discussion. The governing body of the institution shall determine whether the subject is suitable. The member who opens the discussion, but no other member, shall have the privilege of reading a written speech if he pleases. The length of the speeches should not exceed a certain fixed limit, say a quarter of an hour each.

I lay the greatest possible stress upon the necessity of your preparing yourselves for your debates. Speaking makes a ready man, as writing makes a correct man; but, before a man can speak well, reading must have made him a full man, and thinking must have made him a clear man. Without patient preparation scarcely one man in ten thousand can make a really useful speech upon any subject. The famous orations of our great orators, men of extraordinary natural gifts, high education, and constant practice, have been labouriously and painfully prepared. It is but a poor ambition which would take credit for being able to speak off-hand; and there is, perhaps, no one of plain sense and good feeling who might not be able, with due care and diligence, to prepare things worthy to be said upon any ordinary topic.

To talk over what we have read fixes it in our memory, and renders it doubly interesting, because much better understood. Here, then, is an opportunity for a systematic reading of that which is to be systematically talked of, not only with one but with many. The observations of many, much differing in mind and feeling, will be brought to bear upon the same subject—crude opinions may be mellowed by more ripened judgments; mistaken and confused views may be rendered clear and correct, when seen by other eyes and from other points; the knowledge of one may be pleasantly communicated to many; all may derive advantage from the practice of courtesy, deference, obedience to rules, brotherly kindness.

After all it is obvious that results really profitable will be obtained from the class in proportion to the self-denial of its members. If the vanity of speech-making should beset you; if you should prefer to spout fine nonsense (which is an easy accomplishment) rather than to speak good, plain, homely sense, which is less easy; if your subjects of discussion should be chosen for their opportunity of display, instead of for their real value; if you should strive for victory, rather than for truth and knowledge; condescending to use weapons of sarcasm and ridicule; speaking for the sake of speaking, and not because you have painfully prepared something to be said: if you should be over confident of your own views, and intolerent of the views of others; puffed up with the applause of hearers when successful, and out of temper when unsuccessful; if, in fine, you should decide your questions on the low grounds of party feeling or mere worldly judgment, then indeed the sooner your discussion class be abandoned the better it will be for you and for your institution; but, if on the other hand, you steadfestly resist the temptations of vanity, which will urge many of you to desire to shine as orators and debaters; if you aim at being useful rather than fine; if you select your subjects with careful reference to their real value and not to their opportunities of display; if you abstain, as from breaches of faith and charity, from all attempts to annoy or ridicule your opponents in dis-

cussion; if you seek to establish truth for truth's sake, and not for the sake of victory; if you carefully prepare yourselves for your debates by reading, conversing, and thinking; if you express yourselves modestly, though plainly and firmly, for if modest you can scarcely be too plain and firm in stating your sentiments, paying respect to the opinions of others, how much soever they may be opposed to your own; if you do not suffer yourselves to be elated by victory or chafed by opposition and defeat; if, in fine, you try all moral questions by the standard of Divine Truth, that is by the written Laws of God; then, doubtless, you will derive benefit from your discussion class, and it will be creditable and useful to your institution.

I will now make a few observations upon the choice of subjects for discussion. It might advantageously afford to to your members opportunities of preparation if you were to choose, as far as possible, those subjects on which lectures are from time to time given in your theatre, and those which are treated of in the volumes to be found in your library. By the rules of the institution you are debarred from all subjects of controversial Theology, and I hope that you are also forbidden to discuss any religious subject. There can be no doubt of the propriety of such restrictions. The things of God are too solemn, too awful, too dear to our souls, to be here debated and put to the vote. In your lecture-theatre, as everywhere else, think, speak, and act as becomes men who are indeed religious; but do not here discuss and debate your religion.

From party politics, the politics of modern, existing parties, the rules of the Institution restrict you; and this again is a needful restriction. History, and particularly the history of our native land, and the more important of its colonies, will furnish some of the most useful and interesting subjects that you can select for discussion. I would here remark, that in considering history, you should bear in mind that, as far as it is true, it is a record of the ordinary dealings of God with man, Man proposing, God disposing, Man doing good under the influence of grace, or evil under evil influence; God permitting but overruling evil and bringing forth good from all things. Judge no event by its results; judge all things and all men by principles founded in the Divine Law. Biography is a most full and fertile field of interest, which may be cultivated with great advantage. Here, however, I would particularly warn you to be careful of unjust conclusions. Never be led away from an honest Christian judgment by the splendour of great circumstances, great events, or even great services. On the other hand, though acts should always be tried by principles, in considering the moral characters of persons, you should view them in the light of their own times, and not judge them by our own more abundant light. Political economy, if you can treat it apart from the party politics of the day, and if you do not select the more abstruse and difficult subjects, will afford very useful and interesting topics. Emigration would form an important and practical subject. No topics can be more interesting and important, more worthy of being discussed by sensible and benevolent men, than those great social and economic questions which concern the health and happiness, not only the bodily, but the moral and spiritual health and happiness, (for while life remains, you can in nothing separate the bodies from the souls,) of the great masses of our fellow men. I would never lose an opportunity of recommending, particularly to young persons, the study of Natural History. It interests the mind most keenly, without unduly exciting it. It is a study which may be pursued by every one, and in all places; wherever there is earth, air, or water, there are the objects of the naturalist. It has been remarked that, as we are seldom permitted long to retain our great joys and happinesses in this world, we should do well to prepare a solace for their loss, by cultivating an undergrowth of pleasures to supply their place.

"Nature never did betray
The heart that loved her; 'tis her privilege,
Through all the years of this our life, to lead
From joy to joy; for she can so inform
The mind that is within us, so impress
With quietness and beauty; and so feed
With lofty thoughts that neither evil tongues,
Rash judgments, nor the sneers of selfish men,
Shall ever prevail against us, or disturb
Our cheerful faith that all which we behold
Is full of blessings." WORDSWORTH.

I would strongly recommend you to devote a few evenings to the botany, geology, entomology, ornithology, &c., of your own neighbourhood.

All the suggestions, however, that I can offer to you must be summed up in the suggestion that, if you have not already formed, you should at once form, a "Local Board" for examinations in connection with the Society of Arts. I will tell you briefly how you might form the board, and what it might do. Each institution for the instruction of adults, and each of the public schools, in this neighbourhood, might name two or three representatives to be members of the "Local Board. The official representatives of the place, the mayor and the members of Parliament, and a few other influential friends of education, might be invited to complete the number. Thus constituted, the Local Board should represent all the educational interests of the neighbourhood, and would be regarded as of authority in education. A chairman and a secretary must be appointed.

This Board might annually administer a prize scheme, as it is called, for children between thirteen and sixteen years of age. A small subscription would have to be collected to provide the prizes. Notice would be given by the Board that on a certain day an examination, and competition for certificates and prizes, would be open to all children, of those ages, living or receiving instruction within the district. You will see that the operation of the "prize scheme" would be twofold. In the first place it operates, wherever it has been tried, as an inducement to parents to retain their children somewhat later at school; and secondly it encourages the children to continue their study after leaving school. I may add that, if to those children, say turned fifteen years of age, who obtained certificates of the first class from your proposed local board, you were to grant for (say) two or three years the privileges of an honorary associate of the nearest institution, every such privilege would be useful and honourable to the child, and would not only reflect honour on the institution itself, but obtain for it in all probability a future paying member. The subjects of examination, and the mode of conducting it should be simple, and suitable to poor children who have been educated at a good national or British school. If the children are examined as to their knowledge of the Bible, that part of the examination ought not to be compulsory on those whose parents object to it; and controversial questions must of course be avoided. I should recommend you so to frame your scheme as to counteract some of the evil tendencies to superficial and unsuitable acquirement which at present too commonly prevail. In the case of girls, thoroughly good, plain needle-work, darning, cutting out and making up of clothes, a knowledge of cookery and housework, and other necessary attainments of a useful woman, should be insisted on; and in the case of both boys and girls it might be well to devote some encouragement to drill, and to exercises of activity and manual skill.

At the age of sixteen the young persons become admissible to the examinations of the Society of Arts; and, in connection with them, the functions of the Local Board will be such as I have already explained. The Local Board has to conduct the previous examinations, and to supervise the working of the papers of questions in the final examinations. Very full details of the measures necessary for the management of the examination are given in the programmes annually issued by the Council of the Society of Arts.

The Programme for 1861 may be had on application to the Secretary, Society of Arts, John-street, Adelphi, London. S.W.

A "local board," so constituted as to include represen-

tatives of all your institutions for the elementary education of children, and for the instruction and recreation of adults, could scarcely fail to posess the confidence of all classes of society in the neighbourhood. While it would interfere with the internal government of none of your schools and institutions, it would offer encouragement to all of them, as well as to all private tuition and to all self-instruction; not prescribing the processes of education; but testing, attesting, and rewarding the results of instruction; opening avenues of promotion without favour; increasing the general appreciation of education among the parents and employers of the scholars, and among the scholars themselves and their teachers; and creating a bond of union between the promoters of schools for children and the promoters of institutions for adults. It might also act with advantage as a committee of co-operation with the Universities of Oxford and Cambridge, in respect of their "middle-class examinations."

It will be said, doubtless, by some persons, that there will be difficulties in carrying out these plans. Of course there will be difficulties; but, if you turn to a good dictionary in the library of your institution, you will find that the best meaning of the word "difficulty" is *an obstacle to overcome.* The slothful man saith, "There is a lion without; I shall be slain in the streets;" The wise man says, "There is a lion in the streets; I will go forth and slay him." Sixty-three local boards, in the places that I have enumerated, have slain their lions—overcome their difficulties. Why should you be less successful here? When advantages, such as I have described, are offered to all parts of the United Kingdom, and accepted in many parts, those that decline are thenceforth at a disadvantage. There must be many persons here who would gladly avail themselves of the examinations, if they came recommended to them not only by the Metropolitan "Society of Arts, Manufactures, and Commerce," but by persons of station and influence, known by name in the neighbourhood. None need fear to be examined. There is nothing terrible nor puzzling in the ordeal. Your examinations will be conducted quietly, in a room with which you are probably familiar, by a few individuals called "examiners" who are your own neighbours, desirous that you should succeed, and determined that you shall have fair play. You will not be hurried. Full time will be given to you to answer the questions that will be prepared by the central authority in London. A large range of knowledge will not be required of you. A few accurate and sensible answers will gain a higher number of marks than ever so many showy but superficial and indifferent attempts. The "little-go" of the "previous examination" will prepare you for the further trial; and, having once been examined, you will no longer feel nervous under examination.

Be not afraid of the hard names which are given to some of the subjects of examination. They represent matters of common sense, great practical value, and perfect simplicity when understood.

Be not afraid of failure at first. Try; do your best; and resolve not to fail at last; you will then certainly succeed. But believe me that, though success in such an examination is a great object, you may derive inestimable benefit even from failure, if you take your future like a man; not casting the blame on others, but imputing it to your own deficiencies; and resolved, with God's blessing, so to preserve, that ultimately you may obtain success.

In conclusion, allow me to remind you, and to beg you to bear constantly in mind, that the true object of National Education is not merely that particular religious bodies should be recruited, nor even that the spiritual part of man's being should be developed and rightly directed. This development and right direction of what is spiritual can never be wanting in any scheme of education that professes to be complete. But the complete scheme includes something in addition. We must endeavour to develope to the greatest possible extent, and to direct to the best possible aims, not only the spiritual, but also the intellectual and physical capacities of all the individuals who compose the nation. The health, strength, activity, intelligence, skill, and morality of a people, as well as their religion, are dependant neither upon chance nor upon what we call nature. The natural qualities of a race of men depend upon the circumstances by which they are surrounded and affected; and, in so far as we can improve the circumstances, we can also improve the race. I do not advocate an excessive meddling by law with the habits of the people, nor do I wish to see their education permanently under the direct control of the Political Government. Believing that the establishment of the Committee of Council on Education in 1839 was necessary to cope with the "diseases" of Ignorance "desperate grown," with which the people at that time were afflicted, and that the results accomplished by the Committee have amply justified its establishment, I not the less lament the growth of the habit which prevails of urging the Government to interfere further and further in the buisness of Public Education; and I desire to see the growth of an opposite habit of self-reliance, and of local rather than Imperial action, in the development and direction of the national capacities.

I have endeavoured to shadow forth some forms of local combination and local authority in Public Education; they who are conversant with this subject will readily understand that the system of examinations instituted by the Society of Arts, which I have explained and endeavoured to recommend, needs only the cordial co-operation of the friends of education, in a slightly increased degree, to exhibit its great importance, and to make its effects felt, throughout all the schools for the education of children, all the institutions for the instruction of adults, and all departments of the national industry. This system, if it be allowed to grow up naturally, without undue forcing, without insisting upon particular modes and patterns which experience may not justify, may become equivalent to an university for the industrial classes; and I do not in the least doubt that the day will arrive when they will have not merely their "society," but their "university," of "arts, manufactures, and commerce."

EXAMINATION PAPERS, 1860.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

ARITHMETIC.

THREE HOURS ALLOWED.

(1.) A gold snuff box weighed 7 oz. 15 dwts. 15 grs. Find its value at £4 5s. 6d. per oz.

(2.) "If every ducat in six thousand ducats were in six parts, and every part a ducat, I would not draw them, I would have my bond." Calculate the value refused by Shylock at 4s. $2\frac{1}{4}$d. per ducat.

(3.) A regiment of soldiers, consisting of 976 men, is to be clothed, each coat to contain $2\frac{1}{2}$ yards of cloth, $1\frac{5}{8}$ yards wide, and to be lined with shalloon $\frac{7}{8}$ of a yard wide. How many yards of shalloon will be required?

(4.) Of a vessel worth £5,600, A, who has $\frac{17}{24}$, sells $\frac{3}{4}$ of his share to B, who sells $\frac{4}{5}$ of his to C. Find the value of C.'s share.

(5.) If $\frac{1}{5}$ of a sheep be worth £$\frac{3}{4}$, and $\frac{3}{7}$ of a sheep be worth $\frac{1}{12}$ of an ox, what sum must be given for 50 oxen?

(6.) Two clocks point to 2 o'clock at the same instant; one loses 7 seconds, the other gains 8 seconds, in 24 hours; when will one be half an hour before the other, and what time will each clock then show?

(7.) A wall was to be built 700 yards long in 29 days; after 12 men had been employed on it for 11 days it was found they had built only 220 yards. How many additional men must be employed to finish it in the given time?

(8.) A person wishes to dispose of his horse by lottery. If he sell the tickets at £2 each he will lose £30 by the transaction; but if he sell them at £3 each he will receive £30 more than his horse cost him. What was the number of tickets and what did the horse cost him?

(9.) A cistern has three pipes, A, B, and C.; A. and B. can fill it in 3 and 4 hours respectively, and C. can empty it in 1 hour. If these pipes be opened in order, at 1, 2, and 3 o'clock, find when the cistern will be empty.

(10.) If A. can mow an acre of grass in $5\frac{2}{3}$ hours, and B. can mow $1\frac{1}{3}$ acres in $8\frac{1}{2}$ hours, in what time can they jointly mow $8\frac{3}{4}$ acres?

(11.) Property which brings 7 per cent. lets for £85 15s. What was the purchase money?

(12.) A person rents a piece of land for £120 a year. He lays out £625 in buying 50 oxen. At the end of the year he sells them, having expended £12 10s. in labour. How much per head must he gain by them in order to realise his rent and expenses and 10 per cent. on his original outlay?

(13.) What will a banker gain by discounting a bill of £632 12s. 6d., drawn September 1st at 9 months, and discounted January 15th, at 5 per cent?

(14.) Find the amount of £670 for 3 years at 6 per cent., supposing the interest to become due half-yearly.

(15.) Convert £540 17s. 6d. into decimal currency, £1 being the unit, and then find the simple interest of it for $3\frac{1}{2}$ years at 4 per cent., expressing the answer both in the present and in decimal currency.

(16.) By decimal currency. Sold goods for £225 10s. with a gain of $12\frac{3}{4}$ per cent. What would have been gained or lost per cent. by selling them for £187 10s.?

(17.) A lb. of tea and 3lbs. of sugar cost together 6s., but if sugar were to rise 50 per cent. and tea 10 per cent. the same quantities would together cost 7s. What is the price of each?

(18.) A clock has its face marked so as to show 24 hours in a day; and on a certain evening, half an hour after sunset, it was set at 24 o'clock. The following morning it was 8 minutes past 4 by a common clock when it was 4 minutes past 8 by this clock. Find the time of sunset the previous evening.

(19.) If brandy be bought at 25s. per gallon, at what price must it be sold to clear as much on £100 as five gallons are sold for?

(20.) In what time can 8 men perform a work which 7 boys do in 12 hours, if 10 men and 2 boys can do as much per hour as 7 men and 10 boys?

(21.) A merchant engages a clerk at the rate of £20 for the first year, £25 for the second year, £30 for the third year, and increasing the salary each successive year by £5. In what time will the clerk have received as much salary on the whole as if his yearly salary had been £52 10s.

(22.) A person sells out of the $3\frac{1}{2}$ per cents. at $93\frac{1}{2}$ as much stock as produces £9,350. At what price must the 4 per cents. be so that the above sum, when invested in them, shall produce an increase of £10 income?

BOOK-KEEPING BY DOUBLE ENTRY.

THREE HOURS ALLOWED.

N.B.—Candidates who reply to No. 10 need not reply to No. 6, but SATISFACTORY ANSWERING in No. 10 will be deemed an *indispensable* condition to a high degree of excellence.

1. What advantages does the double entry method of book-keeping possess over that of single entry?

2. Does it provide security against, or means of detection of, error of every description incidental to book-keeping?

NOTE.—Assign reasons for the answer given to this question.

3. What is the special use of the Journal in Double entry?

4. Can the principle of double entry be carried into practice without the use of the Journal?

5. What is the use of the Ledger? And, adopting the usual division of the accounts it contains into Real, Personal, and Nominal states, what is the nature of the fact represented by a balance at the *debit* of a real account, of a personal account, and of a nominal account respectively.

6. Write out, in due technical form and language, the proper Journal and Ledger entries of the following transactions:—

Purchased from Irving and Co., of New York, 500 barrels of flour @ 36s.		£900
Received of Irving and Co., their acceptances in payment of such purchase, viz.:—		
At 3 months date	350	
At 4 „ „	550	
		900
Sold to Wordsworth and Co., 200 quarters of wheat, @ 70s.		700
Received from Wordsworth and Co.		
Cash	300	
Their acceptance at 2 months	400	
		700
Purchased of Schiller and Co., of Dantzic, 300 quarters of wheat @ 42s....		630
and paid them on account in cash £100, and Irving and Co.'s acceptance at 3 months date, £350.		

7. What is a trial balance, and what is its use?

8. What should a Profit and Loss account exhibit?

9. What should a balance sheet exhibit?

(10.) Journalize, in proper technical form and language, the following supposititious facts and transactions, post the same into a ledger, and draw out a trial balance thereof, and also a balance sheet accompanied by a profit and loss account.

On the 1st January, 1860, George Wood, corn merchant, ascertained the state of his affairs to be as follows:—

His assets consisted of,

Balance at the Bank of England	£300
Cash in the house	100
W. Smith's acceptance due 23 Jan., £200	
J. Francis, „ „ 1 April, 100—	300
Balance due to him by A. Tod.....	500
Stock of Wheat	1,500
Stock of Flour.	500
On the other hand he owed to R. Smith for cash lent at 5 per cent. interest.....	700
T. Jones for Wheat	500
Acceptance payable at the Bank of England, due 14 January.....	400
Ditto ditto 10 April	200

Jan. 10. Purchased of W. Thompson 500 quarters barley, at 40s.	£1,000	0	0
„ Accepted W. Thompson's draft in payment of barley, at three months' date, for	1,000	0	0
„ 12. Sold to J. Howard, 200 quarters of wheat, at 64s.	640	0	0
„ 13. Received cash from a A. Tod on account of debt due by him.....	250	0	0
„ Purchased of T. Mills 300 sacks of flour, at 50s.	750	0	0
„ Paid cash into Bank of England...	300	0	0
„ 14. Paid by the Bank of England my acceptance due this day	400	0	0
„ 15. Purchased of H. Bacon, on joint account with J. Thomas, 250 barrels of American flour at 40s.	500	0	0
„ 19. Received cash of J. Howard and paid into Bank of England	624	0	0
„ Allowed discount to J. Howard $2\frac{1}{2}$ per cent. on £640.....	16	0	0

,, 22.	Received cash of J. Thomas his moiety of cost of American flour	250	0	0
,,	Paid cash into Bank of England	250	0	0
,, 23.	Sold to H. Bacon 300 quarters of barley, at 42s. 6d.	637	10	0
,,	Paid cash for wharf rent and charges on barley	17	6	8
,,	Discounted with Bank of England W. Smith's acceptance for £200, net proceeds of bill ...197 13 4 Discount charged ... 2 6 8	200	0	0
Jan. 24.	Sold to H. Nilus 150 quarters of barley, at 50s.	375	0	0
,,	Sold to H. Bradley 250 barrels American flour, on joint account with J. Thomas, at 45s.	562	10	0
,,	Received cash from H. Bacon, balance due from him	137	10	0
,, 25.	Sold to John Baker 400 sacks of flour at 48s.	960	0	0
,,	Received cash of John Baker on account of same	700	0	0
,, 26.	Paid Cash into Bank of England	720	0	0
,,	Paid to T. Mills by cheque on Bank of England	740	12	6
,,	Discouut allowed by T. Mills 1¼ per cent. on £750	9	7	6
,,	Cash taken for private expenditure	50	0	0
,,	Paid cash for charge on flour bought on joint account with J. Thomas	6	15	0
,, 31.	Cash paid to R. Hobbs for one month's salary as clerk	12	10	0
,,	One month's interest on capital account to date	5	10	0
	Stock on hand 31 January 300 quarters of wheat @ 60s.	900		
	100 sacks flour, @ 50s.	250		
	50 quarters barley @ 40s.	100		
	Amount due 31 January to James Story, for 1 month's warehouse rent	5	10	0
	To R. Brown for stationery supplied	6	5	0

ALGEBRA.

THREE HOURS ALLOWED.

Notice.—The Candidates are recommended not to attempt to answer the questions in section B, until they have answered as many as they can in section A.

(A.)

1. Add together the following quantities :—

$$\begin{array}{l} a - 2b + 3c - 4d \\ b - 2c + 3d - 4a \\ c - 2d + 3a - 4b \\ d - 2a + 3b - 4c \end{array}$$

2. Mention and explain the rule for the subtraction of algebraical quantities.

Subtract $x^2 - 3xy + 4y^2$ from $2x^2 + xy - y^2$

3. Multiply together, $a + b$, $a - b$, $a^2 - ab + b^2$, and $a^2 + ab + b^2$.

4. Reduce the following fractions to their simplest forms :—

$$\frac{x^3 - x^2y - xy_2 + y^3,}{x^3 + x^2y + xy^2 + y^3}$$

$$\frac{x^2 + xy - 2y^2}{x^4 - y^4}$$

5. Define the least common multiple of two algebraical quantities; and find the least common multiple of $a^2 + 2ab + b^2$ and $a^2 - b^2$.

6. Solve the following equations :—

$$2(x - 3) + 4(x - 5) = 5x + 4$$

$$\frac{x - 1}{x - 3} + \frac{x}{x - 2} = 5$$

$$\left.\begin{array}{r} 3x^2 + 2xy - 6y^2 = 15 \\ x^2 - y^2 = 5 \end{array}\right\}$$

7. Find the number which is to 100 in the duplicate ratio of 4 to 5.

8. Three persons, A, B, and C, divide the sum of £100 amongst them. B is to receive twice as much as A, and C is to receive £20 less than A and B together; find the share of each.

9. There is a number of three digits; the third is twice as great as the second, the second greater by unity than the first, and if the number be increased by 20, it becomes equal to the square of the number represented by the first two digits. Find the number.

(B).

10. What is meant by a negative quantity? Explain the rule expressed by the formula $-a \times -b = +ab$.

11. Define a *root* of an equation; and shew that if a and b be the roots of the equation, $x^2 - px + q = 0$ then $a + b = p$, and $ab = q$.

12. If $y \propto x + y$, then $y^2 \propto x^2 + y^2$. Explain the following phrase:—If a stone be let fall, the space through which it will fall in any time *varies as the square of the time*. If the stone fall 16 feet in the first second, how far far will it have fallen at the end of one minute?

13. Given:—

$$x - ay + a^2z - a^3 = 0$$
$$x - by + b^2z - b^3 = 0$$
$$x - cy + c^2z - c^3 = 0$$

find x, y, and z.

14. The difference of the cube roots of two quantities is a, and the cube root of their difference is b. Find the quantities.

Proceedings of Institutions.

Leeds (Yorkshire Union).—A prize of £10, offered by the Very Rev. Dr. Hook, Dean of Chichester, for the best essay on the present state of the education of the working classes in Leeds, and the best means of improving it, has just been awarded to the essay inscribed "More Light, More Light." The author is Mr. James Hole, the honorary secretary of the Yorkshire Union of Mechanics Institutes, and vice-president of the Leeds Mechanics' Institution.

Liverpool Institute.—A circular has recently been issued by the directors of this Institute, to the public schools of Liverpool, which are under Government inspection (amounting in number to about 50), to the effect that the directors, feeling it a duty to do all in their power to promote the spread of education, especially among the poor, are anxious to connect themselves more closely with the public schools in the town, so as, if possible, to afford to deserving youths increased incentives and facilities for carrying on their studies through the period corresponding with that of apprenticeship. They have therefore resolved:—"That where the managing committees of the schools of Liverpool which are under Government inspection are willing to institute and conduct, for the purpose which hereinafter appears, annual competitive examinations of the boys about to leave school, the directors will grant to the best boy in each school a free ticket of admission, for twelve months, to those classes at the Institute which form the second section of the evening school; or to such of them as may be judged best suited to his capacity and attainments." This second or higher section of the school comprises third, fourth, and fifth years' courses of instruction in English grammar and composition, history, geography, writing, arithmetic, and grammar. The fees are £1 6s. per annum. Yearly examinations are held,

when the first and second pupils of each year receive free admissions to the classes of the following year. The prizes of the fifth year's class consist of five exhibitions to the evening Matriculation Classes of the Queen's College, in which department a scholarship has been established, to assist the successful competitors to obtain the degree of Bachelor of Arts of the University of London. The prize pupils from the public schools are to be admitted to the competitions of their respective classes, equally with the other pupils of the Institute. The directors state that they do not seek to take any part in the examinations for the selection of the prize scholars; they require only that such examinations shall be held as are mentioned in the resolution, and that the best boy in each school shall be certified as such by its chairman, and secretary or master. The directors trust that this measure will have the effect of in some degree prolonging the attendance of the children in the schools which adopt it.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 28th June, 1860.

341. Parliamentary Cities and Boroughs—Return.
393. Parliamentary Boroughs—Abstract of Returns.
399. Enniskillen Postal Arrangements—Return.
401. East India (India Mutiny Compensation)—Return.
404. Excise Duties—Return.
208. Bills—Local Government Act (1858) Amendment.
210. „ Colewort Barracks (Portsmouth).
211. „ Militia.

Delivered on 29th June, 1860.

383 (A1). Poor Rates and Pauperism—Return (A).
390. Poor Law (Ireland)—Return.
405. Assessed Taxes and Customs—Return.
405. Sugar and Molasses—Return.
409. Malt Duty—Return.
410. Naval Forces (Chinese War)—Return.
212. Bill—Smithfield Markets, Streets, and Improvements (as amended by the Select Committee).

Delivered on June 30th and July 2nd, 1860.

169. East India (European Troops)—Papers.
407. Packets and Telegraphic Contracts—2nd Report from Committee.
412. South Harbour and Docks Bill—Minutes of Evidence.
414. Tax Bills—Report from Committee.
148 (a). Bills—Offences against the Person.
149 (a). „ Malicious Injury to Property.
150 (a). „ Coinage Offences.
151 (a). „ Accessories and Abettors.
152 (a). „ Forgery.
153 (a). „ Larceny, &c.
214. „ Sale of Gas Act Amendment (No. 3).
218. „ Game Certificates, &c.
219. „ Dominica Hurricane Loan.
220. „ Postage (Army and Navy).
222. „ Court of Queen's Bench Act Amendment.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 6th, 1860.*]

1541. H. Creaser, York—Imp. in reaping and mowing machines.
1543. W. Routledge, Salford—Imp. in self acting feed apparatus for steam boilers.
1545. E. T. Truman, Old Burlington-street, Middlesex—Imp. in horse shoes.
1547. W. Reade, Hibernia-chambers, Southwark—Imp. in apparatus for carbonizing or partially charring the skins of pigs previous to curing.

Dated 26th June, 1860.

1549. M. Cartwright, 7, Crescent, Carlisle—Imp. in the manufacture of mouth-pieces, for dental and other purposes.
1551. J. Shaw and J. T. Pope, Burslem, Staffordshire—Imp. in the articles technically known as "flys" or "flyers," used in the process of spinning and preparing woollen, worsted, cotton, and other fibrous materials.
1553. H. Cartwright, The Dean, Broseley, Shropshire—Imp. in means or apparatus in connexion with steam engines, to facilitate the working of the same expansively.
1555. G. T. Peppé, Sydenham, Kent—Imp. in apparatus for keeping time, for weighing letters and other matters, and for levelling.

[*From Gazette, July 13th, 1860.*]

Dated 29th March, 1860.

807. G. Haseltine and J. Knight, 4, Symond's inn, Chancery-lane—Imp. in spring bed-bottoms. (Partly a com.)

Dated 30th March, 1860.

824. J. Davies and G. Paine, Truro, Cornwall—Imp. in the manufacture of gunpowder.

Dated 24th April, 1860.

1016. J. Holder, Scabes Castle, Brighton—Imp. in apparatus for consuming all noxious exhalations from drying ovens used for chemical and chemical manure works, and arising from such works, and from mixing decayed substances in strong acids.

Dated 11th May, 1860.

1162. G. Holcroft, Manchester—Certain imp. in the manufacture of iron.

Dated 12th May, 1860.

1180. A. Pullan, Fortie-cottage, New Cross, T. Cresswell, Ravensbourne-terrace, Lewisham, and R. Longstaff, Mornington-road, New Cross, Kent—Imp. in steam generators, and in the means of and apparatus for superheating steam and in heating the feed water.

Dated 4th June, 1860.

1366. J. B. Pascal, 29, Boulevart St. Martin, Paris—Imp. in obtaining motive power, and in apparatus for the same.
1368. C. Wateau, Marle Aisne, France—An improved apparatus for cooling beer and other liquids.

Dated 16th June, 1860.

1474. H. Widnell, Lasswade, Edinburgh—Imp. in printing and steaming threads and yarns of worsted and other materials for carpets and other fabrics, and in the apparatus employed therein.

Dated 19th June, 1860.

1484. M. Baragwanath, Church-lane, Truro, Cornwall—An improved portable hydraulic punch. (A com.)

Dated 21st June, 1860.

1502. J. Telfer, 2, Argyle-place, Newcastle-upon-Tyne—Imp. in capstans and winches for hoisting, which imps. are also applicable to the steering of ships.
1504. W. A. Munn, Throwley-house, near Faversham, Kent—An improved cartridge pouch.
1506. T. Walker, Birmingham—Imp. in means or apparatus for indicating the height of water in steam boilers.
1508. W. P. Eastman, 4, South-street, Finsbury—Imp. in bolts for fastening doors, gates, and windows. (A com.)
1510. W. Clark, 53, Chancery-lane—Imp. in machinery or apparatus for the manufacture of envelopes. (A com.)
1512. A. T. Clark and J. Price, 84, High-street, Southampton—Imp. in signal lanterns.

Dated 22nd June, 1860.

1514. A. Jutteau, Orleans, France—A new system of plating and plastering houses and public buildings, with natural stones.
1518. G. Simpson, Calm-cottage, Hoole-street, Whitehouse-lane, Sheffield—Imp. in wine decanters and waggon or travelling decanter stand.
1520. W. E. Gedge, 11, Wellington-street, Strand, London—Imp. in blinds called Venetian or jalousies. (A com.)
1522. J. Wilson, Glasgow—Imp. in the manufacture or production of sulphur or brimstone, sulphurous acid, and sulphuric acid.
1524. W. E. Newton, 66, Chancery-lane—Imp. in lithographic printing presses. (A com.)
1526. R. A. Brooman, 166, Fleet street—Imp. in horse-rakes. (A com.)

Dated 23rd June, 1860.

1530. J. Ward, Queen-street, Pimlico, Middlesex—Imp. in water closets.
1532. H. Jones, North Devon Pottery Company, Annery, near Bideford—Imp. in water closets.
1534. J. Lane, Cranbrook-street, Old Ford, Middlesex—Imp. in apparatus for grinding edge and other cutting tools.
1535. D. C. Dinsmore, Boston, U.S.—An improved churn. (A com.)
1536. P. Pailleron, Chandon Loire, France—An improved apparatus for distilling.

Dated 25th June, 1860.

1540. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in hydraulic apparatus for obtaining motive power, and for raising water. (A com.)
1542. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the needles used in machinery for manufacturing ribbed stocking fabric. (A com.)
1544. W. Higginbottom, Whittington, Derbyshire—Imp. in pipe joints and valves for gas or water mains, and sanatory purposes generally.
1546. W. Hooper, Mitcham, Surrey—Imp. in reworking compounds of india rubber and sulphur, and in insulating telegraphic wires or conductors.

Dated 26th June, 1860.

1548. G. J. Firmin, Borough-road, Southwark—Imp. in furnaces and fire places.
1550. W. H. Hudson, Widemarsh street, Hereford, and J. Evans, Lugwardine, Herefordshire—Imp. in locks.
1552. J. E. Barnsley, Rowley Regis, Staffordshire—Imp. in the manufacture of welded iron tubes, and machinery employed in the said manufacture.

Dated 27th June, 1860.

1557. W. Macnab, Greenock—Imp. in and connected with marine and other steam engines.

1561. J. C. Evans, East Greenwich, Kent—Imp. in machinery or apparatus for rolling or drawing metals and other substances partly applicable to the covering of electric telegraph cables, and to the manufacture of wire and o her ropes.

Dated 28th June, 1860.

1563. C. Binks, Parliament-street, Westminster—Imp. in manufacturing oxygen gas.

1565. W. Pidding, Borough-road, Southwark—Imp. in fire-lighters, their form or shape, and the machinery or apparatus used in their manufacture.

1567. C. Bosselaers, 74, Mark lane—An improved apparatus for corking bottles, jars, and other vessels. (A com.)

1569. W. Campion and W. Campion, Nottingham—Imp. in sewing machines.

Dated 29th June, 1860.

1573. J. Whitehouse, Birmingham—An imp. in the manufacture of metallic door and other nobs, and a new or improved method of connecting door and other knobs with their spindles.

1575. J. Taylor, Birkenhead—Imp. in locomotive engines and wheel carriages.

1577. F. Vouillon, Louviers (Eure), France—Imp. in drawing, twisting, and felting filamentous, fibrous, or textile materials.

1579. G. C. Morgan, 53, Chancery lane—Imp. in looms. (A com.)

Dated 30th June, 1860.

1583. A. Hawksey, Saint Helens, Lancashire—An improved method of drawing and withdrawing window curtains, and other similar hangings.

1585. H. F. Cohade, Gravelle, Saint Maurice, near Charenton (Seine), France—Imp. in obtaining motive power.

Dated 2nd July, 1860.

1587. J. Newhouse, Farnworth, near Bolton-le-Moors, Lancashire—Certain imp. in machinery for spinning and doubling cotton and other fibrous materials.

1589. L. F. Moulin, 4, Rue du Houblon, Brussels—An improved system of water-guage for steam boilers.

1591. E. C. Nicholson, Kennington-road, Surrey—Imp. in the manufacture of a peroxide of lead having peculiar oxidising properties.

1593. H. H. Bishop, Bristol, Connecticut, U.S.—Imp. in sewing machines.

1595. W. E. Gedge, 11, Wellington-street, Strand—Imp. in chairs and other articles of furniture, to be used principally at sea. (A com.)

597. R. A. Brooman, 166, Fleet-street—Imp. in harrows. (A com.)

Dated 3rd July, 1860.

1599. H. J. Standly, 9, Pall-mall East, Westminster—Imp. in retorts, crucibles, and other vessels, employed for the purposes of fusion and distillation.

1601. J. Haughton, Gomersal, Yorkshire—Imp. in machinery or apparatus for slubbing and spinning wool or other fibrous substances.

1603. R. N. Reid, University-street, Middlesex—Imp. in insulators for electric telegraph purposes.

1605. R. A. Brooman, 166, Fleet-street—An improved fabric, suitable for holding charges of gunpowder. (A com).

1607. J. B. Broadhurst, Compstall, near Stockport) Chester—Imp. in heating water for steam boilers.

1609. J. Morrie, 8, Albert-square, Clapham road, Surrey—An improved key for securing railway rails.

1611. F. Durand, Paris—An improved means of driving spindles used in spinning machinery, applicable also to the communicating of rotary motion for other purposes.

Dated 4th July, 1860.

1613. W. Skinner, Williamsburgh, Massachussetts, U.S.—A new and improved machine for stretching and glossing silk. (A com.)

1615. S. Perkes, Clapham—Imp. in presses and modes of pressing, applicable to cotton, hemp, wool, coir, hides, hay, fibres, peat, linen, thread, piece-goods, extracting oil, and other useful purposes.

1617. H. J. Standly, 9, Pall-mall East—Imp. in the production of gases for illumination and other purposes.

1619. J. Haywood, jun., and T. Claridge, Phœnix Foundry, Derby—An improved arrangement of combined thrashing and dressing machine.

1621. A. Doull, Westminster—Imp. in excavating or clearing away earth, sand, and other substances, prior to forming foundations under water and otherwise.

1623. C. Williams, Newcastle, Glamorganshire—Imp. in means or apparatus for the protection of the coast of a country from invasion by ships or other vessels.

Inventions With Complete Specifications Filed.

1581. C. J. N. Rebour, Paris—A new motive power, so called Rebour's motor.—30th June, 1860.

1592. E. Chetwyn, Worcester—Imp. in the manufacture of gloves.—2nd July, 1860.

1598. C. Stevens, 12, Welbeck-street, Cavendish-square—An improved navigable balloon or aerostatic ship. (A com.)—3rd July, 1860.

1616. J. T. P. Newbon and T. Smith, Fenchurch-street—Imp. in apparatus or machinery and gearing for working, stopping, and holding chains in ships or vessels, and for moving or retaining heavy weights.—4th July, 1860.

Patents Sealed.

[*From Gazette, July 13th*, 1860.]

July 13th.

95. J. Hayes.
105. T. J. Smith.
112. J. Stenson.
116. S. Fearnley.
118. R. A. Brooman.
120. J. F. Spencer.
126. H. Medlock.
131. G. Ermen and J. Pratt.
135. N. D. Maillard.
137. H. Blair.
138. W. Dawes.
139. J. Needham.
141. J. Timmins.
158. O. Vivier.
168. A. V. Newton.
172. C. C. J. Guffroy.
175. C. Iliffe.
176. E. J. Hughes.
185. F. Yates.
203. J. J. Maurer.
221. T. Dunn.
367. H. D. Denison.
832. E. Stelzl.
1223. S. Holdsworth, J. Henderson, W. Henderson, and T. Bagley.

[*From Gazette, July 17th*, 1860.]

July 17th.

136. T. Curtis and J. Haigh.
140. A. Bower.
146. J. Shaw.
147. G. H. Cottam and H. R. Cottam.
151. J. F. Meakin.
156. W. E. Gedge.
162. A. McDougall.
166. J. Potter.
187. T. Ramspacher and C. F. Schmidt.
212. J. Duncan, A. Scott, and J. Dawson.
218. A. Gray.
267. A. Hawkins.
304. W. Spurrier.
321. A. Prou-Gaillard.
377. A. V. Newton.
757. F. C. Meyer.
977. W. E. Newton.
1206. C. Cowper.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, July 13th*, 1860.]

July 9th.

1947. W. E. Newton.

July 10th.

1934. J. Leach, J. J. Salt, and B. Day.

[*From Gazette, July 17th*, 1860.]

July 17th.

1971. J. H. Johnson.
1984. J. H. Johnson.

July 14th.

1953. F. C. Calvert and C. Lowe.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, July 13th*, 1860.]

July 9th.

1662. A. W. Craig, D. Foster, and T. Valentine.

[*From Gazette, July 17th*, 1860.]

July 12th.

1748. Warren de la Rue.

July 13th.

1663. T. H. Bakewell.

July 14th.

1703. S. Colt.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4268	23rd June.	Corner-Joint for a Fender	Joseph Holder	Chunk Works, Coventry-road, Birmingham.
4269	,, ,,	New and Improved Beetle Trap	Thomas Long	2, Westbourne-grove North, Notting-hill, W.
4270	28th ,,	Improved Clasp or Fastener for Umbrellas and Parasols	Fountain John Hartley	21, Pump-row, Old-street-road, E.C.
4271	29th ,,	The Doublet Achromatic Object Glass for Telescopes and Opera Glasses	Alexander Adie and Son	50, Princes-street, Edinburgh.
4272	30th ,,	The Eclipse Box Spur	Thomas Gullick	24, Pall-mall, S.W.
4273	4th July.	Drilling Brace	Drury, Brothers	The Don Tool Works, Sheffield.
4274	6th ,,	An Improved Lock	Cyrus Price	Mill-street, Wolverhampton.

Journal of the Society of Arts.

FRIDAY, JULY 27, 1860.

INTERNATIONAL EXHIBITION of 1862.

The Council have received a letter from the Commissioners for the Exhibition of 1851, stating that they are willing to appropriate a portion of their estate at South Kensington for the International Exhibition of 1862 rent free; to vest in the Society of Arts, at a moderate rent, the site of the permanent buildings proposed to be erected on a part of the ground, provided the sum of £50,000 is expended in their erection, and to reserve the remainder of the ground for an International Exhibition in 1872, provided £10,000 be paid the Commissioners out of the profits of the Exhibition of 1862.

The following is a List of the Names of the Guarantors, and of the Sums Guaranteed for the International Exhibition of 1862, which is to be held on the Site granted by the Commissioners for the Exhibition of 1851, at South Kensington.

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
*H.R.H. THE PRINCE CONSORT, PRES. OF THE SOCIETY OF ARTS † Conditional upon £240,000 being previously subscribed.	£10,000†	Arts.
*Matthew Uzielli, Hanover-lodge, Regent's-park, N.W.	10,000	Commerce.
Robt. Napier, Glasgow	2,000	Manufactures.
*Henry Thomas Hope, 116, Piccadilly, W.	2,000	Arts.
*The Marquis of Salisbury, K.G.	1,000	Arts.
*Thomas Brassey, 4, Great George-street, W.	2,000	Manufactures.
Hunt and Roskell, 156, New Bond-street, W.	2,000	Arts.
*Peter Graham, 37, Oxford-street, W.	1,000	Manufactures.
*J. G. Frith, 13, Wimpole-street, W.	1,000	Commerce.
*J. G. Appold, F.R.S., 23, Wilson-street, Finsbury, E.C.	1,000	Manufactures.
*Morrison, Dillon, and Co., 104 to 107, Fore-street, E.C.	1,000	Manufactures.
Copestake, Moore, Crampton, and Co., 50, Cheapside, E.C., 5, Bow Churchyard, and 60 to 63, Bread-street, E.C.	1,000	Manufactures.
*Leaf, Sons, and Co., 39, Old Change, E.C.	1,000	Manufactures.
*Lewis and Allenby, 195 and 197, Regent street, W.	1,000	Manufactures.
*Wm. Fairbairn, F.R.S., Manchester	1,000	Manufactures.
*Harvey Lewis, 24, Grosvenor-street, W.	2,000	Arts.
*J. A. Nicholay, 82, Oxford-street, W.	1,000	Manufactures.
Henry Poole and Co., 32, Savile-row, W., and Old Burlington street, W. ...	1,000	Manufactures.
*Sir Joseph Paxton, M.P., Rockhills, Sydenham, S.E.	1,000	Arts.
S. Isaac Campbell and Co., 71, Jermyn-street, S.W.	1,000	Manufactures.
*Titus Salt, M.P., Saltaire, Bradford	3,000	Manufactures.
*Dr. Lankester, F.R.S., 8, Savile-row, W.	100	Arts.
J. C. Robinson, Alfred-place West, Brompton, S.W.	100	Arts.
*S. Redgrave, 17, Hyde-park-gate South, Kensington, W.	200	Arts.
*Fladgate, Clarke, and Finch, 40, Craven-street, W.C.	500	Arts.
*Francis Seymour Haden, 62, Sloane-street, S.W.	100	Arts.
*Sir Cusack Roney, 15, Langham-place, W.	1,000	Commerce.
Dr. Lindley, F.R.S., Acton-green, Turnham-green, W.	100	Arts.
*Elkington and Co., Regent-street, S.W.	2,000	Manufactures.
*Day and Sons, Gate-street, Lincoln's-inn-fields, W.C.	1,000	Arts.
*J. J. Mechi, Ald., 4, Leadenhall-street, E.C.	1,000	Manufactures.
E. Gambart, 25, Berners-street, W.	1,000	Arts.
*H. J. and D. Nicoll, 114, Regent-street, W.	1,000	Manufactures.
*Paul and Dominic Colnaghi and Co., 13, Pall Mall East, S.W.	1,000	Arts.
*Thos. Sopwith, F.R.S., 43, Cleveland-square, W.	200	Manufactures.
*Henry Johnson, 39, Crutched Friars, City, E.C.	1,000	Commerce.
*John Webb, 11, Grafton-street, Bond-street, W.	1,000	Arts.
Howell, James, and Co., 5, 7, and 9, Regent-street, S.W.	1,000	Manufactures.
*Sydney Smirke, R.A., 79, Grosvenor-street, W.	1,000	Arts.
*Carpenter and Westley, 24, Regent-street, S.W.	100	Manufactures.
*Robt. A. Phillips, 23, Cockspur-street, Charing-cross, S.W.	1,000	Arts.
*Swan and Edgar, Piccadilly and Regent-street, W.	1,000	Manufactures.
*Bradbury and Evans, Whitefriars, E.C.	1,000	Arts.
*Thomas Little, 43, Oxford-street, W.	200	Manufactures.
*Geo. Jackson and Sons, Rathbone-place, W.	200	Manufactures.
*T. Winkworth, 7, Sussex-place, Canonbury, N.	200	Commerce.
C. Minton Campbell, Potteries, Stoke-on-Trent	2,000	Manufactures.
*James Holmes, Took's-court, Chancery-lane, E.C.	300	Arts.

NAMES.	Amount.	Representing the Objects of the Society—Arts, Manufactures, and Commerce.
R. Redgrave, R.A., 18, Hyde-park-gate South, W.	£200	Arts.
Lightly and Simon, 123, Fenchurch-street, E.C.	500	Commerce.
*F. R. Sandford, Council Office, Downing-street, S.W.	100	Arts.
*Capt. Fowke, R.E., South Kensington Museum, W.	200	Arts.
*Harry Chester, 63, Rutland-gate, S.W.	300	Arts.
*C. Wentworth Dilke, 76, Sloane-street, S.W.	1,000	Arts.
*T. Twining, Jun., Perryn-house, Twickenham, S.W.	1,000	Arts.
*G. F. Wilson, F.R.S., F.C.S., Wandsworth-common, S.W.	500	Commerce.
C. F. Hancock, 152, New Bond-street, W., and 39, Bruton-street, W.	1,000	Arts.
*Wheatley, Starr, and Co., 156, Cheapside	1,000	Commerce.
*Henry Cole, C.B., 17, Onslow-square, S.W.	200	Arts.
Peter Lawson and Son, Edinburgh	1,000	Commerce.
*Sir Thomas Phillips, F.G.S., 11, King's Bench-walk, E.C.	300	Arts.
*Lieut.-Col. Cunliffe Owen, R.E., C.B., 7, Osnaburgh-terrace, Regent's-park, N.W.	200	Arts.
*John Bell, 15, Douro-place, Victoria-road, Kensington, W.	100	Arts.
*Alexander Redgrave, Home Office, Whitehall, S.W.	100	Arts.
*Richard James Spiers, Ald., Oxford	100	Arts.
*George Peel, Soho Iron Works, Ancoats, near Manchester	200	Arts.
*Hart and Son, Wych-street, W.C., and Cockspur-street, S.W.	100	Manufactures.
*W. T. Mackrell, Abingdon-street, S.W.	500	Arts.
*Frederick Lawrence, 94, Westbourne-terrace, W.	200	Manufactures.
*E. A. Bowring, Board of Trade, Whitehall, S.W.	200	Arts.
*Col. Challoner, Portnall Park, Chertsey	500	Arts.
*W. Wilson Saunders, F.R.S., Lloyd's, E.C.	500	Commerce.
*Vice-Chancellor Sir W. P. Wood, V.P.R.S., 31, Gt. George-st., Westminster, S.W.	100	Arts.
*Right Hon. T. Milner Gibson, M.P.	1,000	Arts.
*John Kelk, South-street, Grosvenor-square, W.	3,000	Arts.
*Dr. Chambers, 1, Hill-street, Berkeley-square, W.	300	Arts.
*W. H. Bodkin, Gray's-inn-square, W.C.	500	Arts.
*Philip Nind, 30, Leicester-square, W.C.	300	Commerce.
*H. R. Williams, Board of Trade, Whitehall, S.W.	100	Arts.
*Edward Loysel, C. E., 92, Cannon-street, E.C.	1,000	Manufactures.
*Robt. H. Collyer, M.D., Beta-house, Alpha-road, N.W.	500	Arts.
*John Taber, Herne-hill, S.	100	Commerce.
*The Right Hon. Lord Stanley, M.P.	500	Arts.
*David Chadwick, Town Hall, Salford	100	Arts.
*Edward Corderoy, Queen's-road, Clapham-park, S.	100	Arts.
*Wm. Pickstone, the Oaks, Radcliffe, Manchester	100	Manufactures.
*Patent Plumbago Crucible Company, Battersea, S.W.	500	Manufactures.
*J. Towlerton Leather, Leventhorpe-hall, near Leeds	500	Arts.
*Owen Jones, 9, Argyle-place, W.	100	Arts.
*S. D. Darbishire, Pendyffryn, Conway	1,000	Commerce.
*J. Tylor and Sons, Warwick-lane, E.C.	1,000	Manufactures.
*Joseph Cundall, 168, New Bond-street, W	100	Arts.
*W. H. Clabburn, Thorpe, Norwich	100	Manufactures.
*Thomas Kimber, Holland-house, Blackheath	500	Arts.
*D. T. Ansted, Bon Air, Guernsey	100	Arts.
*Wm. Ewart, M.P., Broadleas, Devizes	500	Arts.
*James Wodderspoon, 7, Serle-street, Lincoln's-inn, W.C.	1,000	Manufactures.
*W. F. Scholefield, Boroughbridge, Yorkshire	1,000	Manufactures.
*Jules Benedict, 2, Manchester-square, W.	300	Arts.
*Samuel Plimsoll, 9, Harrington-square, N.W.	100	Manufactures.
*Geo. Godwin, F.R.S., 24, Alexander-square, Brompton, S.W.	200	Arts.
*Chandos W. Hoskyns, Harewood-park, Ross, Herefordshire	500	Arts.
*Daniel Green, Jun., 11, Finsbury-circus, E.C.	100	Arts.
Newton Wilson and Co., 21, Old Bond-street, W., and 144, High Holborn	1,000	Manufactures.
*J. W. Hume Williams, 3, Dr. Johnson's-buildings, Temple, E.C.	100	Arts.
*C. T. Macadam, 109, Fenchurch-street, E.C.	100	Manufactures.
*S. C. Hall, Lancaster-place, Strand, W.C.	200	Arts.
*James Odams, 109, Fenchurch-street, E.C.	200	Manufactures.
*Robert E. Branston, 36, St. Andrew's-hill, Doctors'-commons, E.C.	250	Arts.
Thomas Gray, 8, Cannon-street, E.C.	100	Arts.
C. B. Findlay, Glasgow.	100	Commerce.
*William Rideout, Farnworth Mills, near Manchester	250	Manufactures.
*Edward Frederick Leeks, 73, Warwick-square, Belgrave-road, S.W.	100	Arts.
J. M. Blashfield, Stamford Pottery, Stamford.	100	Commerce.
*W. G. Prescott, Threadneedle-street, E.C.	1,000	Commerce.
*Walter Macfarlane, Saracen Foundry, Glasgow	100	Manufactures.
*The Right Hon. Sir John S. Pakington, Bart., M.P., F.R.S., 41, Eaton-sq., S.W.	200	Arts.
*Thomas Clegg, Manchester	500	Manufactures.

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
*C. L. Clare, Manchester	£200	Manufactures.
*H. C. White, 88, Great Tower-street, E.C.	500	Commerce.
*H. K. Spark, Darlington	500	Commerce.
*Forster Graham, 37, Oxford-street, W.	250	Manufactures.
*Thomas Colby, Penderi, Eglwswrw, Haverfordwest	100	Commerce.
*Col. Le Couteur, F.R.S., Bellevue, Jersey	100	Arts.
*Geo. Withers, 8A, Baker street, Portman-square, W.	100	Manufactures.
*Wright and Mansfield, 3, Great Portland-street, Oxford-street, W.	300	Manufactures.
*William Williams, Crosby Hall, E.C.	100	Commerce.
*Hooper and Co., Haymarket, S.W.	250	Manufactures.
W. Hargreaves, 34, Craven-hill-gardens, W....	200	Commerce.
*Samuel Gurney, M.P., Lombard-street, E.C....	1,000	Commerce.
*Charles Bagnall, Pattingham, near Wolverhampton	500	Manufactures.
H. H. Gibbs, St. Dunstan's, Regent's-park, N.W.	500	Commerce.
*Rev. James G. C. Fussell, Privy Council Office, Whitehall, S.W.	200	Arts.
*Messrs. Spicer, Bridge-street, Blackfriars, E.C.	500	Arts.
*A. Claudet, F.R.S., Regent-street, W.	100	Arts.
*A. Salomons, 42, Old Change, E.C.	500	Commerce.
*Capt. W. Gray, M.P., 10, St. James's-place. S.W.	1,000	Commerce.
*Wm. Graham, 21, Threadneedle-street, E.C...	1,000	Commerce.
*Messrs. Wm. Clowes and Sons, Stamford-street, S.	500	Arts.
*Robt. Fisher, Gresham Club, E.C.	250	Commerce.
James Parker, Baddowhouse, near Chelmsford	100	Arts.
F. W. Docker, 24, Denbigh-street, Pimlico, S.W.	100	Arts.
*Thomas Dixon, 7, St. James'-place, Hampstead-road, N.W.	100	Arts.
*R. A. Brooman, 166, Fleet-street, E.C.	250	Arts.
Ernest Hart, *Lancet* Office, Strand, W.C.	100	Arts.
*Rt. Hon. Wm. Hutt, M.P., Vice-Pres. Board of Trade, 13, Albermarle-street, W.	1,000	Manufactures.
*James Anderton, 20, New Bridge-street, Blacktriars, E.C....	200	Commerce.
*M. Hanhart, 64, Charlotte-street, Rathbone-place, W.	100	Arts.
*J. W. Gordon, Cairness, Cortes, Aberdeenshire	200	Arts.
J. Veitch, Jun., King's-road, Chelsea, S.W.	100	Arts.
*B. P. Shearer, Swanmore-house, Bishop's Waltham, Hants	200	Arts.
*The Lord Ashburton, F.R.S., Bath-house, Piccadilly, W...	3,000	Arts.
*John Jones, Throgmorton-street, E.C.	500	Manufactures.
Peter Rolt and Co., 1, St. Michael's-house, St. Michael's-alley, Cornhill, E.C. ...	1,000	Commerce.
C. D. E. Fortnum, Stanmore-hill, Middlesex, N.W.	500	Arts.
*J. P. and E. Westhead and Co., Manchester	1,000	Manufactures.
*Dr. Acland, F.R.S., Oxford	100	Arts.
*Joseph Moreland, 18, Old-street, St. Luke's, E.C.	100	Arts.
*Holland and Sons, 23, Mount-street, Grosvenor-square, W.	1,000	Manufactures.
*Edwin Chadwick, C.B., Park-villas, Richmond, S.W.	100	Arts.
*Richard Cobbett, 25, Northumberland-street, Strand, W.C.	100	Arts.
*Sir Edward Belcher, Union Club, S.W.	100	Arts.
*John Leighton, F.S.A., 12, Ormond-terrace, Regent's-park, N.W.... ...	250	Arts.
John Wood, Thedden-grange Alton, Hants	100	Arts.
Christopher Cooke, 58, Pall Mall, S.W.	250	Arts.
D. C. Marjoribanks, M.P., 29, Upper Brook-street, W....	1,000	Arts.
*John Ball, 3, Moorgate-street, E.C.	500	Commerce.
*Lord Ebury, 107, Park-street, Grosvenor-square, W.	500	Arts.
John Christopher Lethbridge, 25, Abingdon-street, Westminster, S.W. ...	500	Arts.
*John Whichcord, jun., F.S.A., 16, Walbrook, E.C.	500	Arts.
*Rev. Benjamin H. Kennedy, D.D., Shrewsbury	100	Arts.
*Henry Bridson, Harwood, Bolton-le-Moors	250	Manufactures.
*Rev. M. Mitchell, 15, St. James's-square, S.W.	100	Arts.
Andrew Cuthell, 63, Warwick-square, S.W.	1,000	Commerce.
*T. R. Pinches, Oxendon-street, S.W.	150	Arts.
*Sir John P. Boileau, Bart., F.R.S., 20, Upper Brook-street, W.	500	Arts.
Edward Marjoribanks, 59, Strand, W.C.	2,000	Commerce.
*Sir Edmund Antrobus, Bart., 59, Strand, W.C.	2,000	Commerce.
Wm. Matthew Coulthurst, 59, Strand, W.C.	1,000	Commerce.
*J. P. Gassiot, V.P.R.S., 77, Mark-lane, E.C.	1,000	Commerce.
*W. B. Simpson, 456, West Strand, W.C.	100	Manufactures.
*William Cubitt, M.P., Abchurch-lane, E.C.	1,000	Commerce.
*Bryan Donkin and Co., Bermondsey, S.E.	500	Manufactures.
*George Pollard, Footscray, Kent, S.E.	100	Manufactures.
*Wm. Sparks (Crewkerne Literary and Scientific Institution)	100	Arts.
*W. Harrison, F.G.S., Galligreaves-house, Blackburn	500	Manufactures.
Sir John V. Shelley, Bart., M.P., 42, South-street, W.	100	Arts.
J. G. Breach, Burlington-hotel, Cork-street, W.	250	Arts.

NAMES.	Amount.	Representing the Objects of the Society—Arts, Manufactures, and Commerce.
Robert Besley, Fann-street, Aldersgate-street, E.C.	£200	Arts.
*J. H. Whitehead, Manchester	250	Manufactures.
*Earl Ducie, F.R.S., 30, Prince's-gate, S.W.	500	Arts.
Octavius E. Coope, 13, Stanhope-place, W.	1,000	Arts.
*Rev. Richard Whittington, 18, Guildford-street, Russell-square, W.C. ...	100	Arts.
John Forster, 46, Montague-square, W.	100	Arts.
*Sir Thos. Dyke Acland, Bart., F.R.S.	200	Arts.
*T. D. Acland, F.R.S., Sprydoncote, Exeter	100	Arts.
J. and R. McCracken, 7, Old Jewry, E.C.	200	Commerce.
*Thomas Bazley, M.P., Manchester	1,000	Manufactures.
*Wm. Squire, 5, Coleman-street, E.C.	500	Commerce.
Alexander Grant, 2, Clement's-court, Wood-street, E.C.	250	Manufactures.
*Frederic Newton and Co., 3, Fleet-street, E.C.	100	Manufactures.
*Messrs. Chance Brothers and Co., Birmingham	1,000	Manufactures.
George Stansbury Pedler, 199, Fleet-street, E.C.	100	Commerce.
Frederick J. Jones, 10, Aldermanbury, E.C.	100	Commerce.
Antonio Panizzi, British Museum, W.C.	200	Arts.
Marquis Clanricarde, Portumna Castle, Ireland	500	Arts.
Lambert and Butler, 141 and 142, Drury-lane, W.C.	500	Commerce.
*George Knight and Sons, 2, Foster-lane, E.C.	100	Arts.
Sir Fitzroy Kelly, M.P., The Chauntry, Ipswich	1,000	Arts.
*A. Angus Croll, ex-Sheriff of London, Coleman-street, E.C.	1,000	Commerce.
*Thomson Hankey, M.P., 45, Portland-place, W.	500	Commerce.
*Joseph Somes, M.P., City Club, Old Broad-street, E.C.	1,000	Commerce.
Charles Farlow, 191, Strand, W.C.	100	Manufactures.
Dr. Lyon Playfair, F.R.S., C.B., Edinburgh	200	Arts.
*David Salomons, M.P., Great Cumberland-place, Hyde-park, W.	500	Commerce.
*Herbert Barker, M.D., Bedford	100	Arts.
James Green, Upper Thames-street, E.C.	100	Manufactures.
*Sampson Lloyd, Secretary to the Mechanics' Institution, Wednesbury ...	200	Manufactures.
James Alexander, 10, Porchester-terrace, Bayswater, W.	500	Commerce.
*Wyndham S. Portal, Malshanger, Basingstoke	100	Manufactures.
Alfred Purssell, 78 and 80, Cornhill, E.C.	100	Arts.
*James Campbell, 158, Regent-street, W.	100	Commerce.
*Michael Daintree Hollins, Potteries, Stoke-upon-Trent.	2,000	Manufactures.
*F. A. Abel, Royal Arsenal, Woolwich, S.E.	100	Arts.
*Thos. Routledge, Eynsham-mills, Oxon	100	Manufactures.
Sir Lawrence Palk, Bart., M.P., 47, Rutland-gate, S.W.	100	Arts.
James S. Virtue, 294, City-road, E.C.	500	Arts.
Young Men's Christian Association, per *S. Morley, 18, Wood-street, E.C. ...	1,000	Manufactures.
*Chapman and Hall, 193, Piccadilly, W.	300	Arts.
Henry Christy, Gracechurch-street, E.C.	1,000	Commerce.
Faulding, Stratton, and Brough, 13, Coventry-street, Haymarket, S.W. ...	200	Arts.
*John Pritchard, M.P., 89, Eaton-square, S.W.	200	Arts.
Richard Michell, 93 and 94, Oxford-street, W.	300	Commerce.
*John Topham, 32, King William-st., London-bridge, E.C.	150	Manufactures.
The Sacred Harmonic Society, 6, Exeter Hall, W.C.	1,000	Arts.
Moate and Company, 65, Old Broad-street, E.C.	1,000	Commerce.
M. H. Cama, 21, Gresham House, London, E.C.	200	Commerce.
*Thos. U. Brocklehurst, Macclesfield	100	Manufactures.
*Charles Tottie, Alderman's-walk, E.C.	500	Commerce.
Thomas Conolly, M.P., 19, Hanover-square, W.	1,000	Arts.
John Edward Clennell, London-fields, Hackney, N.E.	100	Arts.
Lord Feversham, 1, Great Cumberland-street, W.	100	Arts.
Hon. D. F. Fortescue, M.P., 17, Grosvenor-square, W.	100	Arts.
Charles Telford, Widmore, Bromley, Kent	500	Commerce.
Truscott, Son, and Simmons, Suffolk-lane, E.C.	500	Manufactures.
Thomas Stirling Begbie, 4, Mansion House-place, E.C.	500	Commerce.
G. C. Hitchcock, 45, Lime-street, E.C.	250	Commerce.
Willis and Sotheran, 136, Strand, W.C.	500	Commerce.
*James Rock, Jun., Hastings	100	Manufactures.
*J. Anderson Rose, 11, Salisbury-street, Strand, W.C.	100	Arts.
*Jeremiah Evans and Son, King William-street, E.C.	500	Manufactures.
*Henry Keeling, Monument-yard, E C.	250	Commerce.
W. O. Foster, M.P., 35, Lowndes-square, S.W., and Stourbridge	1,000	Manufactures.
J. J. Sylvester, F.R.S., Woolwich, S.E.	100	Arts.
*B. Fothergill, Manchester	100	Manufactures.
*S. Jackson, 66, Red Lion-street, E.C.	200	Manufactures.
*J. F. Bateman, F.R.S., 16, Great George-st. Westminster, S.W.	200	Arts.
T. Q. Finnis, Alderman, 79, Great Tower-street, E.C.	1,000	Commerce.

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Felix Slade, Walcot-place, Lambeth, S.	£500	Arts.
*James Easton, C.E. (Easton, Amos, and Sons), 25, Russell-square, W.C. ..	500	Manufactures.
*James Samuel, 26, Great George-street, Westminster, S.W.	1,000	Arts.
Samuel R. and Thos. Brown, Glasgow	200	Manufactures.
Samuel Straker and Son, 80, Bishopsgate-street, Within, E.C.	100	Commerce.
Henry A. Hunt, 54, Eccleston-square, S.W.	500	Arts.
Charles McGarel, 2, Belgrave-square, S.W.	1,000	Arts.
*John Wilson, F.R.S.E., &c., Edinburgh University	300	Arts.
*William Edward Bartlett, 8, King William-street, E.C.	100	Commerce.
Ordish and Le Feuvre, 18, Great George-street, S.W.	100	Arts.
Geo. Austin, 7, London-street, City, E.C.	100	Commerce.
*Alfred Davis and Co., 58 and 60, Houndsditch	1,000	Commerce.
Smith & Knight, 1, Great George-street, Westminster, S.W.	200	Commerce.
*John Robinson McClean, 2, Park-street, Westminster, S.W.	1,000	Arts.
Grant H. Tod Heatly, 11, John-street, Adelphi, W.C.	300	Commerce.
John Campbell Colquhoun, 8, Chesham-street, S.W.	100	Arts.
Sir Henry Holland, Bart., M.D., F.R.S., 25, Brook-street, Grosvenor-square, W.	200	Arts.
Richard Benyon, M.P., 34, Grosvenor-square, W.	500	Arts.
Lord Dufferin and Claneboye, 1, Spring-gardens-terrace, S.W.	500	Arts.
*Faudel and Phillips, 38 and 40, Newgate-street, E.C.	250	Manufactures.
*John Gregory Crace, Wigmore-street, W.	200	Manufactures.
Francis Brothers and Pott, Nine Elms, S.	100	Manufactures.
Wm. Cory and Son, Commercial-road, S.	500	Commerce.
Frederick Wm. Cosens, 16, Water-lane, Tower-street, E.C.	300	Commerce.
*Wm. Bird, 2, Laurence Pountney-hill, E.C.	100	Commerce.
*R. A. Slaney, M.P. Shrewsbury, Bolton-row, Mayfair, W.	100	Arts.
Shropshire Mechanics' and Literary Institution, Shrewsbury	100	Arts.
Wm. Stirling and Sons, 142, West George-street, Glasgow	500	Manufactures.
Sir Roderick Impey Murchison, F.R.S., D.C.L., Director-General of the Geological Survey, 16, Belgrave-square, S.W.	500	Arts.
Granville E. Harcourt Vernon, 9, Hertford-street, Mayfair, W.	100	Arts.
Marquis of Chandos	1,000	Commerce.
*John Bennett, F.R.A.S., 65, Cheapside, E.C.	500	Manufactures.
*Richard Westmacott, R.A., F.R.S., 1, Kensington-gate, W.	100	Arts.
*J. Bowman Fletcher, 17, New Burlington-street, W.	100	Arts.
James Cadbury, Banbury	250	Arts.
Henry E. Hoole, (Mayor) Sheffield	500	Manufactures.
Charles Mills	500	Commerce.
Geo. Carr Glyn, M.P. } 67, Lombard-street, E.C.	500	
Edward W. Mills	500	
Henry Bake, 8, Philpot-lane, E.C.	200	Commerce.
*John Clutton, 9, Whitehall-place, S.W.	500	Arts.
H. Emanuel, 21, Hanover-square, W.	1,000	Arts.
*Doulton and Co., Lambeth Pottery, S.	200	Manufactures
Poole and Macgillivray, 25, Princes-street, Cavendish-square, W. ...	100	Manufactures.
*H. and A. Holmes, Derby	200	Manufactures.
F. A. Tamplin, Liverpool	250	Commerce.
Joshua Buckton, Leeds	100	Manufactures.
*George Myers, Lambeth, S.	1,000	Manufactures.
Winsor and Newton, 38, Rathbone-place, W.	500	Manufactures.
Marshall and Snelgrove, Vere-street, Oxford-street, W.	1,000	Manufactures.
John Rogerson and Co., Newcastle-on-Tyne	1,000	Commerce.
Edward Hammond Benthall, Heybridge Iron Works, Malden, Essex ...	100	Manufactures.
*Marquis of Stafford, M.P., 2, Hamilton-place, W.	500	Arts.
*Samuel Morton Hubert (John Woollams and Co.), Marylebone-lane, W. ...	500	Manufactures.
*Leo Schuster, Roehampton	2,000	Commerce.
J. Callcott Horsley, A.R.A., High-row, Kensington, W.	100	Arts.
Heyman and Alexander, Nottingham	1,000	Commerce.
Letts, Son and Co., 8, Royal Exchange, E.C.	100	Commerce.
Harry Stephen Thompson, M.P., Kirby Hall, York, and Travellers' Club, S.W.	250	Arts.
Tregelles and Taylor, 54, Old Broad-street, E.C.	100	Commerce.
Julius Schlesinger, Bradford, Yorkshire	100	Commerce.
Benham and Sons, 19, Wigmore-street, W.	500	Manufactures.
Richardson Brothers, 105, West Bow, Edinburgh	500	Commerce.
Lewis Cubitt, 52, Bedford-square, W.C.	500	Arts.
*Robert Rawlinson, C.E., 17, Ovington-square, S.W., & 34, Parliament-street, S.W.	100	Arts.
Samuel Allsopp and Sons, Burton-on-Trent	1,000	Commerce.
George Artingstall and Co., Warrington	500	Manufactures.
James Perry and Co., 37, Red Lion-square, W.C., and 3, Cheapside, E.C. ...	100	Commerce.
John Wright Carr, Colchester	100	Commerce

NAMES.	Amount.	Representing the Objects of the Society—Arts, Manufactures, and Commerce.
Geo. Firmin and Co., 80, Borough-road, S.E.	£100	Manufactures.
Mappin and Co., 77 and 78, Oxford-street, W., and Royal Cutlery Works, Sheffield	500	Manufactures.
John K. Welch, 51, Berners-street, W.	500	Manufactures.
Schweppe and Co., Berners-street, W.	500	Manufactures.
W. C. Bennett, 65, Cheapside, E.C.	100	Manufactures.
*Society for Acquisition of Useful Knowledge, Greenwich, per Dr. Purvis	100	Arts.
*J. R. Lavanchy, 6, New Burlington-street, W.	100	Manufactures.
W. and J. Sangster, 75, Cheapside, E.C.	100	Manufactures.
*Thomas Fawell, Stourbridge	100	Commerce.
*James Smith, Seaforth, Liverpool	500	Commerce.
*A. B. and R. P. Daniell, Wigmore-street and New Bond-street, W.	1,000	Manufactures.
Sir Richard Plumptre Glyn, Bart., 37, Upper Brook-street, W.	500	Commerce.
Henry Grissell, Eagle Wharf-road, N.	500	Manufactures.
Lewis Levinsohn, F.R.G.S., 7, Finsbury-square, E.C.	100	Commerce.
*Frederick Leake, 22, Golden-square, St. James's, S.W.	200	Arts.
*George Fredk. Chantrell, 6, Hatton-garden, Liverpool	100	Manufactures.
Coleman and Sons, Chelmsford	100	Manufactures.
John Haworth, Oswaldtwistle, near Blackburn, Lancashire	100	Manufactures.
James Horn, 14, High-street, Whitechapel, E.	100	Manufactures.
William Shilson, Banbury	200	Commerce.
Robert Hovenden, Crown-street, Finsbury, E.C.	100	Commerce.
Olivier and Carr, 37, Finsbury-square, E.C.	200	Commerce.
W. Marshall and Co., 62, North Bridge, Edinburgh	100	Arts.
Samuel Pitts, 14, Catherine-street, W.C.	100	Manufactures.
W. H. Smith, 184 to 187, Strand, W.C.	500	Commerce.
T. and J. Bragg, Jewellers, Vittoria-street, Birmingham	100	Manufactures.
Henry Charlton, Brass Founder, 10, Great Charles-street, Birmingham	100	Commerce.
Edward Wood, Park-hill, near Burslem	500	Commerce.
Hon. W. Napier, 54, Green-street, Grosvenor-square, W.	500	Arts.
James Payne, Canada Mills, Rotherhithe, S.E.	150	Manufactures.
Thomas Richardson, 20, New Bridge-street, Newcastle-on-Tyne	100	Manufactures.
R. W. S. Lutwidge, 19, Whitehall-place, S.W.	500	Arts.
Daniel Roberts, Page's-walk, Bermondsey, S.E.	100	Manufactures.
John Peter Fearon, 1, Cumberland-place, Regent's-park, N.W.	100	Arts.
Coleman, Ernest, and Rowe, 2, Old Swan-lane, Upper Thames-street, E.C.	250	Commerce.
Charles Parker and Sons, Dundee	300	Manufactures.
*Charles Vignoles, C.E., F.R.S., 21, Duke-street, Westminster, S.W.	1,000	Arts.
W. McConnell, Manchester	100	Manufactures.
Gourlay, Brothers and Co., Dundee	200	Commerce.
Ibbotson and Langford, Manchester	250	Manufactures.
Grant and Gask, 59, 60, 61, and 62, Oxford-street, W., and 3, 4, 5, Wells-st., W.	500	Manufactures.
*Henry O. Robinson, 16, Park-street, Westminster, S.W.	500	Arts.
J. G. Churchward, Admiralty House, Dover, and 56, Lombard-street, E.C.	500	Commerce.
William Girdwood, Old Park, Belfast	100	Manufactures.
James Hartley and Co., Sunderland	1,000	Manufactures.
Beyer, Peacock, and Co., Manchester	1,000	Manufactures.
Elkanah Armitage and Sons, Manchester	1,000	Manufactures.
Banks, Brother, Henderson, and Co., Wigton, Cumberland	200	Commerce.
William Hadfield, Derby House, Longsight-road, Manchester	100	Manufactures.
James Edwards and Son, Burslem	500	Manufactures.
John Macmillan Dunlop, Manchester	100	Manufactures.
*Joshua Bates, 21, Arlington-street, S.W.	3,000	Commerce.
W. Brock, Exeter	250	Commerce.
John Moritz Oppenheim, 85, Cannon-street West, E.C.	1,000	Commerce.
Silk and Sons, 8 and 9, Long-acre, W.C.	100	Manufactures.
James Harris, Hanwell	200	Arts.
*Gwynne and Co., Essex-street, Strand, W.C.	500	Manufactures.
John Malcolm, 7, Great Stanhope-street, Mayfair, W.	500	Arts.
G. O. Wingfield Digby, Sherborne Castle, Sherborne	500	Arts.
*John Hawkshaw, F.R.S., 43, Eaton-place, S.W.	1,000	Arts.
William McClure, Manchester	100	Manufactures.
John F. Ferguson, Donegal-place, Belfast	200	Manufactures.
Bernard Gilpin, Cannock, Staffordshire	100	Manufactures.
Nathaniel Jones Amies, Manchester	100	Manufactures.
John Chadwick, 12, Mosley street, Manchester	200	Manufactures.
Thomas Peake, the Tileries, Tunstall	250	Manufactures.
C. Allhusen, Newcastle-on-Tyne	1,000	Manufactures.
Thomas Garfit, Boston, Lincolnshire	100	Arts.
*Charles Ratcliff, Wyddrington, near Birmingham	500	Arts.

NAMES.	Amount.	Representing the Objects of the Society—Arts, Manufactures, and Commerce.
Ben Lockwood, Huddersfield	250	Manufactures.
Eugene Murray, Glebe House, St. Mary-street, Woolwich	200	Manufactures.
S. Hannington and Sons, North-street, Brighton	100	Manufactures.
Thomas Ainsworth, Cleator, Whitehaven	500	Manufactures.
Edward Steegmann and Co., Nottingham	100	Manufactures.
Charles A. Day and Co., late Summers & Day, Northam Iron Works, Southampton.	1,000	Manufactures.
F. and C. Osler, Birmingham	500	Manufactures.
Edward Elwell, Wednesbury	200	Manufactures.
James Spence, 5, York-buildings, Liverpool	250	Commerce.
Sparrow, Brothers, 11, New North-street, Red Lion-square, W.C.	100	Manufactures.
H. Balderson, Corner Hall, Hemel Hempstead	100	Commerce.
*Matthew Henry Marsh, M.P. (Salisbury Literary and Scientific Institution), Ramridge House, Andover	500	Arts.
W. J. Tomkins, 10, Belgrave-place, Cork	500	Commerce.
*James Whatman, F.R.S., Vinters, Maidstone	1,000	Arts.
Geo. B. Yates, Nottingham	200	Arts.
William Newzam Nicholson, Trent Iron Works, Newark-upon-Trent	100	Manufactures.
Smith, Beacock, and Tannett, Leeds	500	Manufactures.
Barlow, Gooddy, and Jones, Manchester	250	Manufactures.
*Sir James Anderson, Glasgow	100	Manufactures.
John Hynam, 6 and 7, Prince's-square, Wilson-street, Finsbury, E.C.	200	Manufactures.
William Gregory, Canal-street, Nottingham	500	Manufactures.
*M. Digby Wyatt, 54, Guildford-street, W.C.	100	Arts.
John Cornforth, Birmingham	100	Manufactures.
*Jonathan Hopkinson, 40, Grösvenor-place, S.W.	500	Commerce.
Booth and Fox, Cork, and 80, Hatton Garden, E.C.	100	Manufactures.
Wright and North, Monmore Iron Works, Wolverhampton	100	Manufactures.
Horton, Son, and Co., New Park-street, Southwark, S.E.	500	Manufactures.
*W. A. Gilbee (Fontainemoreau, and Co.), 4, South-street, Finsbury, E.C.	100	Manufactures.
Joseph Wood, Lansdowne Villa, Worcester	100	Arts.
*Richard Garrett (R. Garrett and Sons), Leiston Works, near Saxmundham, Suffolk.	500	Manufactures.
*Nicholas Wood, President of the North of England Mining Institution, Hetton Hall, Fence Houses, Durham	100	Manufactures.
*Messenger and Sons, Birmingham	500	Manufactures.
*D. Keith, 124, Wood-street, E.C.	500	Manufactures.
*Joseph Glynn, F.R.S., 28, Westbourne-park-villas, W.	100	Arts.
*Geo. Leeman, York	100	Arts.
Royal Cork Institution, Cork (as per list)	2,400	Arts.
*Messrs. Gray and Davison, 370, Euston-road, N.W.	200	Arts.
*Wm. Muir, Britannia Works, Manchester	100	Manufactures.
G. L. Cobden, London	300	Manufactures.
*Eugene Rimmel, 96, Strand, W.C.	100	Manufactures.
Nicholas Heald, 35, George-street, Manchester	100	Manufactures.
*Wm. Browne, The Friary, Lichfield	100	Arts.
D. and W. Robertson, Iron Merchants, Dundee and Glasgow	100	Commerce.
J. and G. Nicholls, Aldine Chambers, Paternoster-row, E.C.	200	Arts.
*James Glaisher, F.R.S., 13, Dartmouth-terrace, Lewisham, S.E.	100	Arts.
*John Penn, The Cedars, Lee, Kent, S.E.	1,000	Manufactures.
*H. P. Burt, Charlotte-row, E.C.	500	Commerce.
Brecknell, Turner, and Sons, 31, Haymarket, S.W.	500	Manufactures.
*Philip Palmer, 118, St. Martin's-lane, W.C.	100	Commerce.
*Joseph Chater, St. Dunstan's-hill, E.C.	100	Commerce.
David Wilkinson, (Molineaux, Webb, and Co.), Manchester	200	Manufactures.
Sir Culling Eardley, Bart., Bedwell-park, Hatfield	1,000	Arts.
Bevington and Sons, Neckinger Mills, Bermondsey, S.E.	100	Manufactures.
*James B. Bevington, " " " "	100	Manufactures.
George Briggs, 45, Wigmore-street, W.	100	Manufactures.
*William Charley, J.P., Seymour-hill, Belfast	100	Manufactures.
*John Field, Dornden, Tonbridge Wells	1,000	Commerce.
Samuel Beale, M.P., 19, Park-street, Westminster, S.W.	1,000	Commerce.
*Rt. Hon. Wm. Cowper, M.P., 17, Curzon-street, W.	100	Arts.
Sir David Brewster, K.H., F.R.S., Edinburgh University	100	Arts.
*Thomas Hutton, J.P., D.L., Elm-park, Drumcondree, and Summer-hill, Dublin	100	Manufactures,
Lord Wodehouse, 48, Bryanstone-square, W.	100	Arts.
W. S. Hale, Alderman, 73, Queen-street, City, E.C.	1,000	Commerce.
*J. Bailey Denton, Woodfield, Stevenage	100	Arts.
Edmund Potter, F.R.S., Manchester	500	Manufactures.
Henry Pease and Co., Darlington	250	Manufactures.
Richard Fisher, 35, Queen-square, Bloomsbury, W.C.	500	Arts.
*Charles Manby, F.R.S., 29, Cambridge-square, W.	100	Arts.

NAMES.	Amount.	Representing the Objects of the Society—Arts, Manufactures, and Commerce.
James Billinge, Ashton, near Wigan	£100	Manufactures.
Thomas Anderson, M.D., University, Glasgow	100	Arts.
*Charles Whittingham, Took's-court, Chancery-lane, W.C.	200	Arts.
*Richard A. Thompson, South Kensington Museum, W.	100	Arts.
Henry Woollams (Wm. Woollams and Co.), High-street, near Manchester-square, W.	250	Manufactures.
Maw and Co., Broseley	250	Manufactures.
*T. R. Hill, Worcester	100	Manufactures.
E. B. Evans, Worcester	100	Manufactures.
Lea and Perrins, Worcester	100	Manufactures.
Wm. Lewis, Alderman, Worcester	100	Manufactures.
A. C. Sheriff, Railway Manager, Worcester	100	Manufactures.
Jas. Alex. Forrest, 50, Lime-street, Liverpool	100	Manufactures.
James Poulter, sen., Dover Museum, Vice-President	100	Arts.
Sir Francis E. Scott, Bart., 97, Eaton-square, S.W.	300	Commerce.
*Robt. T. Fauntleroy (Robt. Fauntleroy and Co., 100, Bunhill-row, E.C.), 3, Garden-court, Middle Temple, E.C.	100	Arts.
*S. Gregson, M.P., 32, Upper Harley-street, W.	100	Commerce.
Thomas Fairbairn, Northwood, Manchester	1,500	Arts.
Colonel Yolland, R.E., 17, Westbourne-park, W.	100	Arts.
J. and J. W. Pease, Darlington	1,000	Commerce.
Blake, Burn, and Co., Sheffield	100	Manufactures.
*Easton, Amos, and Sons, The Grove, Southwark, S.E.	1,000	Manufactures.
Stillwell, Son, and Ledger, 25, Barbican, E.C.	250	Manufactures.
Charles Burrell, Mechanical Engineer, Thetford	500	Arts.
*Edwd. Henri Todé, 8, Cook's-court, Lincoln's-inn-fields, W.C.	300	Arts.
William Dent, Bickley-park, Bromley, Kent	200	Arts.
Geo. Roe, J.P., D.L., Nutley, near Dublin	250	Arts.
Charles Fowler, Totridge House, near High Wycombe	100	Arts.
Jenkins, Hill, and Jenkins, Manufacturers, Birmingham	500	Manufactures.
Cyrus and James Clark, Manufacturers, Street, Somerset	100	Manufactures.
*T. R. Crampton, C.E., Buckingham-street, Strand, W.C.	1,000	Arts.
P. Carstairs, The Green, Richmond, S.W.	200	Arts.
Thos. Baring, M.P., 41, Upper Grosvenor-street, W.	3,000	Commerce.
Thos. S. Cowie, 24, George-street, Hanover-square, W.	500	Arts.
Robt. R. Broad, K.N.L., K.S.M., Consul, Falmouth	100	Arts.
Henry Alcock, Banker, Aireville, near Skipton	100	Commerce.
Henry Crosfield, Temple-court, Liverpool	500	Commerce.
Edward Cave, Dawson-street, Liverpool	100	Commerce.
*Henry Conybeare, Little Sutton House, Chiswick, W.	1,500	Arts.
W. T. Crosbie, J.P., D.L., Ardfert Abbey, Tralee	100	Arts.
Samuel Robotham, Birmingham	100	Manufactures.
Thomas Chambers, The Common Serjeant, Temple, E.C.	100	Arts.
*J. S. W. S. Erle Drax, M.P., Charborough-park, Blandford	100	Arts.
Richard Croft Chawner, The Abnals, Lichfield	100	Commerce.
Ralph Ward Jackson, Greetham Hall, West Hartlepool, President of the West Hartlepool Mechanics' Institution	200	Arts.
*George S. Trower, 33, Hyde-park-square, W.	200	Arts.
*Edward Akroyd, Bank-field, Halifax	500	Manufactures.
Rear-Admiral Wm. Ramsay, C.B., 40, Charing-cross, W.C.	100	Arts.
Edward Barrington, 202, Great Britain-street, Dublin	100	Arts.
Charles Bartholomew, C.E., Doncaster	100	Arts.
Wm. Marshall, Penworthan Hall, near Preston	200	Arts.
John Ormerod, Mordiford, Hereford	100	Arts.
Samuel H. Thompson, Kingswall, Liverpool	500	Commerce.
J. Rawston Stacy, Coachbuilder, Nottingham	200	Manufactures.
Anthony K. Barker, The Park, Cheltenham...	100	Commerce.
Thos. Woolcombe, 26, Kerr-street, Devonport	100	Commerce.
The Cluny Macpherson, Cluny Castle, Kingussie	100	Commerce.
Charles G. Maclea, J.P., 17, Blenheim-terrace, Leeds	100	Manufactures.
Rylands and Sons, Manchester	500	Manufactures.
Robert Williamson, Scarborough	100	Arts.
G. Rigby and James Robinson, Coach Builders, 7, Park-lane, Piccadilly, W. ...	500	Commerce.
*Griffith Jarrett, Engraver, &c., 37, Poultry, E.C.	500	Commerce.
W. and G. A. Winder, Saddlers, &c., Birmingham	100	Manufactures.
George John Calvert and Co., Iron Founders, York	100	Manufactures.
*Thomas Dunn, Windsor Bridge Iron Works, Manchester	150	Manufactures.
A. G. Vieweg, 82, Wood-street, E.C.	200	Commerce.
John Watkins Brett, 2, Hanover-square, W.	500	Arts.
Erasmus Wilson, F.R.S., 17, Henrietta-street, Cavendish-square, W. ...	200	Arts.

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
George Stanton, Shrewsbury	£100	Arts.
Clayton, Shuttleworth, and Co., Lincoln	1,000	Manufactures.
John Willet, C.E., 35, Albyn-place, Aberdeen	100	Commerce.
James Landon, 88, Inverness-terrace, Bayswater, W.	100	Commerce.
James William Murland, 25, Fitzwilliam-square, Dublin	100	Arts.
Wrigley and Smith, Queen's Chambers, Manchester	100	Commerce.
Thomas Kimpton, 6, Bath-street, Newgate, E.C.	250	Commerce.
Arthur Lyon, 32, Windmill-street, Finsbury, E.C.	100	Manufactures.
W. Hepworth Dixon, Essex Villa, Queen's-road, N.W....	100	Commerce.
James Heath, 4, Broad-street, Bath	100	Manufactures.
James B. Bunning, Guildhall, E.C.	500	Arts.
James Newall, Bury, Lancashire	100	Commerce.
Nathaniel Buckley, Ashton-under-Lyne	100	Manufactures.
George Neighbour and Son, 127, High Holborn, W.C....	500	Manufactures.
C. Lyon McKenzie, of St. Martin's, Provost of Inverness	100	Arts.
Richard Johnson, 27, Dale-street, Manchester	100	Commerce.
Lloyd and Lloyd, Albion Tube Works, Birmingham	100	Manufactures.
W. M. Thackeray, 34, Onslow-square, S.W.	100	Arts.
John Alger, 16, Oakley-square, N.W.	100	Arts.
*Joseph I. Solomon, 22, Red Lion-square, W.C.	100	Arts.
Thomas S. Foxwell, Shepton Mallet	200	Commerce.
Huntley and Palmers, Reading...	200	Manufactures.
Morris Lyons, 143, Suffolk-street, Birmingham	100	Manufactures.
*Kelsall and Kemp, Rochdale	200	Manufactures.
*Francis Le Breton, 21, Sussex-place, Regent's-park, N.W.	200	Commerce.
W. S. Turnbull, Huntingtower, Perth	100	Commerce.
James Johnston, New Mill, Elgin, N.B.	100	Manufactures.
John Slater Pratt, Oakland House, Stokesley, Yorkshire	100	Manufactures.
W. P. Andrew, 26, Montague-square, W.C.	200	Arts.
Edward Evans, Boveney-court, Windsor	100	Arts.
Spencer Steers, Halewood, Prescot	100	Arts.
Wm. Terrall, Welsh Bach, Bristol	100	Manufactures.
	£260,450	
Promised on behalf of the Metropolitan Lines of Railway	80,000	
[Of this the Board of Directors of the London and North-Western have undertaken £15,000.]		
	£340,450	

BY ORDER, P. LE NEVE FOSTER, *Secretary.*

*** *Any names omitted in this List, or received since the preparation of it, will be published in future announcements.*

EXAMINATION PAPERS, 1860.

(*Continued from page* 662.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

GEOMETRY.

THREE HOURS ALLOWED.

1. Draw a straight line perpendicular to a given straight line of an unlimited length, from a given point without it.

Why must it be "unlimited?" How could you draw a straight line perpendicular to a given straight line, from a point over its extremity?

2. All the exterior angles of any rectilineal figure, made by producing the sides successively in the same direction, are together equal to four right angles.

If the interior angles are equal to 10 right-angles, how many sides are there in the figure?

3. If the square described upon one of the sides of a triangle be equal to the squares described upon the other two sides of it, the angle contained by those sides is a right angle.

How would you tell with a foot rule only whether a board, which ought to be rectangular, is really so?

4. If a straight line be divided into two equal, and also into two unequal parts, the squares of the two unequal parts are together double of the square of half the line, and of the square of the line between the points of section.

5. Define circle, segment of a circle, sector of a circle.

Prove that one circle cannot touch another in more points than one, whether it touches it on the inside or outside.

6. If from a point without a circle two straight lines be drawn to cut the circle, the rectangles contained by the whole lines and the parts of them without the circle are equal to one another.

7. Describe an equilateral and equiangular pentagon about a given circle.

8. Triangles which have one angle in the one equal to one angle in the other, and their sides about the equal angles reciprocally proportional, are equal to one another.

9. If from any angle of a triangle a straight line be drawn perpendicular to the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the perpendicular and the diameter of the circle described about the triangle.

10. If two straight lines be at right angles to the same plane, they shall be parallel to one another.

11. At a given point in a given straight line, make a solid angle, equal to a given solid angle contained by three plane angles.

12. Every prism having a triangular base may be divided into three pyramids that have triangular bases and are equal to one another.

PROBLEMS.

1. Two points are taken, one on each side of a box, and joined by a string. When the string is stretched, it makes equal angles with the edge of the box which passes between the two points.

2. Describe a circle which shall touch a given straight line, at a given point, and pass through another given point.

3. If the three perpendiculars from the angles of a triangle ABC, meet in P, the circle passing through P, and any two of the points A, B, C, is equal to the circle described about the triangle ABC.

4. Two given concentric circles are cut by a variable circle whose centre is fixed. Prove that the distance between the chords of intersection is invariable.

5. If from any point in the circumference of a circle, straight lines can be drawn to the angular points of an inscribed equilateral triangle, the greatest of them is equal to the sum of the two others.

6. If three equal circles have a common point, the circle passing through the other three points of intersection is equal to one of the first-mentioned circles.

7. Prove that there may be two, but not more than two, similar triangles in the same segment of a circle.

8. Three parallel straight lines are cut by parallel planes, and the points of intersection are joined; the figures so formed are all similar and equal.

9. A B C D is a regular tetrahedron, and from the vertex A, a perpendicular is drawn on the base B C D, meeting it in O. Show that three times the square on A O is equal to twice the square on A B.

10. A sphere exposed to the sun's oblique rays on a horizontal plane stands in the focus of its elliptical shadow. Prove this geometrically.

MENSURATION.

THREE HOURS ALLOWED.

1. How would you determine by admeasurements whether the two sides of a room are at right angles to one another?

Having a flat triangular board, show how to determine without any measuring whether it has one of its angles a right angle.

2. What is the area of the isosceles triangle of which the base is 60 feet and each of the equal sides 50 feet?

What is the base of the other isosceles triangle which has the same equal sides of 50 feet and the same area?

3. Find the number of acres in the four-sided field ABCD. The diagonal AC, which is ten chains in length makes an angle of 30° with AB, and an angle of 45° with AD, and at a point in AC, 4 chains distant from A, the other diagonal crosses at right angles.

4. Find the cost of carpeting a room which is 15 ft. 9 in. by 17 ft. 8 in; the price of the carpet, 3 quarters wide, being 5s. 3d. per yard.

5. A cistern 5 ft. long, 3 ft. 6 in. wide, and 2 ft. 8 in deep, is lined with sheet lead $\frac{1}{4}$ inch thick; find the cost at £2 per cwt. The weight of a cubic foot of lead is 708 lbs.

6. The diameter of a circular window is 3 ft. 5 in., what will be the cost of glazing it at 1s. 7d. per square foot? How much glass will be *wasted?*

7. Find the cost of the timber in a king-post roof 40 feet long, at 2s. 3d. per cubic foot; each of the five tie beams being 20 ft. and 8 in. by 4 in., each king-post $5\frac{1}{4}$ ft. and 5 in. by 4 in., the principal rafters 10 ft. and 4 in. by $3\frac{1}{2}$ in., the common rafters, 60 in number, 11 ft. and 3 in. by 2 in., the struts 5 ft. and 4 in. by 3 in., the purlines 6 in. by 5 in., the ridge piece 10 in. by $1\frac{1}{2}$ in., the pole plate 4 in. by 2 in., and the wall plate 2 in. by 2 in.

8 What will be the expense of slating the roof in question 7, at £2 5s. per square?

9. Find the quantity of brick work in the gable end of a house, the height of which is 20 feet, the height of the side walls 11 feet, and the angle of the gable 60°, the wall being two bricks thick.

10. The chord of a segment of a circle is 234 feet, and its height 234 inches; find its area and the length of the arc.

11. Find the cost of cutting a ditch which is 9 chains in length and 4 feet deep, the width at the top being 3 feet, and at the bottom 1 foot, at 10d. per cubic yard.

12. Prove that every pyramid on a triangular base is one-third of the prism on the same base and of the same altitude.

13. If a cubic foot of metal be cast into the shape of a regular four-sided solid, what will be the length of one of its edges?

14. Find the diameter of a hemispherical bowl which will contain three gallons.

15. In the square ABCD, draw the diagonal AC, and the quadrant BD; prove that the cone, the hemisphere and cylinder formed by the revolution round AB of the triangle ABC, the quadrant ABD, and the square ABCD, will be proportional to the numbers 1, 2 and 3.

16. Find the surface of a frustrum of a right cone, the height of which is 2 feet, and the areas of the top and bottom 9 feet and 25 feet respectively.

17. A heavy spherical ball 3 inches in diameter, is placed in a conical glass, the diameter of which across the top is equal to the length of the side, sufficient water is poured in just to cover the ball; find how high the water will stand in the glass when the ball is removed.

TRIGONOMETRY.

THREE HOURS ALLOWED.

(1.) Explain the terms secant, tangent, versedsine; and trace the magnitude and sign of the cosine through the four quadrants.

(2.) Shew that.—

$$(1.)\ \text{Tan.}\ \theta = \text{tan.}\left\{(2n+1)\ \pi + \theta\right\}$$
$$= -\text{tan.}\left\{(2n+1)\ \pi - \theta\right\}$$

(2.) Sin. 2 A = 2 Sin. A, Cos. A.

(3.) Sin. A = Sin. (60° + A) − Sin. (60° − A)
Cos. A = Sin. (30° + A) + Sin. (30° + A)

(4.) Sin. $^{-1}\frac{3}{4} + \frac{1}{2}$ tan. $^{-1}\,3\sqrt{7} = 90°$

(3.) If Log. and log. indicate tabulated and Napierian Logarithms respectively, prove that:—

$$(1.)\ \log.\ x^n = n \log.\ x$$
$$(2.)\ \text{Log.}\ n = \frac{\log.\ n}{\log.\ 10}$$

(4.) Explain the principle and the use of the differences and the proportional parts in Logarithmic tables; and, given—

Log. 41723 = 4·620375
Log. 4·1724 = ·620386,
Find Log. ·04172375.

(5.) Calculate the earth's diameter from the fact that two points each 10 feet above the surface of smooth water cease to be visible from one another at the distance of 8 miles.

(6.) Given two sides, and the included angle of a plane triangle, find the third side in a form adapted to logarithmic computation.

(7.) Find the angles of a triangle where $3c = 7b$ and $A = 6°\ 37'\ 25''$;

Log. 2 = ·30103
Log. tan. 3° 18′ 42″ = 8·7624069
Log. tan. 8° 13′ 50″ = 9·1603083 diff. for 10″ = 1486.

(8.) The area of a plane triangle

$$= \frac{a\,b\,c}{2\,(a+b+c)}\,(\text{Sin. A} + \text{Sin. B} + \text{Sin. C})$$

(9.) In any plane triangle

$$\frac{\text{Sin. 2 A}}{a^2} + \frac{\text{Sin. 2 B}}{b^2} + \frac{\text{Sin. 2 C}}{c^2} - \frac{\text{Sin. A}}{bc} - \frac{\text{Sin. B}}{ca} - \frac{\text{Sin. C.}}{ab} = 0$$

(10.) Prove the formulæ in spherical trigonometry:—

$$\frac{\text{Sin. A}}{\text{Sin. } a} = \frac{\text{Sin. B}}{\text{Sin. } b} = \frac{\text{Sin. C.}}{\text{Sin. } c}$$

$$\text{Cos. } a \text{ Sin. } b = \text{Cos. A Sin. } c + \text{Cos. } b \text{ Cos. C Sin. } a.$$

(11.) Show that in right-angled spherical triangles the sine of the middle part = product of the tangents of the adjacent parts.

(12.) Show, by the help of Napier's analogies, that in a quadrantal triangle (a being a quadrant)—

$$-\text{Cos. A} = \text{Cos. B Cos. C.}$$
$$\text{Cos. } c = \text{Sin. } b \text{ Cos. C.}$$

CONIC SECTIONS.

THREE HOURS ALLOWED.

Section I.—Geometrical Conics.

1. In the parabola, prove that the sub-normal is constant, and that the perpendicular from the focus on the tangent is a mean proportional between the least distance and the focal distance, ($SY^2 = SA \times SP$.)

2. Define a diameter of a parabola, and prove that all diameters are parallel.

3. Prove that the tangent to an ellipse makes equal angles with the focal distances. How does this property explain the meaning of the word *Focus?*

4. Prove in the ellipse

$$(1)\ CN \times CT = CA^2$$
$$(2)\ AN \times NA' : NP^2 :: CA^2 : CB^2$$

5. Define an ellipse in as many different ways as you can, and deduce from the definitions which do not state the property, that an ellipse has two foci, and that the sum of the focal distances is constant.

6. What is the *Latus rectum* of a hyperbola. If L is the latus rectum, prove that $L \times AC = 2\ BC^2$.

7. Prove in the hyperbola that

$$CP^2 - CD^2 = CA^2 - CB^2.$$

8. Define asymptotes of a hyperbola. A straight line intersects the asymptotes and the hyperbola in the points p, P, Q, q, in order. Prove that $p\,P = Q\,q$.

9. A section of a cone made by a plane parallel to the side of the cone is a parabola.

10. In an ellipse, PH is the chord of the circle of curvature drawn through the centre C, and D is the point conjugate to P. Prove that $PH \times CP = 2\ CD^2$.

11. By the method of projections draw a pair of tangents to an ellipse from an external point.

12. Prove, by the method of projections or otherwise, that the area of an ellipse is $\pi a b$; and that the area of a parabola is two-thirds of its circumscribed rectangle.

Section 2.—Analytical Conics.

13. Deduce from geometrical considerations the equation to a straight line, in the forms

$$(1.)\ y = tx + b.$$
$$(2.)\ x \cos \alpha + y \sin \alpha - p = 0.$$

14. Find the conditions that the straight lines

$$A\,x + B\,y + C = 0$$
$$A'x + B'y + C' = 0$$

should be (1) parallel; (2) perpendicular to each other.

15. Find the equation to a circle when (1) any point, (2) a point in the circumference, (3) the centre, is the origin. Also give a geometrical interpretation of the polar equation $r = 2a \cos \theta$.

16. Find the equation to a tangent of an ellipse; and put it into the form $y = \alpha\,x + (\alpha^2\,a^2 + b^2)^{\frac{1}{2}}$. Hence find the locus of the point of intersection of two tangents, which are perpendicular to each other.

17. Prove analytically the theorems contained in questions 1, 3, 4, 6, 7 of the preceding section.

18. Examine and trace the lines represented by the following equations:—

$$(1.)\ x^2 + y^2 + 4x + 6y - 3 = 0.$$
$$(2.)\ 2x^2 - 4xy + 3y^2 - 4x + 2y - 5 = 0.$$
$$(3.\ \frac{a}{x} + \frac{b}{y} - 4 = 0.$$
$$(4.)\ 4x^2 - 4xy + y^2 + 12x - 16y = 0.$$

(*To be continued.*)

ENGLISH AND FRENCH MANUFACTURES.

The Superior Council of Commerce, which has under its consideration the rates of duty which are to be adopted under the provisions of the Treaty of Commerce, in some of the reports which it has published makes the following statements relative to the metal trade:—

Germany imports considerably more needles from France than England, but those of England are of superior quality, and are infinitely more esteemed. French needle-makers calculate that, on the whole, England only makes needles some 10 per cent. cheaper than they do, and yet they ask for protection equal to 22 per cent. At present, certain sorts of English needles pay high duties, though the like is not made in France at all. Numerous English workmen are employed in the needle trade in France, and are better paid than the French workmen. The same is the case in the steel pen trade; in it three foremen out of every five are English. The demand for English steel pens is declining in France. For watch springs no protection whatever is needed if coal and steel can be obtained cheap: this is admitted by some of the leading men in the trade. Saws, files, and tools generally are represented not to be so good in France as in England, and rather large protection is demanded. For steel ornaments it is said that no protection whatever is necessary, large quantities of them being exported to England; still it is admitted that certain descriptions of such articles are made better and cheaper by the English. Works of art in bronze are declared to have no need whatever of protection, and the opinion is expressed that the treaty will largely increase the demand for them. From, however, the English way of living and style of furnishing houses, it is intimated that the demand for such articles in England will never equal that which prevails in the United States, Spain, and Germany. In connection with the bronze question, it is stated that articles of that material are not at all equal in quality to what they used to be in former years, though not inferior in an artistic point of view. The opinion is also expressed by a high authority that the English, in spite of the marked progress they have lately made in manufacturing art, will never be equal to the French in artistic design. On the subject of copper, certain founders make very extravagant demands for protection against the English. Button makers also, who use copper, ask for a protection equal to 15 per cent. *ad valorem*, against English buttons, and yet they admit that they export largely to England. To compete with Germans, they say they require not less than 30 per cent. Finally, a lamp maker has declared that the English cannot make lamps at all approaching those of France, and that he himself does an extensive business in England; yet he asks for 30 per cent. protection "because it is put down in the treaty."

Home Correspondence.

MANAGEMENT OF MECHANICS' INSTITUTIONS.

Sir,—As the season is approaching when it is usual to commence the active operations of Mechanics' Institutes, I venture to offer a few suggestions to Committees of

Management with reference to details, with a view to endeavour, if possible, to overcome those difficulties which impede their achieving the success which they merit. It should at all times be borne in mind that exertions should be made in a spirit of hopefulness, and that no apparent obstacles be permitted to discourage those who are confident of th e goodness of the cause in which they are engaged.

One of the most important elements of success in Mechanics' Institutes, as in most other undertakings, is a sufficiency of resources, not the large donations of the wealthy few, but the aggregate subscriptions of the many. For this purpose the rate should be so fixed as to bring it within the means of the great majority, so that poverty would hardly be an admissible excuse for non-payment. In most country towns I would suggest a rate of 2s. 6d. a quarter, payable in advance, and entitling the subscribers to free admission to lectures, reading-room, library, &c. Honorary members, paying 21s. a year, should have the additional privilege of being allowed to nominate a pupil of classes, to be admitted upon the payment of only one penny a week. But whatever be the rate of subscription, it will not be regularly paid by the majority unless it be called for. For this purpose a collector and canvasser should every quarter call upon each inhabitant, and his services should be remunerated either by a fixed salary, say one week in each quarter, or by a commission on his receipts. There are many persons who would not refuse the small quarterly payments, and yet they do not feel sufficient zeal for the prosperity of the Institute to volunteer their subscription, or send the amount of the payment required of them.

For pupils of classes I would recommend a weekly payment, say 3d. a week, of which 2d. should be paid for a competent teacher, who might receive gratuitous assistance. By paying a teacher, punctuality of attendance, which is indispensable to success, might be procured; and by making his remuneration dependent on the number of pupils, it would give him an interest in increasing the class, and also secure the general funds of the Institute from any risk. The pupils should be entitled to class instruction and the use of the library. Classes should be formed with the special object of preparing pupils for the examinations, not only of the Society of Arts, but previously in the elementary branches and preparatory studies. A class should also be formed for the encouragement of English composition by the reading of essays and subsequent discussion of them. If practicable, a class for singing on Saturdays would be desirable, and also for young women in the most useful branches of domestic economy. It would, I believe, do much to stimulate class instruction, if the committee were to offer a prize of a valuable book, such as the works of Shakspeare in one volume, to the pupil who between Michaelmas and Christmas shall introduce the greatest number of new pupils. It would enlist the active services of a number of young men amongst their companions and those of their own class. Many a young man, desirous of class instruction, is too bashful to apply for it, but might be induced by the solicitation of a companion to join the Institute.

Lectures are by no means an unimportant part in the operations of a Mechanics' Institute, but unfortunately the great complaint is a want of attendance. This, I believe, is mainly owing to the irregularity of the times when they are delivered, and the difficulty of preventing their clashing with other engagements, as well as of giving sufficient publicity to the announcements. To obviate these I would suggest that a particular evening in the week should be selected, and an arrangement made for a lecture on that evening in each month. The intermediate weeks should be devoted to popular readings by gentlemen in the locality, after the plan so successfully pursued at Ipswich, and described in the *Journal of the Society of Arts* some months back. Three gentlemen each evening, for half-an-hour each, from such works as each may select,—prose, poetry, popular works, &c. The members should have free admission, and others be charged 1d. each, with something extra for reserved seats. If, for instance, a Wednesday be selected, the programme might be issued thus:—

Wednesday,	5	Sept.,	Opening Meeting.
,,	12	,,	Lecture.
,,	19	,,	Readings.
,,	26	,,	,,
,,	3	Oct.,	,,
,,	10	,,	Lecture.
,,	17	,,	Readings, and so on.

The great advantage would be that the inhabitants would soon become familiar with the fact that on each Wednesday, or whichever the evening selected, there would be an entertainment, either a lecture or readings, at the Institution. Knowing this, they would make their other engagements accordingly, and very soon acquire a habit of attending.

Most Institutes possess a library, many of them numbering several hundred volumes, but unfortunately in too many the numbers do not represent an equivalent amount of readable literature. In some Institutes there is an erroneous objection to what is called light literature, as though the highest of all authority had not conveyed His precepts in parables; and the shelves are consequently occupied with heavy matter, which remains there, for however good it may be in itself, it does not attract readers nor promote reading. A very little outlay might remedy this. The Committee should from time to time purchase any really popular work, such as "Tom Brown's Schooldays," "Livingstone's Africa," "Adam Bede, "M'Clintock's Voyage of the Fox," "The Mill on the Floss," &c. They may be had of the London libraries at a reduced price, and while extracts from them would furnish subjects for the popular readings, they would do more to attract subscribers to the library than the many volumes already on its shelves.

Another means by which to achieve success would be an annual festival, if possible in the autumn, with the accompaniments of tea, music, and such local talent in the way of advocacy of the Institute as the Committee may be able to procure. The good effect should not, however, be allowed to pass away, but should be followed up by an energetic canvass of the town and neighbourhood, small sub-committees being formed for the purpose, and a district allotted to each.

One of the sources of strength which has hitherto been much neglected is publicity. Everything requires it, as we require to be constantly reminded of our highest duties. The London Mechanics' Institution endeavoured to exist upon the impetus of its former reputation, instead of keeping itself in the public eye, and dwindled almost to extinction. Continuous advertising is the only way of maintaining the sale of the most popular article, and is equally necessary for Mechanics' Institutes. I would suggest that, if possible, there should be every week a paragraph about the Institution in the local newspaper, and another point, which has not been sufficiently attended to, is to have the name of the Institution in very conspicuous letters outside the building. The programme of lectures, readings, terms of subscription, &c., should also be printed on a neat card, and exhibited wherever practicable.

A word more and I have done. Establish a Penny Savings Bank in connection with the Institute. It will promote early habits of prudence and economy, and do more to suppress the vice of intoxication than all the teetotal societies have yet been able to effect.

BARNETT BLAKE.

Leeds, July 16, 1860.

Proceedings of Institutions.

Wigan Mechanics' Institution.—The sixth annual report of this Institution congratulates the members upon the improved condition in which it now stands. The

number of members has increased considerably. The number on the books, at the close of the year, was 432, being an increase of 30, as compared with the number at the close of 1858. The directors, in the report for 1858, noticed a circumstance which was very injurious to the pecuniary interests of the Institution, viz., "that during the summer months many of the members cease to subscribe." They are happy to state that an improvement in this respect has taken place. Another gratifying proof of the increased prosperity of the Institution is the circulation of books in the library, which has increased with regard to numbers, besides which, the books read are of a higher class; the issues of those relating to biography, history, travels, poetry, &c., have much increased, and the directors hope that as such classes of works are added to the library the circulation of them will increase in a still greater proportion. The number of books taken out during the year is as follows:—Novels, Romances, and Tales, 5,073, Dictionaries, Encyclopædias, &c., 35; Fine Arts, 67; Mathematics, 60; Miscellaneous Works, 557; Natural and Experimental Philosophy, 362; Natural History, 259; Biography, History, and Geography, 1,207; Periodicals, Reviews, and Magazines, 753; Poetical Works, 150; Voyages, Travels, and Adventures, 515; Parliamentary Reports, 9. The total number of volumes issued during the past year is 9,047, which, compared with the issue of 1858, gives an increase of 1,373 vols. The following table shows the number of volumes in the library, the number taken out, and the average for each member for each year since the inauguration of the Institution, on the 20th Oct., 1853, to the 31st December, 1859:—

	For the Year					
	1854	1855	1856	1857	1858	1859
Number of vols. in the library	1,646	1,748	1,994	2,000	2,170	2,381
Number of volumes taken out by members	4,220	5,600	6,717	7,000	7,084	9,047
Average number of volumes for each member	17	22	22	23	23	23

The library was only opened for eleven months in 1858.

The average number of subscribers to the news room has increased, being 114, while that of last year was 109. The attendance in the reading room has been very good. In the evening school during the past year the average number on the books was seventy, and the attendance fifty. The Mining and Mechanical School has continued in operation with considerable success, having been attended at one time or another during the year by 57 pupils. The average weekly attendance has been twenty, against fifteen for the year 1858. The subjects which have secured most attention are mining, geology, and chemistry. The Latin class has been very regularly attended by about six of the members. In the mathematical class the teacher was obliged to relinquish his duties, and received a testimonial from the members for his valuable gratuitous services. The directors have not yet been able to supply the vacancy. The directors speak of the great difficulties they have had to contend with in finding suitable teachers to conduct other classes than those already formed, more especially those for instruction in mathematics, mechanical drawing, and French, from not being in a position to offer any remuneration for their services. Only three lectures have been given, on each of which a loss was sustained. After speaking of the Exhibition and Bazaar, which appears to have been successful, the report mentions the improved financial position of the Institution as compared with previous years, this and last year being the only years in which the Institution has been self-supporting. The income has amounted to £250 2s. 9d.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 3rd July, 1860.

392. Clare Election—Minutes of Evidence.
406. Pembroke Dockyard Gas Works—Return.
411. Census Acts (1851)—Return.
206. Bills—Heritable Securities, &c. (Scotland).
207. Bills—Refreshment Houses and Wine Licenses (Scotland).
213. Bills—Industrial Museum (Scotland.
216. Bills—Registration of Births, &c. (Scotland) (Amended in Committee and on Re-commitment).
221. Bills—Medical Act (1858) Amendment.
Argentine Confederation—Convention.

Delivered on 4th July, 1860.

395. Foreign Sugar—Account.
400. Poor Rate Assessments, &c.—Return.
413. Maynooth College—Report.
415. Special Services—Return.
416. Scottish Universities—Copy of Ordinance.
448. British Museum—Return.
422. Maynooth College—Return.
423. China (Vote of Credit)—Estimate.
243. Bills—Burial Grounds (Ireland) Act (1856) Amendment (amended).
215. Bills—Annuity Tax Abolition (Edinburgh) (as amended in committee, on re-commitment, and 2nd re-commitment).
217. Bills—Prisons (Scotland) (Amended).

Delivered on 5th July, 1860.

169(1). East India (European Troops)—Papers, Part 2.
425. Mediterranean and Telegraphic Communication—Return.
428. Post Office (Packet Service)—Detailed Account.
224. Bills—Mines Regulation and Inspection (as amended in Committee, and on re-commitment.
225. Bills—Tenure and Improvement of Land (Ireland) (as amended in Committee, and on re-commitment).
226. Bills—Gunpowder, &c.
209. Bills—Corrupt Practices at Elections.

Delivered on 6th July, 1860.

419. British Museum—Returns.
430. Mary Carter—Return.
375. Cambridge University Copies of Statues.
227. Bills—Church Temporalities (Ireland) Act Amendment.
228. Bills—Ecclesiastical Courts and Registries (Ireland).
229. Bills—Metropolitan Building Act (1855) Amendment (amended)
240. Bills—Friendly Societies Act Amendment (as amended in Committee, and on re-commitment).
232. Bills—Manchester Cathedral Church.

Delivered on 7th and 9th July, 1860.

403. Highleigh Prebendal Grammar School—Return.
420. Civil Contingencies—Return.
429. East India—Copy of Lord Canning's Despatch.
427. British Museum, etc.—Return.
432. British Museum (Details of the Expenditure)—Return.
347. Finance Accounts—Classes 1 to 8.
235. Bills—Queen's Prison.
236. Bills—Lands Clauses Consolidation (as amended in Committee, and on Consideration, as amended).
237. Bills—Felony and Misdemeanor (amended).
238. Bills—Crown Debts and Judgments,
239. Bills—Wexford Harbour (Ireland)
240. Bills—Admiralty Court Jurisdiction (No. 2) (amended)

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 20th*, 1860.]

Dated 18th April, 1860.

970. G. Canouil, 93, Curtain-road, Shoreditch—Improved compositions for priming percussion caps, and a machine or apparatus employed therein.

Dated 14th June, 1860.

1454. M. Henry, 84, Fleet-street, London—Imp. in treating vegetable substances so as to obtain paper-pulp and other useful products therefrom. (A com.)

Dated 20th June, 1860.

1493. A. Arthur, Southampton—Obtaining and applying motive-power.

Dated 22nd June, 1860.

1528. D. Dawson, Milnes-bridge, near Huddersfield, Yorkshire—Imp. in the dyeing of cotton, wool (or waste), black and brown.

Dated 25th June, 1860.

1538. A. Barnsley, New Town, Staffordshire—Imp. in apparatus for the manufacture of welded iron tubes.

Dated 26th June, 1860.

1556. W. E. Newton, 66, Chancery-lane—Improved machinery for the manufacture of lace or bobbin net. (A com.)

Dated 27th June, 1860.

1558. R. Formby, Liverpool—Improved apparatus for applying water power to the working of ships' pumps and winches, and to other useful purposes.
1560. J. Macintosh, North Bank, Regent's park, Middlesex—Improved compounds for coating or insulating submarine or other telegraphic wires, also in rendering the gutta percha or india rubber coatings of telegraphic wires impervious.

Dated 28th June, 1860.

1562. W. H. Fletcher, Denmark-court, Golden-lane, London—Imp. in the form and arrangement of stoves for heating irons, used for dressing and polishing shirts, collars, and similar articles, and also in the figure or form of the said irons.

1566. J. Blakeley and W. H. Blakeley, Netherton, near Hudders field, Yorkshire—Imp. in machinery or apparatus for sawing or cutting wood, bone, ivory, stone, or other vegetable, animal, or mineral substances.

1568. J. Allen, Trafalgar Wharf, Ratcliff Cross Stairs, and J. Glasson, Fore-street, Limehouse, Middlesex—An improved method of connecting together the several tubes used in connection with steam boilers for superheating steam.

1570. W. Richards, Birmingham—Imp. in ordnance, also in cartridges and cap holders.

Dated 29th June, 1860.

1572. J. Sale, Chesterton, Staffordshire—Imp. in the construction of ovens and of chambers in ovens for firing bricks, tiles, pipes, quarries, and other articles of the like nature.

1574. T. Wilson, Birmingham—Imp. in breech-loading fire arms and ordnance, and in cartridges.

1576. J. Sutter, Hoxton, Middlesex—Imp. in steam boilers, and an improved arrangement of steam engine to be used therewith.

1578. W. Hale, 6, John-street, Adelphi—Imp. in impelling shells or shots, and in apparatus for directing their flight from ships or vessels, which apparatus is applicable to guns or mortars used on board ship for preventing them being acted upon by the pitching or rolling of the ship or vessel.

1580. G. C. Morgan, 53, Chancery-lane—Imp. in the manufacture of driving belts and straps. (A com.)

Dated 30th June, 1860.

1582. W. E. Gedge, 11, Wellington-street, Strand—Improved bricks and tiles. (A com.)

1584. T. Cox, jun., and R. Harrington, Birmingham, and W. Holland, King's Norton, Worcestershire—Imp. in the manufacture of runner notches and top notches for umbrellas and parasols.

Dated 2nd July, 1860.

1588. C. P. Gontard, 60, Boulevart de Strasbourg, Paris—Imp. in remontoirs for winding up and setting right watches without keys.

1594. J. A. Salmon, Glasgow—Imp. in apparatus for feeding boilers, and in furnaces.

1596. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of hats. (A com.)

Dated 3rd July, 1860.

1600. C. J. E. Dumont, Liège, Belgium—Imp. in machinery or apparatus for separating minerals and substances of different specific gravities.

1604. J. Lane, Cranbrook-street, Old Ford, Middlesex—Imp. in screw-cutting lathes.

1606. L. E. Weber, Hotel de Bellevue, Brussels—Imp. in pipes and cigar holders.

1608. T. Richardson, Newcastle-on-Tyne—Imp. in purifying coal gas.

1612. F. Durand, Paris—An improved mode of purifying the Thames, and other tidal rivers.

Dated 4th July, 1860.

1614. G. S. Harris, 10, Oxford-street, Middlesex—Imp. in apparatus for rapidly cooling or refrigerating water, wine, beer, or other liquids.

1618. J. Shipley, Elton-street, J. Taylor, Asylum-street, and J. Shuttlewood, Thorpe-street, Leicester—Imp. in knitting machinery.

1622. J. Blake, Sheffield, Yorkshire—Imp in the manufacture of guns and fire arms of steel.

Dated 5th July, 1860.

1625. W. S. Squire, 37, Acacia-road, Saint John's-wood, Middlesex—Imp. in the production of colours for dyeing and printing.

1627. J. Ogden, Manchester—Certain imps. in power looms for weaving.

1628. W. Hood, Glasgow—Imp. in ladies' riding trousers.

1629. H. J. Standly, Pall-mall East, Westminster—Imp. in the production of gases for illumination and other purposes.

1630. A. V. Newton, 66, Chancery-lane—An improved construction of spring butt hinge. (A com.)

1631. W. F. Thomas, Newgate-street, London—Imp. in sewing machines.

1632. J. Noone, Peterboro', U.S.—A new and useful imp. in the carding machine. (A com.)

Dated 6th July, 1860.

1633. B. Lambert, 4, Warner-street, Dover-road—Imp. in treating printed paper to remove the ink and to obtain pulp, and also in treating printers' rags to remove the ink therefrom.

1634. W. Grimshaw, Lower Broughton, near Manchester—Certain imp. in machinery for compressing brick, earth, and other materials.

1635. J. De Maegt, Saint Josse-ten-Noode, near Brussels—Imp. in the manufacture of paper.

1637. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for pressing and ironing, applicable to clothing, book binding, and other purposes. (A com.)

1638. E. Biedermann, 14, Rockingham-row, New Kent-road, Surrey—Imp. in apparatus for the measurement of gas and other fluids.

1639. T. Doublet, 7, City-road, Finsbury square—Imp. in rifles and other fire-arms.

Dated 7th July, 1860.

1640. J. Leslie, Conduit-street, Hanover-square, Middlesex—Imp. in the manufacture of gas.

1641. J. Bircumshaw, New Lenton, Nottinghamshire—Imp. in machinery for the manufacture of warp fabrics.

1642. E. A. Snuggs and J. Snuggs, New Windsor, Berkshire—Imp. in the manufacture of tea-kettles and fountains, coffee-pots, cans, saucepans, stewpans, pails, and other articles of a similar character for domestic use, and baths, watering-pots, and other articles of a similar description.

1643. J. Newman, Birmingham—Imp. in the manufacture of hooks, and other similar dress-fastenings.

Dated 9th July, 1860.

1645. J. I. Taylor, Tucks-gardens, Sloane-street, and G. Butler, 3, Carlton-street, Kentish Town, Middlesex—Imp. in apparatus for stamping, printing, and embossing.

1647. J. Townsend and J. Walker, Glasgow—Imp. in obtaining sulphur, sulphite, and hyposulphide of lime, and oxide of manganese from bye or waste chemical products.

1649. G. F. Forbes, Inverness—Imp. in machinery or apparatus for cleaning cotton.

1651. R. A. Brooman, 166, Fleet-street—Imp. in railway breaks. (A com.)

1653. A. V. Newton, 66, Chancery-lane—Imp. in the construction of portable ovens. (A com.)

Dated 11th July, 1860.

1665. E. Franquinet, 4, South-street, Finsbury—Imp. in machinery or apparatus for rolling iron.

1667. T. Trotman, Crimscot-street, Grange-road, Bermondsey—An improved dress-fastening.

1669. R. Walker, Glasgow—Imp. applicable to horse bits.

1671. A. Smith, Glasgow—Imp. in the material for sizing or dressing yarns preparatory to weaving.

1673. J. Davis, Cinderford, Gloucestershire—Imp. in apparatus for the prevention of accidents at mines or pits.

1675. S. Povah, Liverpool—An improved combined portable steam-engine winch, and apparatus or machinery for operating the pumps and parts of the rigging, warping, raising the anchor, and for other uses on board ships where power is required, parts of the same being applicable for like uses separately.

PATENTS SEALED.

[*From Gazette, July 20th*, 1860.]

July 20th.

153. C. P. P. Laurens.
154. J. W. Scott.
169. R. F. Finlay.
178. T. Harrington.
179. J. T. Carter.
189. T. Donkin.
194. G. Ryder and J. Clay, jun.
200. J. Ingham & G. Hinchliffe.
201. P. Effertz.
235. J. Luis.
248. A. A. Larmuth.
285. R. Adams.
312. J. W. Walton.
1158. G. Price.

[*From Gazette, July 24th*, 1860.]

July 24th.

170. J. Appleby.
195. J. P. Lamar.
219. J. Lord.
220. C. N. Nixon.
226. J. Jeffreys.
227. T. B. Daft.
229. E. Langen.
246. G. Smith.
249. T. Smith.
251. G. Owen.
253. R. A. Brooman.
269. L. J. Brethon.
274. T. Routledge.
322. P. Chartroule.
329. E. Lea.
351. W. A. Gilbee.
395. L. J. T. Howard and L. Howard.
401. W. Hunter.
417. G. Bonelli.
519. C. W. Siemens.
569. W. Clark.
881. W. Clark.
1251. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, July 20th*, 1860.]

July 16th.

2027. C. Norris.

July 17th.

1988. T. Roberts and J. Dale.
1989. A. D. Lacy and W. C. Homersham.
1992. G. J. Wainwright and C. T. Bradbury.
2003. W. E. Newton.
2062. J. Clay.

July 18th.

1997. G. N. Newbery.

[*From Gazette, July 24th*, 1860.]

July 19th.

1988. F. H. Holmes.
2090. J. Beale.
2113. W. C. Cambridge.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, July 20th*, 1860.]

July 18th.

1714. C. Breeze.

[*From Gazette, July 24th*, 1860.]

July 19th.

1726. W. Thorp.
1728. E. Cockey, H. Cockey, and F. C. Cockey.

July 20th.

1740. J. M. Napier.

July 21st.

1733. G. Spencer.

Journal of the Society of Arts.

FRIDAY, AUGUST 3, 1860.

MECHANICS' INSTITUTIONS.

A Bill has lately been before Parliament to "Amend the Acts concerning Theatres and Public Houses," by one clause of which it was proposed to extend the meaning of the word "stage plays," as used in the Police Acts, so as to include under that term a great variety of entertainments, dramatic or otherwise. Such an extended meaning it was thought would (though not intended to do so) interfere with the proceedings of Mechanics' Institutions and other bodies of a similar character, and a letter was addressed by the Secretary of the Society of Arts to Sir G. Lewis, the Secretary of State, by whom the Bill had been brought into the House of Commons, calling his attention to the circumstance, and requesting that such modifications might be introduced as would exclude Institutions from the operation of the Bill. The Bill has since been withdrawn entirely.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£340,450	
*George Kent, 119, High Holborn, W.C.	200	Manufactures.
James Pratt Marrian, Birmingham	100	Manufactures.
Fownes Brothers and Co., 41, Cheapside, E.C.	100	Manufactures.
*Clabburn, Sons, and Crisp, Norwich	100	Manufactures.
George Jay and Son, Albion Mill, Norwich	100	Manufactures.
Aire and Calder Glass Co. Castleford, Free Trade Wharf, and 61, King William-street, E.C.	500	Commerce.
Brown and Polson, Paisley	250	Manufactures.
J. and J. Hopkinson, 235, Regent-street, W....	200	Manufactures.
Richard Viccars, jun., Vine Cottage, Padbury	100	Manufactures.
Barnett Meyers, Mill-lane, Tooley-street, E.C.	100	Manufactures.
Sir C. L. Eastlake, President of the Royal Academy, 7, Fitzroy-square, W. ...	200	Arts.
Frederick Tayler, 11, Upper Phillimore-gardens, Kensington, W.	200	Arts.
John Jackson Blandy, High-grove, Reading...	100	Arts.
The Earl of Rosse, F.R.S., Birr Castle, Parsonstown, Ireland	1,000	Arts.
Caley Brothers, Windsor	100	Manufactures.
Elsmore and Forster, Tunstall, Staffordshire	250	Manufactures.
C. Bruce Allen, Architectural Museum, South Kensington, W.	100	Arts.
Directors and Officers of the Crystal Palace Company:—		
Thos. N. Farquhar, Chairman	1,000	Arts.
A. Anderson	1,000	Arts.
David Price	1,000	Arts.
H. S. Bicknell	500	Arts.
Charles Horsley	200	Arts.
James Low	200	Arts.
Reginald Read, M.D.	200	Arts.
*A. C. Ionides	100	Arts.
*R. K. Bowley, General Manager	500	Arts.
Geo. Grove, Secretary	100	Arts.
John Moreton, Wolverhampton	100	Commerce.
TOTAL	£349,050	

BY ORDER, P. LE NEVE FOSTER, *Secretary.*

EXAMINATION PAPERS, 1860.

(*Continued from page* 675.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

NAVIGATION AND NAUTICAL ASTRONOMY.

THREE HOURS ALLOWED.

1.

One Question only in each Section to be answered.

(1.) On April 1st, 1860, in longitude 54° 35′ E., the observed meridian altitude of the sun's lower limb was 39° 27′ 35″ (z.s.), index error — 1′ 20″, height of the eye 13 feet: required the latitude.

On April 8th, 1860, at about 10h. 20m. 36s. a.m., mean time at place, in latitude 57° 25′ S., longitude 42° 40′ W., the observed altitude of the sun's lower limb was 21° 50′ 40″, index error — 2′ 00″, height of the eye 19 feet; and at the same time the sun's bearing by compass was N. 15° 45′ E.: required the variation.

(2.) On April 11th, 1860, at about 4h. 28m. a.m., mean time at place in latitude 31° 30′ N., longitude by account 22° 22′ W., when a chronometer showed 6h. 58m. 13s., the observed altitude of β Scorpii was 32° 35′ 45″, index error — 2′ 34″, height of the eye 21 feet: required the longitude.

On March 27th, at G. M. noon, the chronometer was fast on G. M. T. 58m. 34·5s., losing daily 2 seconds.

II.

Shew, by the sphere, that the *difference of latitude* equals the *nautical distance multiplied into the cosine of the course.*

(2.) Prove that $\text{Tan Course} = \frac{\text{Diff. long.}}{\text{Mer. diff. lat.}}$

(3.) Prove that, when sailing due east, the *distance* equals the *difference of longitude multiplied into the cosine of latitude.*

III.

(1.) Show that the distance determined by the log in a current, is the same as if there were no current.

(2). A ship sails by her reckoning 10 miles N.E., while a current sets her N.W. 10 miles; what is her actual course and distance?

(3). How do you find the course to be steered in a current?

IV.

(1). Correct the following courses :—

Compass Courses.	Variation.	Winds.	Leeway.
N. b. E. ½ E.	2¼ W.	N.W. ½ W.	2¼
S.S.W.	2¼ W.	W.	¼
N.W. b. W.	2¼ W.	S.E.	0
S. b. W. ¾ W.	2¼ W.	S.E. ¼ E.	2¼
S.W.	1¾ E.	S. b. E.	2½

(2.) My port bears N., and the wind is due N., and I can sail within 60 degs. of the wind, how much longer shall I be in reaching the port than with a fair wind, supposing the ship's rate the same?

V.

(1.) Required the course and distance from A to B,
Latitude A, 41° 16′ N., Longitude A, 39° 29′ W.
Latitude B, 43 29 N., Longitude B, 42 16 W.

(2) Sailed from A, S 49° 49′ E., 347 miles, required the latitude and longitude in. latitude A, 58° 29′ S., longitude 27° 39′ E.

VI.

(1.) Prove that the altitude of the pole is equal to the latitude of the place of observation.

(2.) Explain the method of finding the latitude by meridian altitudes.

(3) Explain the method of finding the meridian distance of a star. How will you know whether it is east or west of the meridian?

VII.

(1.) Explain and investigate an expression for the augmentation of the moon's semi-diameter.

(2.) What is the "equation of time?"

(3.) How is an interval of "mean solar time" converted into "sidereal time?"

VIII.

(1.) Investigate the rule for computing the "equation of equal altitudes."

(2.) Investigate the rule for computing the true azimuth.

(3.) Investigate the method of clearing the lunar distance from the effects of parallax and refraction.

PRINCIPLES OF MECHANICS.

THREE HOURS ALLOWED.

(1.) Mention the properties that distinguish a solid from a liquid and a gas.

(2.) State and prove the parallelogram of forces acting on a particle. If the angle between two equal forces acting on a particle be 120°, what is their resultant?

(3.) What is the centre of gravity of a body? Find that of five equal heavy particles placed at five of the angular points of a regular hexagon.

(4.) Find the ratio of power to weight in equilibrium on the screw. Construct a screw such that a force of 1 cwt. acting on an arm ten times the radius of the screw may raise five tons.

(5.) Find the (1) whole pressure, (2) resultant pressure on a surface immersed in a fluid. Estimate the pressure sustained by a diver when his centre of gravity is 32 feet under water. (N.B.—Surface of body = 10 square feet. 1 cubic foot of water weighs 1,000 oz.)

(6.) Define specific gravity. That of zinc is 6·862. What is the weight of water displaced by a portion of it which, when immersed, weighs 5,862lbs.?

(7.) Describe the air-pump, and any contrivances for estimating or increasing its exhaustive power. Compare the quantities of air in the receiver at the beginning and end of a stroke.

(8.) Describe the thermometer. Show how to compare the three principal methods of graduating it.

(9.) Describe the high-pressure steam engine. In what respect does it differ from other forms of the steam engine?

(10.) Give some account of varied construction and recent improvements in water-wheels.

(11.) Find the velocity with which an incompressible fluid, acted on by gravity, issues through a small orifice. A globe full of water, whose radius = 5 feet, has a cork, whose area = $\frac{1}{10}$th square inch, withdrawn from its base. Find the time of emptying the globe.

(12.) State and illustrate, by pertinent experiments, the three laws of motion.

(13.) Given the velocities of two inelastic bodies before impact, find their common velocity after impact. An inelastic sphere A, moving with a known velocity, impinges on an inelastic sphere B at rest, the line joining their centres at the instant of collision making an angle of 45° with the direction of A's motion. Determine the velocity of A after collision.

(14.) Show that the path of a projectile in vacuo is a parabola, and deduce the formulæ for its greatest height, range, and time of flight. What are the circumstances of motion, when the resistance of the air, which varies as the square of the velocity, is taken into account?

(15.) Exhibit the motion of a particle moving under the attraction of a central force varying inversely as the square of the distance. Acceleration varying inversely as square of distance; a point is at a distance of 32 feet, and moves through 100 feet per minute; the velocity necessary to describe a circular orbit is 10 feet per minute; find the periodic time.

(16.) What principle is largely employed in the solution of problems respecting rigid bodies? State it; and deduce from it the principle of Vis Viva in a system of rigid bodies. What forces will not appear in the equation?

A carriage with four wheels descends an inclined plane. Find its velocity at the bottom. Compare this with the velocity that would be acquired, (1) if two of the wheels were prevented from turning, (2) if the plane were smooth.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

(1.) Explain the principle of the hydraulic press, and give some details of the construction of this machine. What is the mode of preventing leakage between the ram and the cylinder?

(2.) Describe Newcomen's atmospheric steam-engine, show how it was altered and improved by Watt.

(3.) Sketch some forms of slide valve, and explain what is meant by the "lap" and "lead" of a slide.

(4.) Describe the mechanism usually employed for giving motion to the valves of a steam-engine.

(5.) In what manner can the exact working power of a steam-engine be ascertained?

(6.) Describe any self-acting drilling machine. What is the general principle of the methods commonly adopted for advancing the drill.

(7.) State the usual arrangement of a machine for planing iron, and describe some contrivances for reversing the motion of the table.

(8.) What is the object of providing change wheels for a lathe; explain how to use them.

(9.) Give some explanation of the mechanism of a lever watch.

(10.) How may the number of revolutions of a shaft be recorded mechanically. Explain the construction of the counting apparatus attached to a gas meter.

(11.) State briefly some of the modern improvements introduced into the construction of steam-boilers, and indicate their tendency in a mechanical point of view.

(12.) Show how to calculate the thickness of the plates of a cylindrical boiler of given dimensions, the pressure of the steam being also given.

MAGNETISM, ELECTRICITY, AND HEAT.

THREE HOURS ALLOWED.

(1.) What are the principal characteristics of magnetic force?

(2.) Explain the construction of the mariner's compass, and the dipping needle.

(3.) State the principal periodic phenomena by which terrestrial magnetism is influenced.

(4.) Explain the relations of magnetic and diamagnetic force.

(5.) State the two theories of electricity, and any reasons that you may have for preferring either.

(6.) What is the difference between an electrometer and an electroscope? Explain the construction and action of Coulomb's electrometer.

(7.) What are the principal requisites in the construction of lightning-conductors?

(8.) Explain the condensing electroscope.

(9.) By what means can you show that the electricities excited by friction and by chemical action are identical?

(10.) Explain the mode in which a voltaic current is produced in a battery-cell.

(11.) What is an astatic needle, and how is it employed in a galvanometer?

(12.) Explain the phenonomena of electro-magnetic rotation, and illustrate them by the action of any of the ordinary apparatus.

(13.) Explain the construction of an induction coil, and the several means of intensifying its effects.

(14.) What is the construction of the magnetic telegraph?

(15.) Is it likely that electricity can be advantageously employed as a source of mechanical power? State the reasons for your answer.

(16.) Explain the nature of muscular and nervous currents.

Heat.

(17.) Explain the difference between the conduction and convection of heat.

(18.) Describe the instruments required for observing very low, medium, and very high temperatures.

(19.) Explain the terms specific and latent heat; and mention the amount of latent heat in some bodies.

(20.) State some analogies between light and heat, and the theory of heat that you would thence be led to adopt.

(21.) What is the boiling point of a fluid? Mention the boiling points of ether, alcohol, oil, and mercury.

(22.) Explain the "spheroidal state" of a fluid; is this phenomenon of any practical importance?

(23.) What facts have been observed respecting the transmission of heat through various transparent bodies?

(24.) Explain the construction and use of either Daniell's, Mason's, or Regnault's hygrometer.

ASTRONOMY.

THREE HOURS ALLOWED.

(1.) Find the time of day by observation of the sun's altitude, his declination and the latitude of the place being given.

(2.) Explain the method of drawing a meridian line at any place.

(3.) Explain atmospheric refraction and its influence on astronomical observations.

(4.) Define horizontal and annual parallax and state what is known respecting the parallax of the fixed stars.

(5.) Describe the course of the seasons, at the pole, at the polar circle, on the tropics, and at the equator, and show when and where the sun is vertical.

(6.) Define the sidereal, tropical, synodic, and anomalistic periods of the moon.

(7.) Distinguish sidereal time, mean and true solar time.

(8.) Explain the principle of the repeating circle, and its use.

(9.) Describe the changes of temperature to which the moon is exposed in the course of a revolution.

(10.) Explain the apparent retrogradations and stationary conditions of the planets.

(11.) Describe the chief lunar inequalities.

(12.) Mention any particulars of comets, their motions, physical constitution, &c.

(13.) Explain the aberration of light.

(14.) State the construction and use of the meridian circle, and the method of determining the zenith point.

(15.) Explain the nature and result of observations on the length of the pendulum at different parts of the earth.

(16) Give any physical proof of the earths motion in its orbit.

(17.) Explain Newton's method of determining the motions of the moon and planets to be due to a force the same as terrestrial gravitation.

(18.) Explain the "conservation of areas," how first established, and how proved by theory.

(19.) How is the distance of the sun from the earth found by means of a transit of Venus across his disc?

(20.) Mention what is known of the nature and motions of double stars.

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is to answer more than three questions in each division.

First Division.

(1.) Describe the composition of the atmosphere and the processes by which several of its constituents are removed and returned.

(2.) By what methods can oxygen be most conveniently prepared on a large scale?

(2.) What are the chief constituents of the smoke evolved on the imperfect combustion of coal? And what conditions must be fulfilled by every contrivance for the combustion of smoke?

(4.) What is the cause of the hardness of spring water? How is that hardness estimated quantitatively? How removed?

(5.) Describe the manufacture and chief uses of lamp-black.

(6.) In what reactions do chlorine, bromine, and iodine resemble one another? How are they separated from one another?

Second Division.

(1.) How is arsenic most conveniently separated from organic or other mixtures?

(2.) Describe the metallurgy of copper and the commonest impurities occurring in the metal.

(3.) Describe the preparation and properties of the chief commercial products containing chromium.

(4.) How is cobalt purified from nickel?

(5.) Describe and explain the manufacture of soda-ash, also the preparation of pure carbonate of soda from that product.

(6.) How much sulphur is contained in 315 grains of sulphate of baryta?

Third Division.

(1.) How much air is needed for the complete combustion of a cubic inch of olefiant gas?

(2.) Describe the process of analysing compounds containing carbon, hydrogen, and oxygen, and the calculation of the formula of a compound from the results of analysis.

(3.) What are the chief products formed by the dry distillation of wood? And how are they separated from one another?

(4.) How is acetone prepared? How purified? How distinguished from alcohol?

(5.) Describe the manufacture of quinine from bark.

(6.) What compounds does bisulphite of soda form with organic bodies?

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

N.B.—The Candidate may choose such questions from this paper as he judges he can satisfactorily answer within the time allowed; it being understood that value will be given for the fulness as well as the number of the answers, provided they are to the point.

(1.) Explain briefly the meaning of the following terms:—Organ, Function, Vital Property, Absorption, Nutrition, Secretion, Homology.

(2.) Give a short account of the structure and function of the skin; including the cuticle, hairs, and nails, with the perspiratory and sebaceous glands. By what means may the sensibility of the skin on different parts of the surface of the body be compared, and what are the chief results of such comparison?

(3.) What are the anatomical peculiarities of the human frame which specially fit man for his erect posture?

(4.) State the proximate chemical constituents of the human body, specifying the several tissues or fluids in which they severally occur; mention also the alimentary principles contained in human food, and point out the purposes which they respectively fulfil in nutrition. Are all the constituents of the body equally liable to waste and renewal, and how far is there evidence to warrant the assertion that "we may be said to moult or cast away our old body and get a new one every forty days?"

(5.) Describe the structure of the heart, the general arrangement of the blood-vessels, and the course of the circulating blood in each class of vertebrated animals.

(6.) Give an outline of the structure and general arrangement of the nervous system in a vertebrated animal, and mention the chief differences that system presents in the invertebrata. State briefly the functions of the nervous system.

(7.) How is the human eye adapted to distinct vision at different distances; and how does vision enable us to distinguish between superficial figures and solids?

(8.) How is the sound of the voice generated, and by what means is it varied in pitch and intensity?

(9.) State what fishes are known to have the power of giving an electric shock. Describe the structure of the electrical apparatus of these animals, and give an account of the electrical phenomena which they exhibit, and of the part which the nervous system appears to perform in the manifestation of these phenomena.

(10.) What is there remarkable in the reproduction of the plant-louse (Aphis); and what other animals present similar phenomena?

BOTANY.

THREE HOURS ALLOWED.

The Candidate is to answer every question in each Section.

Section I. (For Competency.)

(1.) Of what parts or organs does a flower usually consist? Mention those of the peach or plum.

(2.) What are the parts of a stamen, and what the purposes they serve?

(3.) When a plant is said to be stemless (*acaulis*), what is really meant?

(4.) Explain the meaning of the word tuber, and mention some plants in which that body is found.

(5.) What purpose do leaves answer?

(6.) What is the nature of that part of a thistle which is vulgarly called its flower; what is the "down," and what the so-called "seeds"?

Section II. For (Proficiency or Excellence.)

(1.) Describe the functions of the epidermis?

(2.) What are the functions of the root, and by what means is it able to perform those functions.

(3.) Describe the effect of light upon plants.

(4.) Describe the relative position of the various organs found in any complete flower, whose parts are of the same number in each whorl or series; and explain the reasons why they stand in such a relative position.

(5.) By what character is the genus Aconitum known from Helleborus?

(6.) What are the characters of the Leguminous order? Name the common species, used for food and otherwise If an unknown Leguminous plant were placed in your hands, what would you expect its sensible properties to be?

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

(1.) Describe the effect of the division of labour when carried to excess, upon individual characters

(2.) Who was Mandeville, and what were his notions of Political Economy.

(3.) What is meant by the exchanges being at par between two countries. What causes keep them at that level, or make them rise above or sink below it?

(4.) In what cases do taxes on the necessaries of life fall upon the wages of the labourer.

(5.) What are the principal taxes that come under the description of the Inland Revenue? What does a 1 per cent. income tax produce? And what are the particular objections to the paper duty?

(6.) Name, in their order, the six most populous towns in the United Kingdom, and state the respective population of each.

THE FOLLOWING QUESTIONS ARE OPTIONAL.

(7.) Describe the different sorts of Insurance, the principles on which they rest, and the mode in which they are severally conducted, and account for the greater prevalence of insurance in this country than in any other.

(8.) Describe savings banks, state their most important regulations, the whole amount deposited in them, and show in what way they have cost money to the state.

(9.) What does Mr. John Stuart Mill mean by the stationary state, and in what way does a country arrive at it.

(*To be continued.*)

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, OXFORD.

On the Density of Saturated Steam, and on the Law of Expansion for Superheated Steam. By William Fairbairn, Esq., F.R.S.

At the last meeting of the British Association, I detailed a new method* of ascertaining the specific gravity of vapours,

* A description of the method adopted is given in the *Journal*, Vol. VII., p. 749.

which, in conjunction with my friend Mr. Tate, I was employing with a view to ascertain the density of steam at all temperatures. It may be of interest to the Association to know, that I believe the method to have proved itself reliable, and that we have now experimental determinations of the density of steam, and these fully verify the anticipations of Mr. Thomson and Mr. Rankine, that the vapour of water does not accurately obey the gaseous laws. I have found the density of saturated steam always greater than that given by the gaseous steam even for temperatures as low as 136° Fahr., and for pressures less than that of the atmosphere.

The experiments as they stand at present extend over a range of temperature from 136° Fahr. to 292°, or from 2·6 to 60lbs. pressure per square inch. But as I hope to extend them to higher pressures, I have preferred to leave at present the consideration of their bearing on other formulæ, and the ultimate generalisations to which they may lead in regard to the use of steam. The following simple formula, however, very nearly expresses the results of the experiments as to the extent of density and pressure of saturated steam, the relation between pressure and temperature having been already determined with scrupulous accuracy by the elaborate investigations of Regnault.

Let V be the specific volume of the steam or volume as compared with that of an equal weight of water.

P = the pressure in inches of mercury; then I find,

$$V = 25{\cdot}62 + \frac{49513}{P+72}$$

Table of Results,

Showing the relation of Density and Pressure of Saturated Steam.

No.	Pressure. In lbs. per sq. in.	Pressure. In inches of mercury.	Temperature Fahr.°	Specific Volume. From Experiment.	Specific Volume. By Formula.	Proportional error of Formula.
1	2·6	5·35	136·77	8,266	8,183	$+\frac{1}{100}$
2	4·3	8·62	155·33	5,326	5,326	0
3	4·7	9·45	159·36	4,914	4,900	$-\frac{1}{350}$
4	6·2	12·47	170·92	3,717	3,766	$+\frac{1}{74}$
5	6·3	12·61	171·48	3,710	3,740	$+\frac{1}{123}$
6	6·8	13·62	174·92	3,433	3,478	$+\frac{1}{76}$
7	8·0	16·01	182·30	3,046	2,985	$-\frac{1}{50}$
8	9·1	18·36	188·30	2,620	2,620	0
9	11·3	22·88	198·78	2,146	2,126	$-\frac{1}{97}$
1	26·5	53·61	242·90	941	937	$-\frac{1}{235}$
2	27·4	55·52	244·82	906	906	0
3	27·6	55·89	245·22	801	900	$+\frac{1}{100}$
4	33·1	66·84	255·50	758	758	0
5	37·8	76·20	263·14	648	669	$+\frac{1}{32}$
6	40·3	81·53	267·21	634	628	$-\frac{1}{100}$
7	41·7	84·20	269·20	604	608	$+\frac{1}{150}$
8	45·7	92·23	274·76	583	562	$-\frac{1}{29}$
9	49·4	99·60	279·42	514	519	$+\frac{1}{100}$
11	51·7	104·54	282·58	496	496	0
12	55·9	112·78	287·25	457	461	$+\frac{1}{114}$
13	60·6	122·25	292·53	432	428	$-\frac{1}{108}$
14	56·7	114·25	288·25	448	456	$+\frac{1}{56}$

The above table exhibits accurately the results at which we have arrived in regard to saturated steam; we have also obtained some results on the rate of expansion of superheated steam. These results are at present less complete than those upon saturated steam, as they do not range more than 20 degrees of temperature in each case, above the maximum temperature of saturation. They appear, however, to show conclusively that near the saturation point steam expands very irregularly, thus agreeing with what we know of other bodies in their physical relations at or near the point at which they change their state of aggregation. Close to the saturation point we find a very high rate of expansion, but this rapidly declines as the steam superheats, and at no great distance above it the rate of expansion nearly approximates to that of a perfect gas.

Thus for instance in the experiment where the point of maximum saturation was 174°92, between this and 180° the steam expanded at the rate of $\frac{1}{190}$, whereas air would have expanded $\frac{1}{634}$; but on continuing the superheating the co-efficient was reduced, between 180° and 200°, from $\frac{1}{190}$ to $\frac{1}{637}$ and for air the co-efficient would have been $\frac{1}{639}$, or almost exactly the same, and this rule holds good in every experiment; a high rate of expansion close to the saturation point diminishing rapidly to an approximation to that of air.

Giffard's Injector for Feeding Boilers. By William Froude.

This singular and interesting instrument, in the opinion of almost all those who have had an opportunity of testing its merits, bids fair to supersede entirely the ordinary feed pump.

It is not intended here to enter into its economical merits, though these are many and obvious. But the dynamical principles involved in its action seem to need investigation, parly on account of the *primâ facie* paradoxical character of its results, and partly least, from its principles being imperfectly apprehended, and the rules for its management resting solely on an empirical basis, its results should in some instances be less successful than they ought to be.

The illustration (see next page) represents a vertical section of the apparatus, which may be modified and varied in its mechanical details and the proportions of its parts. A B is a steam pipe, leading from the boiler to the steam jet pipe C D, which is fitted at its extremity with a contracted nozzle. The aperture of this orifice is governed by the adjustable rod F, by the conical end of which it can be entirely closed at pleasure. G is a pipe connected with the supply of feed water, which it conveys to the small chamber I, surrounding the steam jet pipe C D. This chamber is expanded at the bottom so as to admit of the free passage of an annular jet of water which is drawn up through the pipe G by the action of the steam jet, and is tapered away to a conical outlet corresponding with the contracted orifice or nozzle of the steam jet pipe; so that the water flowing to this outlet embraces the steam jet at the point of its issue. The pipe C D is provided with a longitudinal adjustment, as shown in the illustration, by which the virtual area of the conical outlet upon the chamber I can be regulated or closed.

P is the feed pipe leading into the boiler; it is provided with a valve at O, which permits an influx of water into the boiler but prevents its reflux.

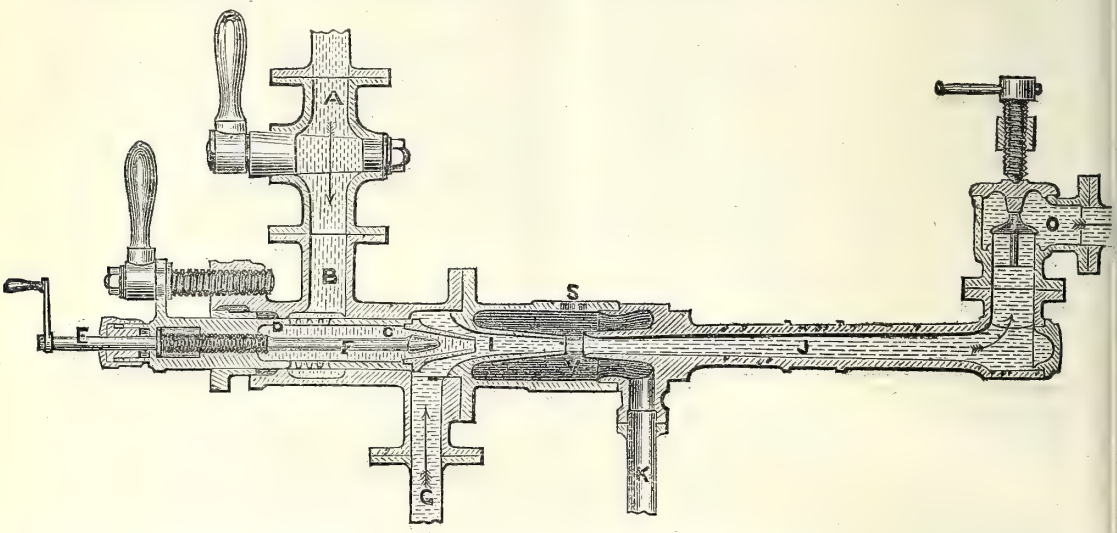
When the instrument is in operation, the jet of steam issuing from the nozzle of the steam jet pipe C D combines with the water which embraces it at I, and both rush together through the mouthpiece J and valve O into the feed pipe P, entering the boiler—the water thus carried in is the *feed*.

At the commencement of the operation, and before the motion has become established, an overflow of water takes place at the interval between the nozzle of the steam jet pipe and the contracted extremity of the mouth piece J. This space is therefore housed in, and is provided with a waste pipe K, through which the overflow passes into a small cistern or reservoir immediately below it, which can be emptied at pleasure.

A glazed peep-hole S, in the upper part of the housing, enables the operator to watch the result, and satisfy himself that it is such as it ought to be.

Before proceeding to discuss the rationale of the process, it cannot be improper to point out the apparently paradoxical character of its results. It may fairly occa-

sion surprise, to find that a jet of steam issuing from one part of a given boiler, will not only force its way violently into an aperture opened in another part of the same boiler, but will carry with it a considerable volume of water



which it has taken up in its course; or, what seems still more strange, that it is capable of thus forcing its way into a boiler working under a considerably higher pressure than that from which it has issued. But the explanation appears to be sufficiently simple.

The velocity with which the particles of steam will issue from an orifice in a boiler working at a given pressure, does not admit of accurate statement in very simple terms; but it will be sufficiently near the truth to say that this velocity must be such that if we were to take an account of the momentum of the steam issuing in any given unit of time, (expressing this in terms of the product of its mass or weight, and its velocity), and were to compare this with the momentum of a similar jet of water or any other fluid issuing from an equal aperture under the same pressure, the momentum must be in both cases the same, for it must be the true equivalent of the force which operates through the given unit of time, to create the discharge; and this, depending on the area and pressure, may be treated as being the same in both.

It may be observed in passing that a jet of steam thus issuing, if made to impinge on an aperture opening into a boiler of rather lower pressure than that from which itself has issued, would overcome the momentum of the jet which would endeavour to issue thence, would reverse the motion and would itself penetrate into the boiler.

If now we could contrive simply to condense our jet of steam at the moment of its issue as if by surface condensation, it would assume the form of a jet of water whose particles possessed exactly the same weight and the same velocity as that which they had possessed when in the shape of steam, and would possess therefore the same momentum. There is nothing in the act of condensation which can tend to modify this.

But the momentum would be embodied in a jet of very reduced diameter, and if the jet of steam possessed a sectional area of one square inch, we should find that the jet of water to which it was reduced would possess an area of only $\frac{1}{1700}$ part of an inch.

Although therefore the absolute momentum of the jet would be exactly the same as it had been before condensation, its *momentum per square inch* would be 1,700 times as great as it had previously been, and would be capable of driving back a jet of water or steam which might be attempting to issue from a boiler carrying a pressure nearly 1,700 times as great as that carried by the boiler from which itself had issued.

This simple condensation would indeed be, perhaps, difficult to accomplish, and would be useless when accomplished, except as an illustration of a principle. But if a supply of water be allowed to flow in and mingle with the steam while it effects its condensation, as is the case in the "Injector," we accomplish an easy and very useful result. Whatever be the quantity of water which the steam takes up with it, the momentum of each unit of the compound jet thus created will remain exactly what it was; for what has been gained in its volume will have been lost in its velocity; and if only the increase of volume be limited by the condition that the sectional area of the compound jet shall be somewhat less than that of the original jet of steam had been, so as to contain the same momentum within a smaller sectional area, that jet, if allowed to impinge on a corresponding orifice leading into the feed pipe, will be capable of freeing its way in a continuous stream into the boiler from which the steam had issued. Or if the water supplied be such as to leave the diameter of the compound jet still smaller, the jet will be capable of penetrating into a boiler having a pressure greater in the same proportion.

It would be difficult to deduce the limits governing the possible pressure of feed and volume of feed which it would be in our power to command, under the varying conditions of volume and temperature in the water supplied. But probably the practical difficulties of insuring instantaneous condensation, when the feed water is very limited in amount or very high in temperature, are such as to render the complete investigation nugatory; in point of fact, it was found difficult to manage the instruments satisfactorily in the *Great Eastern*, when the temperature of the feed water approached 100° of Fahrenheit.

But as the only test of the correct adjustment of the instrument for successful action, is for the present the purely empirical one of observing that it operates quietly and without overflow, it will be of service to point out that from the nature of the principles on which the operation depends, this apparent equilibrium may arise from two causes, one of which involves a loss of real effect. It may arise either from the fact that the steam is so fully condensed and charged with water, that it is only just capable of penetrating the feed pipe with its load, and thus the maximum effect is produced; or, on the other hand, it may arise from the fact that the supply of water is so small as to be only just sufficient to enable the penetration to take place; when, of course, the result will be

defective: in the former case, the jet will consist wholly of water; in the latter case, uncondensed steam will preponderate in volume. In the intermediate condition, the jet will contain an excess of penetrating power, and will therefore seize upon and carry with it a volume of air which will thus be carried into the boiler with the feed acting injuriously in another way.

On board the *Great Eastern*, Mr. Appold and myself witnessed the occurrence of this very circumstance. In two separate instances we observed that air was being drawn up through the waste pipe into the jet of feed; and the test of this was not only that light substances were drawn into it, such as threads of cotton waste, or filaments of smoke, but that on filling the cistern with water so as to cover the exit of the waste pipe, the water itself was continuously drawn up pretty rapidly, and was thus added to the feed. On our pointing out the circumstance to the fireman who had charge of the instrument, he proceeded in each case to check the suction of air, by limiting the primary supply of feed water, thus producing an apparent improvement, while he was in truth doubly impairing the final value of the result; for he both lessened the primary supply of feed, and stopped that auxiliary supply which we had seen the instrument was ready to take up through the waste pipe.

IRON.

The *Newcastle Courier* says:—"In Kent, Sussex, and Northampton, the iron trade is about to receive an extension. Two companies are being organised near Faversham, for the purpose of working the iron ore in the two former counties, and shipping it to the Tyne and the Tees for the use of the furnaces in this district. The vessels that bring the iron here will take coal back again, and the freights by these return cargoes will be eased. The coals taken will be coking and household, for both of which kinds a great demand has sprung up since the opening of the Mid Kent and East Kent Railways. The coking coals will be made into coke by the railway companies, and for the household coals a ready market will be found in the towns along the new lines, which will get them cheaper and easier by this route than by any other at present available. Our enterprising neighbours, Messrs. Bell Brothers, of Middlesborough and Wylam, have tested the Kentish ore, found it of excellent quality, and expressed themselves ready to enter into a contract with the promoters of the company for purchasing a large quantity both for melting and forge purposes. The demand for the Northamptonshire ironstone increases steadily, and the quality is found to improve. One Newcastle firm has recently tried it, and found it produced 40 per cent. of iron. Mr. J. Morrison, of Newcastle, has some blast furnaces at Heyford, near Weedon-beck, Northamptonshire, which have recently been blown out in consequence of an unfortunate difference with the parties who supply the ore."

Home Correspondence.

EXHIBITIONS OF COLONIAL PRODUCE.

Sir,—A most interesting Exhibition, consisting of the products of Algeria and other French colonies, has just been opened at the Palace of Industry, in Paris, and is announced to be a permanent one. In going over it the other day, I was struck with the idea that the formation of a similar permanent Museum in London, comprising all the varied productions of our extensive colonies, would establish a perpetual connecting link between the producers abroad and the consumers at home, which is now wanting, and would prove a great boon to both in a commercial way, besides the information it would afford in a scientific point of view. Should this plan be approved of and taken up by influential persons, the forthcoming Exhibition of 1862 would afford an excellent opportunity for carrying it out. The various Committees in the Colonies would be glad to see the specimens they send, formed into a Museum at the close of the Exhibition, instead of being wasted as they were in 1851; and were they informed that those collections were intended for permanent exhibition, it would no doubt induce them to make them still more perfect and complete.

If any of your readers feel interested in the matter, I beg to refer them to a review of the French Colonial Exhibition, in the *Technologist*, a new scientific magazine, the first number of which, under the editorship of one of our active members, Mr. P. L. Simmonds, has just appeared, and in which they will find my views on the subject more fully developed.—I am, &c., E. RIMMEL.

August 2, 1860.

UNIONS OF INSTITUTES.

Sir,—It is now twenty-three years since the Institutes of the great county of York were formed into union for mutual aid and support, and the wisdom of the step which was then taken is not only proved by the present condition of the Yorkshire Institutes, but the example has been followed in other parts of the kingdom. In Lancashire and Cheshire, in Northumberland and Durham, in Hampshire and Wiltshire, in Dorset and Somerset, in Worcestershire, in South Staffordshire, and in some other districts, unions have been formed with similar objects, and there can be little doubt that if the system were general, if the whole of England were divided into local districts containing one, two, or three counties, according to the respective area and population of each, a considerable impetus would be given to adult education, and to that promotion of mental cultivation, and the study of science and literature, which are indispensable to the maintenance of our national supremacy. We hear of political advancement and social progress, but they will not be promoted by speeches, however eloquent, either on the hustings or in Parliament. The nation is an aggregate of individuals, and the object can only be accomplished by individual exertion, each one in the first place for himself, then by his influence operating on others, forming local institutions for mutual assistance and encouragement, and by district unions, stimulating each Institution to renewed efforts and sustained perseverance.

The Yorkshire Union now comprises 143 Institutes, with an aggregate of more than 26,000 members, of whom 2,600, or ten per cent., are females, so that in this respect alone, in the influence exercised on those who are merely subscribers, there exists a great power for good, an interest, if little more, in the cultivation of human intelligence, and a co-operation which can hardly be without beneficial results. As a further proof, however, of the success with which the Institutes in the Yorkshire Union are labouring for the common good, the following figures may not be uninteresting:—

Number of Pupils of Evening Classes.....	8,500
Number of Books in the several libraries ...	143,000
Issues of Books during the year.....	350,000
Number of Periodicals in Reading-rooms ...	1,050
Do. Newspapers do. ...	1,050
Number of Lectures delivered during the year	750

The subjects taught in the evening classes are numerous and varied, many of them having special reference to the Examinations of the Society of Arts; and the number of certificates which have been obtained by Yorkshire candidates—190 this year—will show the success which they have achieved. The subjects are:—

Reading.	Mensuration.	Dictation.
Writing.	Book-keeping.	Elocution.
Arithmetic.	Chemistry.	Discussion.
Grammar.	Latin.	Philosophy.
Geography.	French.	Theology.
History.	German.	Chess.
English Literature.	Vocal Music.	Needlework.
Mathematics.	Instrumental do.	Cookery.
Algebra.	Drawing.	
Geometry.	Phonography.	

With reference to the proportion of class pupils to members, it may be stated that in the Borough of Leeds there are 12 Institutes, having 3,809 members, of whom 1,081, or nearly 30 per cent., are pupils of evening classes; at Bradford, 2 Institutes have 1,706 members, of whom 855, or 50 per cent., are class pupils; at Halifax, 2 Institutes, with 1385 members, and 580 pupils, or 22 per cent.; whilst at Huddersfield the number of members in 2 Institutes, is 1,461, and the class pupils 1,024, or 70 per cent. This must be satisfactory evidence of the educational agency of Mechanics' Institutes in the manufacturing towns of Yorkshire.

It may not be uninteresting to know the kind of books which circulate amongst the members of Mechanics' Institutes. The following is a statement of the circulation of the library of the Leeds Mechanics' Institution during the years 1855, 6, 7, 8, and 9:—

		Per cent.
Theology	7,086	3·10
Philosophy—Education ...	7,210	3·15
Politics—Statistics	1,757	0·75
History—Biography ...	28,075	12·60
Voyages and Travels ...	11,928	5·35
Poetry—the Drama ...	7,839	3·45
Fiction	76,779	33·90
Fine Arts—Literature ...	18,358	8·10
Science	8,699	3·85
Natural History—Gardening	5,580	2·45
Bound Periodicals	22,046	9·72
Unbound ,, ...	30,725	13·58
	226,082	100·

The above may be a guide to those desirous of increasing or forming a library for a Mechanics' Institute.

It may be asked in what way the Union promotes the success of the several Institutes which it comprises. There is, in the first place, the advantage of organisation and mutual co-operation. Every year a Conference is held of delegates from the several Institutes, and the opportunity is thereby afforded for the interchange of experience, so that errors in management may be corrected, and flagging energies stimulated to renewed exertions. The annual report of the central committee embraces the principal features furnished by the experience of each Institution during the preceding year, and forms the only permanent record of the history and progress of these Institutions. Besides this, it extends the knowledge of them to many others, and often leads to their formation in districts where no Institute exists. It contains also much valuable and interesting information.

The Union affords many facilities to Institutes for obtaining lectures both professional and gratuitous. It has the services of a paid agent and lecturer, who is in constant communication wherever his services are required, giving the advantage of his experience in all cases of doubt and difficulty, and assisting in the formation of new Institutes, as well as advocating their support at public meetings. Through the organisation of the Union, information is disseminated of anything which may affect the interests of the several Institutes, and united action commenced wherever it may be deemed to be necessary.

At the annual meeting of the Union, which is held every year in a different locality, the presence of the nobility and influential gentry directs public attention to these Institutions more efficiently than it could otherwise be done, and helps to secure that sympathy and support which might otherwise be withheld. In the organisation of an efficient system of Examinations preparatory to the more advanced studies required for those of the Society of Arts, a distinct Union is almost indispensable, and if such Unions were generally formed throughout the kingdom, they would not only materially assist in increasing the individual prosperity of each Institute, but extend far more widely than hitherto the beneficial influences of the Society of Arts Examinations.

I am, &c., BARNETT BLAKE.

Leeds, July 30, 1860.

Proceedings of Institutions.

Abingdon Mechanics' Institution.—The annual report of this Institution states that the year now terminated has been the sixth of the Society's existence, and it has been a year of marked increase in the number of the Society's members, in the number and attendance on the Society's lectures, and generally it is hoped in its usefulness and value. The numbers have increased from 170 at the commencement of the year to 296 at its close, and the committee feel that this large increase is the best evidence of the usefulness of the Institution, of the soundness of the principles upon which it has been conducted, and of the increasing interest which its proceedings have excited. The library has been increased to 281 volumes, having numbered at the beginning of the year 220 volumes. The Committee press upon the Society the importance of a larger outlay in this department; they request gifts of books, special donations to a library fund, and they advise that members be invited to recommend books suitable for purchase, and that the librarian be instructed to keep a register of all books so recommended to the notice of the Committee. The number of issues of books from this small library has amounted during the past year to 660. 16 lectures have been delivered during the past year, 9 of them gratuitous. The expenses which have been incurred on the account of lectures amount to £54 15s. 9d., against £56 18s. 6d. realised by the sale of tickets of admission. A great increase has taken place in the number of lady members (frem 25 to 60) owing to the improved character of the lectures. The music class has been continued during the past year, and its numbers have averaged 23 members. In August 1859, a Discussion Class was formed in connexion with the Institute, to which 38 members have been admitted. The Committee are under great obligation to Mr. H. P. Peyman, for allowing the meetings to take place at his house. This class, as well as the former, is self-supporting. The increased number of members has necessitated some increase in the expenses incurred for newspapers, but, nevertheless, the accounts present a balance of £5 14s. 2d. carried forward to the next year's income.

Ebbw Vale Literary and Scientific Institution.—In the report for the past year the Committee remark with regret that the progressive improvement which has hitherto characterised it from the commencement has not been maintained. There is still a great, if not increased demand for books from the library, and the average attendance of members in the reading-room has been larger than in past years, but there is a marked falling off in the number of subscribers. The year commenced with a list amounting to 244; each succeeding quarter has shown a decrease, until at the end of the year, the number who have paid up their subscription amounts only to 205. Another great source of regret is the want of success attending the working of classes. Several have been formed during the year, but from some cause their duration has been brief, and the Committee take the opportunity of drawing the attention of all the members to the advantages, and indeed the necessity (unless they are content with a much lower status than that possessed by Institutions of a kindred nature) of employing these comparatively cheap and practical means of instruction and advancement. The society, during the past year, has lost the services of Mr. William Davies, who has resigned office after a period of nine years' gratuitous service as secretary; his assistance was more valuable since it was rendered at a time when the Institution was struggling with difficulties. The Committee have accorded him a suitable vote of thanks, but have deferred until the annual meeting that acknowledgment which they consider due, and which, coming from a general meeting of members, they think would be more acceptable, viz:—placing his name on the list of honorary members. The number of books issued from the library has been as follows:—History, 112; science and

philosophy, 147; biography, 155; voyages and travels, 172; tales and novels, 854; poetry, 205; general literature, 526; religious literature, 185; periodicals, 141; making a total of 2,497. 217 additions have been made in this department. A new and enlarged catalogue has been issued. The Society now possesses 1,335 books, and all but a few are in very good preservation. The thanks of the members are due to Mr. R. S. Small, the librarian, for his constant and valuable services. The museum still continues to attract, and many donations have been made during the year. The committee strongly invite the attention of members who have repeated opportunities to the securing specimens illustrating the geology of the district, and any other objects of interest connected with the neighbourhood, thereby rendering it generally as well as locally instructive. The lectures and entertainments, which the sub-committee appointed for that purpose have succeeded in procuring during the year, are as follows:—Mr. Frederick Yorke Mellon, "Shaksperian Readings: Lays and Lyrics;" Mr. Basil Young, "A Peep at Life;" Mrs. C. L. Balfour, "On the Moral and Intellectual Influence of Women on Society;" Charles Moore, Esq., F.G.S. (Gratuitous), "On the Ancient Natural History of the Earth;" Mr. Walter Rowton, "An Evening with Charles Dickens;" Miss Lizzy Stuart, "Lays and Legends of Scottish Minstrelsy;" Mr. Ellis Roberts, "An Hour with the Welsh Bards; Mr. J. K. Applebee, "Oliver Goldsmith: A Literary and Biographical Review;" Mr. L. W. Lewis (Llew Llwyfo), "A Literary and Musical Entertainment." To all of these the members have been admitted with considerable privileges, and to many of them free, the object being not so much to increase the funds of the Society from this source, as by offering advantages to its members to induce others to join. The sum of £1 5s. 4d. has been handed over to the society. Although the statement of accounts shows that there is a balance due to the treasurer, the Committee are of opinion that the society is financially in a better position than at the close of the past year.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

241. Bills—Plea on Indictments.
243. Bills—Clearance Inwards and Lien for Freight.
San Juan—Correspondence.
Papal States—Despatches from Mr. Lyons.
Italy, Savoy, and Switzerland—Correspondence.
Honduras—Treaty.

Delivered on 10th July, 1860.

370. Army Examinations—Return.
426. Scottish Universities—Copy of Ordinance.
242. Bill—Endowed Charities.
Chancery Evidence Commission—Report.

Delivered on 11th July, 1860.

169 (2). East India (European Troops)—Papers, Part 3.
433. Dockyard Workmen—Return.
435. Criminal Law Accounts—Returns.
437. Scottish Universities—Paper.
438. East Indies (India Office)—Copy of an Order in Council.
231. Bills—Common Law Procedure (Ireland) Act (1853) Amendment.
244. Bills—Inclosure (No. 2).

Delivered on 12th July, 1860.

394. Sugar, &c.—Return.
424. National Gallery (British School)—Return.
422. East India (Local European Forces)—Return.
445. Chalk—Return.
233. Bills—Larceny Laws Consolidation Act Amendment.
234. Hackney Carriages (Metropolis) Act Amendment.
245. Bills—Herring Fisheries (Scotland) (as amended in Committee and on Re-commitment).
246. Bills—Fisheries (Scotland) Lords Amendments.
250. Bills—East India Stock Transfer, etc.
252. Bills—Turnpike Acts Continuance.
253. Bills—Copyhold and Inclosure Commissions, etc.
254. Bills—Turnpike Trusts Arrangements.
255. Bills—Highway Rates Act Continuance.

Delivered on 13th July, 1860.

446. Public Works (Ireland)—Return.
248. Bills—Votes at Elections.
249. Bills—Railways (Ireland) Act (1851) Amendment.
251. Bills—Maynooth College,
257. Bills—Locomotive (as amended in Committee and on Re commitment).

Delivered on 14th and 16th July, 1860.

15. Railway and Canal Bills (154, Forest of Dean Central Railway (No. 2)—Board of Trade Report.
436. Education (Ireland)—Annual Report of Commissioners.
502. East India (Disarming the Natives)—Return.
451. Reform Bill (1858)—Return.
453. China (Naval Operations)—Estimate.
431. Packet and Telegraph Contracts—3rd Report from Committee

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 27th*, 1860.]

Dated 17th March, 1860.

706. W. N. Wilson, 144, High Holborn, Middlesex—Imp. in floor sweepers.

Dated 1st June, 1860.

1355. T. F. Newell, Cloak-lane, Cheapside—Imp. in punching the leaves of cheque and other books and other papers. (Partly a com.)

Dated 4th June, 1860.

1364. W. Taylor, Nursling, near Southampton—An improved hand light or portable green house, to be used for growing and protecting plants, either with or without artificial heat.

Dated 6th June, 1860.

1388. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved mode of preparing plants to be used in the manufacture of paper. (A com.)

Dated 22nd June, 1860.

1516. H. Palmer, 8, Wakefield-terrace, Caledonian-road, Islington, and H. S. Swift, Langbourn-chambers, Fenchurch-street—Imp. in the method of, and apparatus for, propelling ships, vessels, boats, or other craft, in, on, or through the water.

Dated 26th June, 1860.

1554. J. Fletcher, Farnham-place, Southwark, Surrey—Imp. in the apparatus for treating saccharine and saline solutions.

Dated 28th June, 1860.

1564. C. Binks, Parliament-street, Westminster—Imp. in manufacturing chlorine.

Dated 5th July, 1860.

1624. T. Walker, 2, Grove-cottages, Hill-street, Peckham, Surrey—An improved collapse detector pocket, for protecting articles worn on the person.
1626. S. Krotkoff, 1B, Welbeck-street, Cavendish-square—Imp. in apparatus for employing the electric light.

Dated 9th July, 1860.

1644. R. Pollit, Bolton-le-Moors, Lancashire—Certain imp. in the construction of steam boilers.
1648. H. Disston, Laurel street, Philadelphia, U.S.—Imp. in hand saws.
1650. J. C. Malfille, Bordeaux—An improved elastic band for sustaining and tightening pantaloons, and waistcoats, drawers, petticoats, or other dresses.
1652. F. Heindryckx, Northumberland-street, Strand—Imp. in the construction of the permanent way of railways.
1654. W. H. Pritchard, Saint Luke's, Middlesex—An improved apparatus for amusing and exercising children, and assisting them in learning to walk.

Dated 10th July, 1860.

1655. R. Wilson, Glasgow—Imp. in the finishing and folding of textile fabrics.
1656. T. P. Jordeson, 25, Eastcheap, London—Imp. in life boats.
1657. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved steam boiler. (A com.)
1658. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction and arrangement of apparatus for obtaining motive power from heated compressed air. (A com.)
1659. A. Green and W. H. Green, Stourbridge, Worcestershire—An imp. in water tuyeres.
1660. F. C. Warlich, 14, London-street, Fenchurch-street—Imp. in the manufacture of artificial coal fuel, and in apparatus employed in such manufacture.
1661. S. Zoubtchaninoff, Paris, 36, Boulevart de Batignolles—A cement to prevent the leaking of all liquids, and also dampness in buildings.
1664. G. Speight, 19, Woodbridge-street, Clerkenwell—An improved means of protecting watches and other small portable articles from being stolen from the person.

Dated 11th July, 1860.

1668. W. Clark, 53, Chancery-lane—Imp. in steam engines. (A com.)
1670. G. Davies, 1, Serle street, Lincoln's-inn—Improved apparatus for supplying steam boilers with water. (A com.)
1672. J. Webster, Leicester—Imp. in the construction of circular knitting machinery.
1674. J. Jack, Liverpool—Imp. in the construction and arrangement of surface condensers for marine and land steam engines.

1676. P. Pizzi, 9, Winsley street, Middlesex—Imp. in preparing and treating the surfaces of the interiors and exteriors of houses, edifices, monuments, and other buildings, to imitate polished marble or stone, also rendering them impervious to the action of the atmosphere and other elements.

Dated 12th July, 1860.

1677. J. Gibbs, Brentford—Imp. in constructing submerged works.
1678. E. T. Hughes, 123, Chancery-lane—Imp. in shrouds or winding sheets. (A com.)
1679. J. Askew, 27, Charles-street, Hampstead-road—Imp. in window sashes.
1680. T. Brearley, Dock-street, Whitechapel—Imp. in machinery for producing and revivifying animal charcoal.
1681. P. Graham Oxford-street—Imp. in means or apparatus for operating roller blinds.
1682. H. Shaw, Dublin—Imp. in means or apparatus for stopping railway trains.
1683. F. Ayckbourn, Mitcham Common, Surrey—Imp. in tubular beds and bolsters.
1684. F. Osbourn, Aldersgate-street—Imp. in the construction of endless saws and cutters.
1685. F. Mordan, Goswell road, Middlesex—Imp. in bottles, jars, or vessels for holding blacking, and in certain appurtenances thereof, part of the invention being applicable to stoppers for bottles used for other purposes.
1686. J. Ferguson, Glasgow—Imp. in machinery or apparatus for sawing or cutting wood in veneers and planks. (A com.)

Dated 13th July, 1860.

1687. P. M. Parsons, Arthur-street West, London Bridge—Imp. in ordnance and fire-arms, and in tools for rifling the same.
1688. J. W. Edge, Manchester—Imp. in rifled fire-arms, guns, and ordnance.
1689. M. V. Bouquet, 60, Boulevart de Strasbourg, Paris—Canisters or vessels, fitted moveable and hermetically stopping covers, for containing preserved alimentary or other substances.
1691. F. J. Risse, Great Bland-street, Southwark—Imp. in gun locks.
1692. F. J. Risse, Great Bland-street, Southwark—Imp in pressure guages.
1693. G. Anderson, Leadenhall-street, London—Imp. in singeing pigs, and in apparatus for the same.
1695. C. G. Hill, Commerce-square, High-pavement, Nottingham—Imp. in machinery for the manufacture of bonnet fronts, rouches, and other millinery trimmings, or for other purposes.
1697. Michael Henry, 84, Fleet-street—Imp. in looms, and in the Jacquard apparatus of looms. (A com.)

Dated 14th July, 1860.

1698. W. Bragge, Atlas Steel Works, Sheffield—Imp. in the manufacture of tyres for railway wheels.
1699. J. Pile, and J. Smyth, West Hartlepool, Durham—Imp. in the preservation of iron surfaces from corrosion or decay.
1700. H. G. Austin, The Grange, Canterbury, Kent—Improved apparatus for propelling vessels.
1702. T. W. Miller, Dockyard, Portsmouth—Imp. in the construction of tubular boilers or steam generators, and surface condensers and such like apparatus, and in the method of forming, applying, fitting, and using, metal tubes for the same.
1703. J. and S. Lingford, Bishop Auckland, Durham—An improved machine for washing, drying, and dressing currants.
1705. S. T. Cornish, Beaumont-square, Mile End-road, Middlesex—Imp. in ships' closets.
1707. M. L. J. Chollet, 7, Rue Marbeuf, Paris—A solid alimentary compound for making soups, seasoning meats, made dishes, and vegetables.
1709. A. V. Newton, 66, Chancery-lane—Imp. in the construction of windlasses. (A com.)

Dated 16th July, 1860.

1711. W. F. Henson, New Cavendish-square, Portland-place—Imp in railway carriage buffer and other springs.
1713. S. Ivers, Halshaw Moor, Lancashire, and M. Smith, Heywood—Imp. in machinery for communicating motion to and for stopping looms for weaving.
1717. W. Bauer, 36, Burton-street, Burton-crescent—A new method of laying down and raising, or cutting off for repairing and other purposes, of telegraph cables, chains, or ropes.
1719. R. A. Brooman, 166, Fleet-street—An improved clip for holding tickets and others. (A com.)

Dated 17th July, 1860.

1723. Capt. H. Gloag, Edinburgh—Imp. in breech loading fire-arms and cannons.
1725. J. Henson, Watford, Hertfordshire, and W. F. Henson, 15, New Cavendish-street, Portland-place—Manufacturing canvas and other fabrics for tarpaulings, sacks, rick-cloths, ship sails, and for other purposes, and also for uniting the edges of the same.
1727. L. Unger, 123, Chancery-lane—Imp. in the construction and arrangement of box-irons, used by laundresses and others for pressing and smoothing clothes and fabrics.
1729. G. Spencer, 6, Cannon-street West—Imp. in the means or apparatus used in lubricating valves and pistons, and other portions of locomotives and other engines worked by steam, air, gas, or vapour. (A com.)
1731. E. Leysel, Cannon-street—Imp. in locks or fastenings. (A com.)
1733. P. Vallance, 4, Bolton-road, Abbey-road, St. John's-wood—Imp. in the construction of telescopic sights for rifles and other fire-arms and ordnance.

Dated 18th July, 1860.

2737. P. Verdat du Trembley and A. D. Martin Rouen, France—Imp. in brake apparatus, suited for railway carriages and for other purposes.
1739. T. Gray, 7, Bride-lane, London—Imp. in the manufacture of flock, such as is employed for flocking paper hangings, and for other purposes.
1741. S. P. Jackson and A. Jackson, Ashley-place, Bristol—Imp. in the manufacture of window sashes, casements, and other frames suitable for glazing.
1743. J. Hunt, Birmingham—Certain imp. in hair-triggers, or detents for single or double barrelled guns and pistols.
1745. C. Stevens, 18, Welbeck-street, Cavendish square—An improved screw cutting machine. (A com.)

Dated 19th July, 1860.

1747. I. B. Shaw, Tunstall, and J. E. Shaw, Burslem, Staffordshire—Imp. in the ornamentation and decoration of earthenware, porcelain, glass, and other articles, and in producing the designs, figures, patterns, and roller moulds used in such process, such roller moulds being also applicable for the casting of rollers used in typographic and lithographic printing.
1751. W. Barrett, Norton, near Stockton-on-Tees—Imp. in machinery, to be used when casting metals.
1753. T. Tyrrell, Guildhall-yard, London—Imp. in the construction of tubular boilers.

INVENTION WITH COMPLETE SPECIFICATIONS FILED.

[*From Gazette, July 27th*, 1860.]

1772. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction and arrangement of marine steam engines. (A com.) 21st July, 1860.

PATENTS SEALED.

[*From Gazette, July 27th*, 1860.]

July 27th.

59. R. Mathers.
232. T. Walker.
233. H. Hodgson and P. M. Crane.
241. B. Mathewman, jun.
242. G. A. Cater.
247. L. Appleton.
252. T. Culpin.
255. R. J. Cole.
256. F. Jessa.
260. J. Ambler.
282. W. Howes and W. Burley.
286. R. Fielden, jun., and T. Fielden.
293. J. G. Willans.
296. J. G. Dahlke.
302. C. T. Launay and A. M. A D. de Vernez.
308. J. Smith.
310. J. E. Boyd.
311. J. Skertchly.
323. H. C. Jennings.
324. A. L. E. Breittmayer.
332. J. M. Rowan and T. R. Horton.
349. J. C. Lupton and J. Bleasdale.
352. H. Deacon and T. Robinson.
354. G. White.
380. W. Harwood.
396. S. Copping.
418. J. Hamilton and T. Silver.
426. W. Clark.
506. S. Ward.
522. G. Jenkins.
531. J. Faber.
606. W. E. Newton.
618. W. R. Jeune.
817. J. Hamilton, jun.
1083. H. Rawson.
1088. G. T. Bousfield.
1224. H. Conant.
1410. G. Kane.

[*From Gazette, July 31st*, 1860.]

July 31st.

259. B. Shaw.
275. S. Chatwood.
279. L. P. Barré.
295. A. Kerr.
297. E. W. Uren.
299. G. A. Biddell.
301. C. T. Launay and A. M. A. D. de Vernez.
309. J. Smith.
327. C. Hall.
373. T. Shedden.
387. E. Landsberg, senr.
413. G. Whight.
461. F. W. Mart.
489. W. Charlesworth and H. Charlesworth.
507. J. H. Johnson.
521. T. Lambert and O. Wakefield.
643. W. Clay.
773. J. H. Johnson.
1183. W. H. Muntz.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, July 27th*, 1860.]

July 24th.

2052. O. H. Smith.

[*From Gazette, July 31st*, 1860.]

July 27th.

2060. P. A. F. Bobœuf.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, July 27th*, 1860.]

July 24th.

1772. B. C. Brodie, jun.

[*From Gazette, July 31st*, 1860.]

July 28th.

1824. R. B. Roden,

Journal of the Society of Arts.

FRIDAY, AUGUST 10, 1860.

NOTICE TO INSTITUTIONS.

The Programme for the Society's Examinations in 1861 will shortly be ready for issue. A copy will be sent to each Institution and Local Board. Any Institution or Local Board desiring an extra number of copies for distribution, will be supplied gratis on application to the Secretary of the Society of Arts, John-street, Adelphi, London, W.C.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£449,050	
Henderson and Co., Durham	300	Manufactures.
W. A. Pope, 52, Charles-street, Berkeley-square, W.	100	Commerce.
*Frederick Braby, Fitzroy Works, Euston-road, N.W.	100	Commerce.
Coalbrookdale Co., Shropshire	1,000	Commerce.
Dr. David S. Price, Technological Museum, Crystal Palace, S.E.	100	Arts.
Charles Chatfield, Croydon	100	Arts.
Joseph Curt, 33, Great Portland-street, W.	100	Arts.
Stephen Bird, Hornton Villa, Kensington, W.	250	Commerce.
Wm. M. Christy and Sons, Fairfield, Manchester	500	Manufactures.
Henry Browne Alexander, The Laurels, Barnes, Surrey	100	Arts.
Thos. W. Cook, 8, Clifford-street, New Bond-street, W.	250	Manufactures.
Samuel Blackwell, 259, Oxford-street, W.C.	200	Manufactures.
Robert Mackay Smith, Edinburgh	250	Commerce.
James Heather, The Crescent, Camden-road-villas, N.W.	100	Arts.
TOTAL	£352,500	

By Order, P. LE NEVE FOSTER, *Secretary.*

MINERAL RESOURCES OF TUSCANY.—No. II.*

METALLIFEROUS MINERALS; INCLUDING THE HISTORY OF THE MINES ON THE TUSCAN MAINLAND, FROM THE EARLIEST PERIOD DOWN TO THE CLOSE OF THE LORRAINE DYNASTY, IN 1859.

By WILLIAM PAGET JERVIS, F.G.S.

To place Tuscany among the richest mineral producing countries of Europe would, perhaps, startle some, but we hope that that province may soon be to the new kingdom of Italy what Cornwall is to Great Britain, or Hungary to the Austrian Empire: nor does this seem an extravagant notion when we search into the records of the past, in order to discover why the mines of Tuscany have hitherto been so neglected. I hope to present to the reader in the few following pages the true state of the case, and have no doubt that he will arrive at the same conclusion which I have myself formed, namely, that political events and the unhappy subdivision of Italy among numerous despotic princes, no less than the priest-ridden condition of the inhabitants, have been ample reasons for the mines being entirely overlooked. In 1742 *only one mine* was open on the Tuscan mainland, that of Sta Fiora, near Monte Amiata, whence mercury was obtained. Three other copper mines were tried a short time before, but had been abandoned, viz., Lievora, Monte Catini, and the Carbonaie di Montieri.

In our own country, we have 10,000 miles of railway, with a population of 30,000,000; in Tuscany, with a population of 1,817,466, there were last year, at the close of the Grand Duke's reign, only 151 miles of railway; in the former case there is a mile of railway for every 3,000 inhabitants; in the latter for 12,036 inhabitants; on the other hand, the number of ecclesiastics, priests, monks, nuns, &c., in Tuscany, amounted to 17,543, 0·96 per cent. of the population, or 1·4 per cent. of the adult inhabitants. In Modena the case was more desperate; the duke put every obstacle in the way of mining, and the utmost difficulty was experienced till very lately in opening a copper mine at Massa. Francis V. absolutely forbad the working of coal near Sarzana. I must hasten with the publication of the description I have drawn up, persuaded as I am that after a few years of the wise administration of Victor Emmanuel, the whole face of the mining interests of Tuscany will have undergone great changes for the better; that not only the political and social condition of the amiable population of that garden of Italy will start forth into new life, after centuries of oppression and ignorance, but that the mineral wealth of the western group of

* No. I. See former paper in present Vol. of the *Journal*, p. 536.

hills and the Tuscan archipelago will speedily become of European importance. The notes which I offer the British public are very imperfect, none can be more sensible of the fact than myself. I have, however, studied to keep as near the truth as possible, and to omit anything of a doubtful nature. Whatever faults I may have fallen into, the courteous reader will ascribe to the difficulty of a task, in which I may say no Englishman has preceded me.

First and foremost among the metalliferous minerals of Tuscany are the ores of iron and copper; but, excluding the Tuscan archipelago, copper is the chief mineral, and next come lead and silver.

I. Copper Mines.

Copper occurs under three distinct conditions:—

A. As veins in sedimentary rocks, accompanied by quartz gangue, and associated with other ores, as in Cornwall.

B. In amphibole or pyroxene.

C. In serpentine without diallage or *gabbro rosso*.

The two latter rocks are eruptive.

A. Copper in Sedimentary Rocks.

Of the copper mines in the sedimentary rocks I know of none better suited for description than that of Capanne Vecchie, situated in a retired and beautiful spot called the Val Castrucci, 3 miles south of Massa Marittima, in the Maremme, and surrounded by woods of *cerro* and other useful species of oak, extensively employed for making charcoal.

The ore is found in a large vein, running nearly north and south, filled with a hard whitish quartzose rock, containing minute crystals of iron pyrites disseminated throughout the mass in many places. The dip of the vein is 45° east. Only one shaft has been sunk, the *pozzo* Carlo, which was calculated to cut the vein at the depth of about 66 yards; but after proceeding half that distance they were obliged to stop short on account of the accumulation of an enormous quantity of water. For 8 to 12 yards the vein runs through calcareous schistose rocks, which belong, if I am not mistaken, to the *macigno*, an Eocene formation. At the depth of 22 yards is the Galleria Alessandra, passing laterally to the vein of the same name. In proceeding downwards five little veins, or ramifications, which are given off from the principal one, have been already met with. The richest part of the ore is found on the *tetto*, or "hanging-wall;" that near the *letto* or "foot-wall" is considered as less productive. It appears that the vein or dyke (the rocks in the neighbourhood are considered by some geologists to have been subjected to igneous action) is more and more metalliferous as we descend. In size it is pretty constant from 30 to 50 feet. The ore found at the surface was very poor, only yielding ½ per cent. of copper; in proceeding downwards, irregular zones or nests of pyrites were met with, containing 1, then 3, then 5 per cent. of copper. In the prospectus of the company, made in 1855, they only calculated on procuring 1½ per cent. by the best smelting process then known, taking the whole of the ore together. Since then, at a greater depth, a large quantity of ore has been worked, containing 10 to 15 per cent.; very lately, that is to say within the last year, the ore from the bottom of the mine has yielded 20 to 25 per cent., all which phenomena are easily accounted for by comparison with other mines. The dimensions of the zones are from 80 to 120 feet in length, and 6 feet in depth. The length of the gallery by which the vein is worked is 150 yards. It is situated at a very inconsiderable depth. Another company has been proceeding from the opposite direction: it so happened that the afternoon I went down the men had made an opening into the adjacent mine, and reached the limit of their ground, all beyond having been already worked out in that part of the vein. I might here incidentally mention a word about this division of mining property; it stands to reason that in such cases, were both parties to amalgamate their interests they would work the ores to far greater advantage, since the drainage-water of one company must necessarily flow into the levels of his neighbour, to say nothing of the useless expense attendant on the establishment of two smelting houses, a double quantity of machinery, and two systems of accounts.

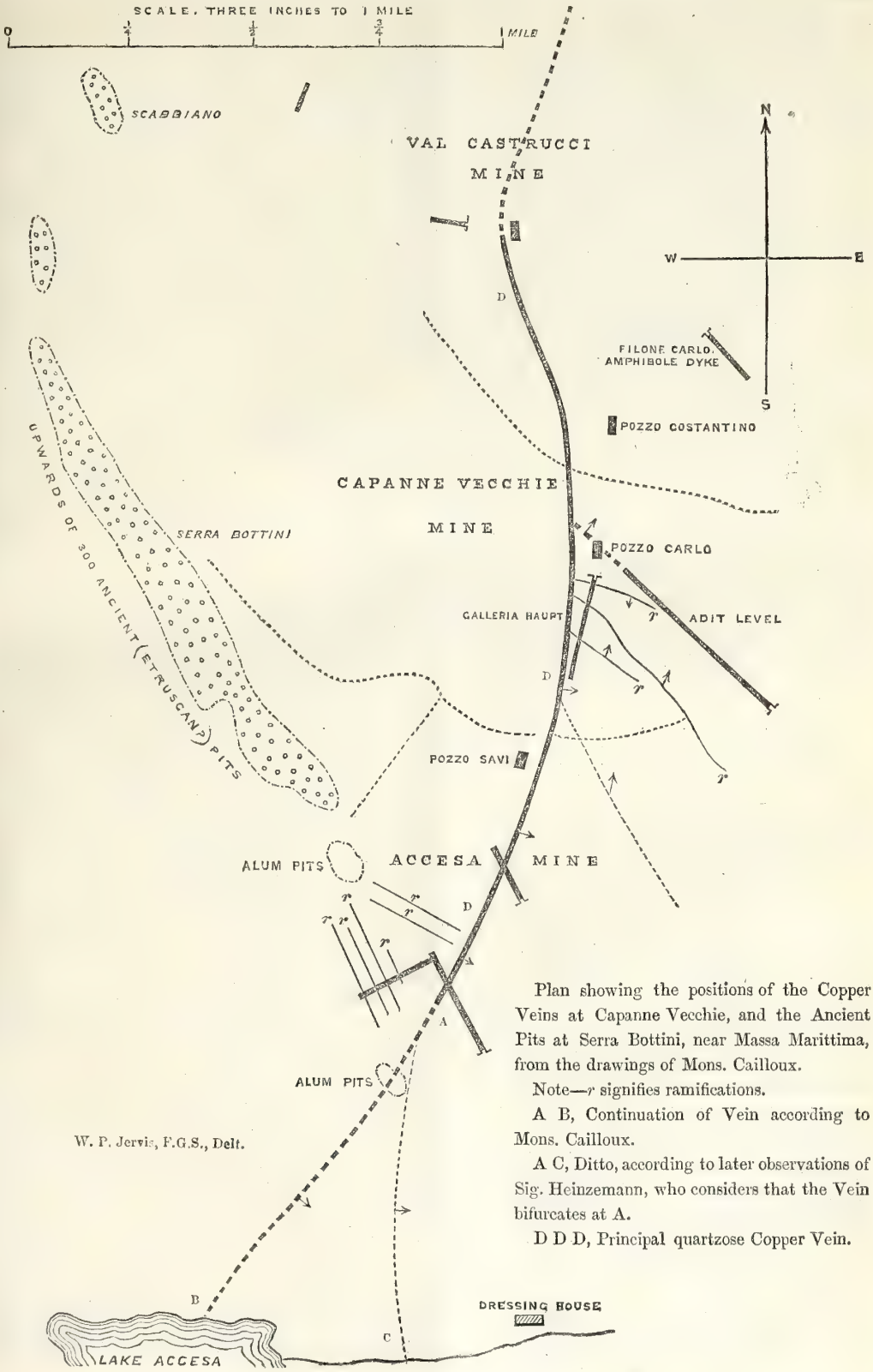
Ancient workings may be seen within a few yards of the present shaft, distinguishable by their great irregularity and shallowness, and from being more or less open to the air; I was informed by one of the gentlemen at the mine that some ancient pottery, supposed to be Etruscan, was found in one of them. The greater part of the ore is copper pyrites, in minute quantities, distributed through semi-vitreous quartz, and yields 2½ per cent. of copper. The miners are now paid 5 Tuscan *lire* for raising 1000 Tuscan lbs. of it, or 4½ *lire* for a cubic *mètre*, equivalent to about 11s. 6d. per ton; they furnish their own oil and gunpowder, though provided with the necessary tools. Commencing their operations in September 1846, the former company only worked the mine for the seven winter and spring months up to 1854, at which period, according to hearsay, from bad management, they gave up the business, and the present gentlemen, Sig. Heinzemann and Company, took a lease of the affair from them for 40 years, reserving to themselves the option of giving up the mine at the expiration of six years, in case they did not feel disposed to continue any longer: since then they have not intermitted during the summer.

The ores are smelted at the mine by a modification of the cementation process, which I shall only roughly sketch out. In order to understand it better, I must first mention that they are divided into three kinds.

1st.	Pyrites containing	20 to 25	per cent.	of copper.
2nd.	,,	,,	10 to 15	,,	,,
3rd.	,,	,,	2 to 3	,,	,,

A ton of ore of 3 per cent. contains 1·075 oz. of silver.

The first sort includes chiefly hand-picked specimens. I have made no mention of the native copper also found here, because, though excellent, it is very unimportant economically. Prof. Bechi, and Sig. Haupt, who was engineer of the former company, were requested to propose the best treatment for these ores, among which, as I have mentioned, the poorer variety preponderates. The method of concentration suggested by these gentlemen was modified in several practical details, by Prof. Schwarzenburg, of Zurich, and has been patented. The success attending it is stated to be such that ores containing 2 and 3 per cent. may be treated without the loss of more than one-half per cent. of copper; though I do not think this can be established to be the best method until it has stood a longer trial. The third kind of ores, containing least copper, are placed in large heaps, something like those of Mansfeld, in Prussian Saxony, interstratified with twigs and brushwood. When once properly ignited, the sulphur of the copper pyrites keeps up the combustion, and after three or four weeks of this treatment, the pyrites have become much concentrated, and consequently poorer in sulphur. They are also very friable. The more earthy portion is then stamped and roasted with salt in a large reverberatory furnace (*forno a reverbero*), charged at the top, on the upper floor of the building, so that the ore is raked into the hole, which is then covered up. Chloride of copper is one of the products, which, being alone soluble to any extent in water, is easily separated from the rest of the products, the solution of chloride of copper passing into a reservoir below, where *ferraccio di prima fusione*, cast iron, or waste castings from the furnaces at Follonica, is thrown in, by means of which a large proportion of the copper is precipitated in a metallic state in thin plates and laminæ crystallised on one side, and containing 50 to 80 per cent. of copper. This *rame cementato* (cement copper) is shovelled out and refined directly. That which escapes precipitation by this simple means, passes on to a second tank situated a little below, where quick-lime is added; a double decomposition ensues; insoluble pale



W. P. Jervis, F.G.S., Delt.

Plan showing the positions of the Copper Veins at Capanne Vecchie, and the Ancient Pits at Serra Bottini, near Massa Marittima, from the drawings of Mons. Cailloux.

Note—*r* signifies ramifications.

A B, Continuation of Vein according to Mons. Cailloux.

A C, Ditto, according to later observations of Sig. Heinzemann, who considers that the Vein bifurcates at A.

D D D, Principal quartzose Copper Vein.

blue hydrated oxide of copper is precipitated, and presenting at first somewhat the consistency of clay, gradually falls to the bottom, where it accumulates to the depth of a foot or more; the soluble chloride of calcium is then decanted. I presume the chemical changes must be these:

$$Ca\,O.\,H\,O + Cu\,Cl + H\,O = Cu\,O.\,2\,H\,O + Ca\,Cl.$$

The oxide of copper contains from 18 to 20 per cent. of metal. After draining, it is dug out with shovels and placed in a small blast furnace, *forno a manica*, along with the richer pyrites, the interior portion of the nodules of ore concentrated during the roasting in heaps, and rich slags from previous operations. These produce a *metallina*, or matt, containing 50 per cent. of copper, and a slag; it is again treated to produce a second *metallina* and another slag, and, during the next process, *rame nero* (black copper) is produced, containing 90 per cent. of copper, from which *rame rosetta* (rosette copper) is obtained by refining. At the period of my visit, last summer, a new English refining furnace had just been built. None of the secondary products have hitherto been utilised, though I would strongly suggest the employment of the chloride of calcium, in the place of a new quantity of salt, for the concentration of the ore. This might be effected without the least expense, beyond the formation of a large shallow reservoir, where the chloride of calcium would evaporate and crystallise during the summer, and be raked out, in the autumn, in an analogous manner to that by which the Tartars in the Crimea and the Steppes of the Caspian Sea, procure salt from the salt lakes, as I have before described.* Thus, there would be no loss of chlorine beyond mechanical waste. Manganese might also be raised from a ramifying vein close by, and would doubtless be eminently useful in the manufacture of glass, but more especially of bleaching powder, to say nothing of the pozzuolana and alum abounding in the neighbourhood, and which I am not very incorrect in asserting to be only locally employed.

An analysis of the copper smelted at Capanne Vecchie is—

Copper	99·50
Iron	0·02
Silver	0·10
Suboxide of copper	0·30
	99·92

The presence of suboxide is intentional, and gives the rosetta copper that beautiful colour whence it derives its name; it is simply the result of prolonged refining.

During the first years since the formation of the present company in 1854, Capanne Vecchie produced about 13⅓ tons of ore of the second quality, and 334 tons of the third quality annually, which was washed, but with considerable waste, at the neighbouring mine of Accesa, the proprietors of the two mines having made an agreement to that effect.

Through the kindness of Signor Heinzemann, by whom I was most hospitably entertained, I am at liberty to publish the cost of producing 1 cwt. of copper at Capanne Vecchie, as estimated five years ago by the former engineer, the mean of many calculations being given; though I may remind the reader that, the average of the ores now raised being higher, the result is under the mark:—

	£	s.	d.
1. Cost of raising 50 cwt. of ore, yielding after smelting 1 cwt. of copper, inclusive of extraction and separation from gangue	0	12	6
2. Stamping and washing the above, inclusive of washing and conveyance to and from the establishments at Accesa, as was then the mode of operation, and by which the *slicco* or dressed ore was concentrated to 9 per cent.	0	17	6
3. Smelting 4½ cwt. of dressed ore to obtain 1 cwt. of rosetta copper	1	7	6
Thus, the total expenses of raising and smelting 1 cwt. of copper may be estimated at	2	17	6

* See my Geol. Map of the Crimea.

In this calculation, however, no notice whatever is taken of the expenses incident to the formation or maintenance of the various establishments, the machinery, or administration. Of the richer ore belonging to the 1st quality, a fresh market has presented itself in our own country; it is now shipped to England at the rate of about 23 tons 8 cwt. per month; the rest is still smelted on the spot. In June, 1860, the quantity of rosetta copper made was estimated at 7 tons.

Till very recently brushwood or charcoal was the only fuel consumed here, but occupying as it does so large a space, and being also liable to accident from fire, they have lately tried the Tertiary lignite of Castiani, near Tatti, found at the distance of only six miles, over nearly level country, but to which place there is not yet the most ordinary kind of road. The experiment now being made has answered perfectly, though they have still enormous stacks of brushwood. The latter is, however, much more expensive than the lignite, primitive as is the present mode of transport in ox-waggons, over the marshy heaths and through the woods.

	£	s.	d.
Price of lignite at Capanne Vecchie, per ton.	0	18	0
Chestnut Charcoal . . per ton.	2	14	0
Oak (*Leccio*) Charcoal . . per ton.	3	0	0
Salt . . . . . per ton.	1	2	0
Gunpowder . . . . per cwt.	3	10	0
Sulphur . . . per cwt. 12s. to	0	14	0
Cast iron . . . . per ton.	5	4	0
278 cubic feet of oak, *leccio*, &c., cost .	1	0	0

Ten tons of sulphuric acid are consumed monthly at this mine.

Regarding the machinery, the water is drained from the mine by an 8-horse-power high pressure steam engine, made in London, pumping out 30 cubic feet of water per minute, and the draught is supplied to the furnaces by a 20 horse-power condensing engine, manufactured at Genoa. The air cylinders which were being erected for the latter at the time of my visit, are 3 feet in diameter and 5 feet long. Up to that period a 3 feet 6 inch disc was employed. By a simple arrangement this same engine not only moves the stamps—*peste*—both wet and dry, such as are used in Cornwall for crushing ores, but also an apparatus for crushing the roasted ore, and the tromps, *trombe a pressione*.*

The continuation of the vein northwards, towards the Val Caldo and Val Castrucci, constitutes the mine deriving its name from the latter locality, and is worked by the *Società Fenice Maremmana*. They have already erected two pumps in the shaft, called pozzo Costantino, which together throw out 40 cubic feet of water per minute, and they are at the present time fitting up a third, to pump out 20 more cubic feet; the engineer being determined to sink the shaft till it reaches the vein, at the depth of about 200 feet from the surface, they have concentrated all their efforts to the attainment of this point.

Adjoining Capanne Vecchie, to the south, is the mine of Accesa, belonging to the *Società Metallurgica Maremmana*. I procured some large masses of copper pyrites from thence, and some was shewn in the Tuscan department of the Great Exhibition of 1851. I much fear the locality is in one of those unfortunately pestilential spots where fevers rage in the summer months, so that the operations have then to be suspended. As the season was far advanced I was unable to go there. But the great drawback to these mines, and which has, doubtless, tried the patience of the engineers, is the immense quantity of water which accumulates in the shafts, especially during winter, but that will speedily be rectified as far as regards the mine of Capanne Vecchie, since I was informed that an adit level, *galleria di scolo*, was being driven to meet the

* Since writing the above I have been informed that the copper ore now raised is so much richer than it used to be, that the company have quite given up the practice of smelting it at the mine; it is now sent away to be smelted at Swansea and Hamburg; the reason of thus exporting the ore is the heavy price of the combustible.

shaft below the galleria Alessandra, *i.e.* about 100 feet below the surface of the pit, to complete which would require till next Christmas, at least, when the pumps will only have to raise the water for part of the distance, and thus, after the shaft has reached the vein at the depth of 200 feet, the engine will in all probability have little more load on it than at present.

Numerous ramifications of the principal vein are found on the setts of Capanne Vecchie and Accesa, running more or less parallel to each other, and having a general north-west and south-east course. They incline at an angle of about 50° west of the great vein. As far as I can judge it was these ramifications which the ancients worked for a linear distance of more than an English mile, at Serra Bottini and Scabbiano, by irregular pits, of which more than 300 are visible. Signor Rovis, in mapping the country round Massa, has indicated no less than 400 such ancient pits, accompanied for the most part by "burrows," or masses of rubbish containing quartz gangue and copper ore. The accompanying plan may be relied on, being a reduction of the drawings of the engineer of the mine.

A short walk inland brings us to the active mine of Castellaccia, the upper part of which produces copper pyrites; the rocks in the neighbourhood are macigno. I there noticed some nice specimens of ferruginous gangue or "gozzan," with incrustations of malachite and azurite in minute crystals, but though very pure, they were in every instance in very small quantities. It appears to me that in Tuscany these minerals are only found as superficial coatings on oxide of copper or commoner ores, where they have been very recently formed, but never in massive lumps, as in Australia, Africa, or the Russian Government of Perm.

B.—Copper Mines in Amphibole Dykes.

A mile from Campiglia, in the Maremme, in a largely developed Liassic limestone district, in the midst of well-wooded undulating hills and luxuriant valleys, enlivened by rich fruit-gardens and plantations of chestnuts, which attest the fertility of the soil, rise extensive dykes of amphibole, enclosing in certain places a very great quantity of copper. The ore has been worked in the neighbourhood of Campiglia, about a mile towards S. Vincenzo, where the Emilian road from Pisa to the south passes, the little mine of Temperino lying at a gunshot distance on the right. Though only four miles from the frightfully unhealthy district along the coast, the inhabitants of these charming hills and valleys are not in the least degree affected by fever, so that the peasants flock into Campiglia from the fatal plains every evening during summer, just as the sun sets, in order to escape from the frightful intermittent and more malignant species of fever so easily caught by exposure to the night air and noxious exhalations, especially as they are compelled to drink brackish water, which is considered one of the most injurious beverages possible. I might be asked what I have to do with a medical question here; but the bearing on the working of mines is exceedingly important. I visited Follonica, a little manufacturing village not many miles from Campiglia, in the middle of June. The director of the foundry told me that I had just arrived in time to see the operations, for the S. Giovanni, as the Italians call the 15th of June, is the signal for all the work to be suspended till the end of October or beginning of November. If a man exerts himself much, and sweats profusely, he is liable to catch these fevers, which linger about him for a year or two, notwithstanding the extensive employment of quinine by the medical men. The latter informed me that there is less danger for a person riding in a conveyance than for one on foot, who has to exert himself much, and I myself proved the truth of the offensive effluvia arising in the marshy ground in spite of the large dykes, for being obliged to be out late one night it was very evident to the senses. A poor widow, with whom I conversed on the road, told me a sad tale of the loss of one after another of her family, husband and sons, by fever, and how she was left alone; and a carter who was taking a load of straw from the Maremme to Pisa, said that in passing through Follonica the night before he had caught the fever, and was so weak that he could not sit upright in the cart. Nor are these by any means exceptional cases; in fact there is a hospital at Campiglia, where such patients are particularly provided for. To secure a healthy spot for a mine or any industrial establishment in this district, is, therefore, an object of the highest moment, as it admits of the enterprise being carried on so many months longer every year. The inhabitants of Follonica and other low parts of the Maremme, in fact, leave their villages, where only a few persons remain behind to take charge of the houses, with such as are too poor to remove.

The descent of the mine of Temperino is by short and nearly perpendicular ladders, not more than 30 feet in length, a great mistake to my mind, being so very fatiguing to the men; and after proceeding a few hundred feet in depth we arrive at the workings; we then enter the Galleria Fortunata, a large chamber, 44 yards high, communicating with ancient Etruscan excavations, which are, however, chiefly situated at a higher level, having been commenced from the surface at a distance of 220 yards from the present shaft. Farther on is an excavation called the Grande Cava. These are no longer accessible from above by the original openings, without risking oneself by descending with ropes and other appliances, but in approaching them underground by the modern workings they may be seen to great advantage, and serve very nicely to exhibit the ancient method of mining. Greatly was I delighted to see the grand and almost stupendous proportions of the cavities whence the copper pyrites has been procured, the large vaulted chambers assuming the dimensions of lofty natural caverns, wholly dissimilar to anything of the kind which we possess in Britain; they frequently attain as much as 15 to 20 yards in height and breadth, and were originally filled with hard, fibrous, crystallised amphibole, at the extremities of certain fasciculi of crystals, which generally rest on the prismatic faces of other fasciculi whose axes are placed in a different direction, detached pieces or flattened veins of tarnished copper pyrites lie concealed. Disseminated through so large a quantity of rock, the ore, as taken from the mine, only yields 3 per cent. of copper. As large masses of amphibole are so intimately associated with the copper pyrites, they have to be entirely worked out as long as the amount of ore is remunerative, which produces the remarkable chambers spoken of, rarely equalled by any artificial excavations. Amphibole, a variety of hornblende, is a crystallized eruptive rock, having the same chemical constitution as augite, so commonly found in all recent volcanos, and passes insensibly from olive-green to black, and in composition into Yenite or Ilvaite, a very hard, but brittle silicate of iron, almost peculiar to Tuscany; $2\ Fe^2\ O^3 + 3\ (2\ Fe\ O.\ Si\ O^3) + 3\ Ca\ O.\ 2\ Si\ O^3$. It is stated by Mitscherlich, that the difference between the amphibole and augite is simply the result of the former having been slowly cooled, the latter rapidly. Below this are two other galleries; in the first are seen ancient works with masses of rubbish, placed aside by the Etruscans, which in process of time have become indurated into a species of breccia by the percolation of ferruginous waters, resulting from the decomposition of the yenite, and perhaps even the amphibole, as I have seen that rock, in Tuscany, under certain circumstances, perfectly friable. I found this breccia in places so hard as to need a violent blow with the hammer to detach the original fragments from the paste in which they are imbedded, and in one part I discovered a regular little vein of crysocolla in it, about an inch wide. I was much interested in finding snow-white arragonite in the face of one of the old workings; it was not imbedded in the rock, but evidently at the surface, from which it stood out in some measure. At the moment I fancied that it militated against the received notion that that form of carbonate of lime was only produced at the temperature of boiling water, but I think it better

explained by supposing that the atmospheric action on the rock had produced oxidation of the pyrites, and consequently a high degree of temperature, and that in the presence of carbonic acid some decomposed amphibole had furnished the lime.

At this part of the mine, the marks made by Etruscan pickaxes may still be seen, and in the dim light given by the oil lamp suspended to the miner's button hole, which has very much the form of the Etruscan lamps, a little poetical embellishment will picture out the scene which must have presented itself in this little nook in the rock, when the world had made some 2,500 revolutions less round the sun than at present, or possibly before Æneas set foot on the shores of Lavinia; for such is the fabled antiquity of the polished inhabitants of Etruria.

Close by is a little Etruscan communicating gallery, in places so narrow as scarcely to admit of a man creeping along. Though the difficulty of working this hard rock was such as to render them careful in going through poor ground, they deserve much praise for the skill which they have evinced in their extensive grotto workings, where the ore was richer, for such a fibrous rock presents almost insuperable difficulties if we are deprived of the aid of gunpowder, from the entire absence of joints, flaws, or cleavage planes, such as in one form or another are common to all stratified and metamorphic rocks.

At the end of two cross-galleries, white metamorphic Liassic marble has been reached; it has the appearance of being still stratified, a highly interesting point, since at Carrara it is almost impossible to detect any stratification, the mass being divided by fresh planes of cleavage. In one part of the gallery the marble lies nearly horizontally; immediately afterwards it is seen to rise towards the west, and become nearly vertical, so that not only have we evidence of the posterior date of the dyke of amphibole, but the cause of the conversion of the limestone into marble, the quality of which is by no means bad, and may be, probably, somewhat analogous to the *ravaccione*, or third sort from Carrara. Quarries have been made in the neighbourhood for its extraction.

In one spot, over the gallery, soft ore is found in nodules varying in size, from an ounce or two in weight upwards. To reach it a frame-work of loose timbers has been erected, thickly strewed with brushwood and twigs with their leaves, on which the mineral falls when taken out, without in the least degree blocking up the level below, to which it is occasionally lowered after careful hand-picking. A considerable quantity of good ore has already been procured from this spot. At the same depth an ancient Etruscan excavation is perceived, extending much lower down. The re-working of this part has been resolved on.

All along the hill side, adjoining the irregular ancient workings, are incredible quantities of copper slag, *loppe*, in small pieces, which, for many reasons, appear to be unanimously considered by scientific men, and common report, to be Etruscan. I was shown a little pottery lamp, found some time before in the *débris*, but not being sufficiently an antiquarian, I am unable to pronounce whether it is Etruscan or Roman.

Monsieur Blanchard, who has analysed these slags, gave me the following:—

Copper, 1·0 to 3·0; mean, 2·0 per cent.

I brought away some specimens of the slag for analysis, and pounded up one piece, which was rather green on the surface, and, on being broken open, presented, on close inspection, small fragments of charcoal; after taking a fair average of the whole I found it to contain no less than 6·5 per cent. of copper.

Lead slags also occur in the same neighbourhood, particularly at the mine called Cava del Piombo, in all probability one of the same antiquity. Mons. Blanchard told me that they contain:—

Lead, 2·0 to 4·0; mean,	2·5	per cent.
Silver	0·0015	,,
Silicates	97·	,,

His estimate of the Etruscan *spurghi*, or refuse, is no less than 50,000 tons, which, provided the above analyses represent a fair average, (as they were intended to do for the sake of knowing if they were worth re-smelting,) must contain at least 1,000 tons of copper and lead. Assuming the improbable hypothesis that the loss in smelting amounted to 5 per cwt., it would give 20,000 tons of lead and copper raised from these mines, and allowing a fourth part to be less ancient, 15,000 tons of metal would have been procured by the Etruscans from hence, while the Druids lived in Britain, or even before.

Assays of ores, as raised from the shaft, give

	copper	3·0 per cent.
,,	broken and hand-picked ...	4·5 ,,
,,	small, washed by machinery	5·0 ,,
,,	rich, hand-picked	15·0 ,,

Some parts of the mine produce a large quantity of "black jack," in others I observed very perfect crystals of dark blende; they are not employed.

The ores were smelted here along with those from Rocca Tederighi, which belongs to the same company. I do not know why the works were stopped last year, but most probably only from the unsettled state of the political horizon, for the engineer was still at his post. Temperino is eleven miles from the port of Piombino, to which there is an excellent road. The present company began working in 1843.

C. Copper in Serpentine. (Gabbro Verde.)

Having elsewhere treated of the geological relations and other scientific points connected with the copper mines in the serpentine of Tuscany, I will here briefly allude to the subject there brought forward, referring any who may deem it worth their while, to my paper read before the Geological Society last session, and to be printed in abstract in the Proceedings of the Geological Society, next November.

I have observed that whereas the veins in the aqueous rocks, spoken of under section A., are chiefly confined to the Maremme, and the lower spurs of the hills in the adjacent territory, those in the *gabbro verde* are principally found near the summits of the hills. This is not an accidental coincidence, but may be entirely attributed to the eruptive nature of the serpentine, which in many places has elevated the strata to nearly 1,800 feet above the level of the sea, generally piercing them near the summit, in such cases as the resistance offered by the sedimentary beds was sufficient to cause them to snap asunder, as it were, and allow a passage for the serpentine. Where the serpentine appears near the summit of the conical hills, the sedimentary strata and metamorphosed rocks naturally dip away in all directions towards the plains; the section would be elliptical. For these and similar axes I have proposed the term *periclinal*. The term gabbro, originally only a provincial name, is now rendered classical from the use which Italian geologists have made of it. It is a soft, steatitic, loose and easily worked serpentine, without diallage, often variegated, and very variable in colour, the predominant tints being greenish, ochre-yellow, olive-green, and all the intermediate shades. To the touch it is frequently greasy, especially where abounding with white steatite. When perfectly dry and exposed to the air, a slight blow with a hammer shivers it into shapeless fragments, but when moist it appears to acquire the tenacity so peculiarly characteristic of clays. In such a soft state it is sometimes found in very damp mines. The gabbro frequently contains the richest ores of copper, but apparently only at the junction with the *gabbro rosso*, a brick-red metamorphosed schistose rock, produced by the intrusion of the serpentine into the clays and micaceous sandstones, so abundant in Central Italy.

It would be incorrect to say that copper ever forms ordinary veins in the serpentine. Its mode of occurrence is altogether peculiar, and has attracted much attention from Pilla, Menegheni, Savi, and others. Outlying indications of ore, which often surprise the discoverer by their

richness, are seen close to the surface, just below the superficial cover, but on digging down nothing more in the shape of ore may be found for several fathoms, when suddenly fresh masses of hard yellow pyrites, and even richer ores, turn up, in lumps more or less rounded, mostly enveloped in *gabbro verde*. The condition of the matrix is fragmentary, and the serpentine nodules often present the appearance of having been subjected to attrition, as in the act of ejection. The success attending the working of such ores may readily be conceived to have been very varied, and until the able researches of the sound geologists whose names I have brought forward, all was mere groping in the dark, for to this day our own Cornish serpentine copper is an enigma. In all cases failure must result without the presence of a thorough geologist, whose experience in palæontology and general geology and mineralogy are frequently taxed to the utmost. In too many instances the proprietors lose heart after having for a short time conducted their operations in the most timid manner, without sufficient scientific knowledge, and thus, according to the proverb "Give a dog a bad name, you may hang him at once," the copper is said to be poor. The very large capital required at the outset renders the British method of working by companies composed of shareholders the only one likely to yield any returns. It also appeared to me that, having once established the main direction of the ore, it might frequently be preferable not to commence at the outcrop at all, but if possible to drive an adit level at once, at a vertical depth of several hundred feet below,—a mode of procedure which would be frequently facilitated by the rapid slopes of the hills,—and thus, by the formation of a tramroad, without a farthing's expense for pumping or raising ores by machinery, there would be a great likelihood of coming directly upon rich deposits of ore.

Trial mines have been made in the serpentine, in many parts of Tuscany, as at Montajone, Monte Castelli, Riparbella, San Gimignano, Querceto, and even within seven or eight miles of Florence, at l'Impruneta, but decidedly the most famous, and hitherto in descending order, are those of Monte Catini, Rocca Tederighi, and Libbiano; in the two former especially, the spirited enterprisers have alike achieved great results. Three kinds of ore are recognised at Rocca Tederighi, containing 27, 18, and 12 per cent. of copper. A countryman of ours has lately directed his attention to the mine of Libbiano, south of Pomarance, and has all the prospects of eventual success in having the experience of his neighbour, who has been for some time engaged in working the ore in his vicinity, but more especially in having secured so eminent a man of science as Prof. Meneghini to direct his labours. The rocks at Libbiano are of various kinds. The sedimentary strata consist of limestone, this is pierced by four different eruptive rocks, viz., diorite, euphotide, serpentine with diallage, and serpentine without diallage. Copper ore has been found in numerous parts of the commune; thus rich outcrops of veins, or indications of copper, shewed themselves at a place called La Trossa, at the junction of the torrent of the same name, with the Secolo; a shaft was accordingly sunk at a suitable spot, to the depth of 52 feet, when levels were driven for a considerable distance in search of the vein; none, however, could be found. A beautiful copper vein appeared at the surface, on the banks of the Secolo, south of the Paggio Sugharello, in proximity to *gabbro verde*, and in spite of the immense influx of water a shaft was sunk there. Though Prof. Meneghini is confident that copper ore indubitably exists at this place at a greater depth, he has dissuaded the proprietors from prosecuting their search any further, not knowing when they might reach the other part of the vein, the rocks being so convulsed at Libbiano that there is no means of theorizing beforehand on the dip of the vein. Want of success does not by any means prove that at some future day these very parts of the mine may not be profitably worked. The experiments at the Pozzo Samuele, the Galleria di Frontosini, and the Aja al Cerro have not been continued sufficiently long to enable one to pass any opinion as to their desirability. The ore at the Botro Castagno has proved much more favourable for working; a level was driven from the bottom of the *botro* (ravine), in the direction of the vein, which was met after proceeding 250 feet, and for the next 180 feet numerous other nearly parallel veins were cut; two of these were followed to the right and left by cross galleries, and worked by "overhand" and "underhand stoping" (*cammini ascendenti e descendenti*).

A friend of mine, having essayed the ores from Libbiano, has placed the following at my disposal:—

	Copper.
Botro Castagno; "vein" running east and west, dipping north, copper pyrites containing	21·0 per cent.
Ditto ditto ditto ...	19·8 ,,
North and south "vein," intersecting the former, hard copper pyrites	13·8 ,,

A specimen of quartz with a little copper ore, from several spots in the serpentine, yielded, per ton, 6 dwts. 12 grs. of gold; but, what appears to be more remarkable, an analysis of the *gabbro* itself is stated to have yielded, per ton, silver, 1 oz. 17 dwts.; gold, 9 grs. I have also before me the assay of some auriferous copper ore from Beverino, near La Spezia, on the former confines of Piedmont and Modena, containing 31 per cent. of copper, and producing per ton of ore, silver, 13 oz.; gold, 10 dwts. A ferruginous gozzan, from Colle Palestro, Modena, gave by assay, copper, 1·25 per cent., yielding 13 oz. of silver per ton. Yellow pyrites with manganese in quartz, as broken, furnished copper 8 per cent. The amount of precious metal was, silver 2 oz. 18 dwts.; gold 13 dwts. per ton.

The presence of minute and scarcely utilisable quantities of gold in Tuscany and Piedmont, is not confined to lead and copper ores. A manganese ore from Rochetta, in the Lunigiana, furnished 3 dwts. 6 grs. of gold per ton of ore, and the magnetic iron of Stazzema, in the Versiglia, has given silver 2 oz. 16 dwts.; gold 6 dwts. 12 grs. per ton of ore.

The history of the operations at Monte Catini from the earliest period, commenced, abandoned, and resumed a dozen times, would form a most interesting archæological record, and show what a pernicious influence the unsettled state of Italy in the Middle Ages had on mining.

That Monte Catini was worked many centuries ago is certain, though the fact that one person or another commenced operations there, or formed a society for exploring the hidden riches of the rock is, for the reason I have assigned, no criterion, as far as Italy is concerned, that the mine in question was then for the first time opened. It would now be a difficult task to prove whether the inhabitants of the ancient Etruscan city of Felathri, now Volterra, knew of the rich deposits of ore so near the gates of their fortress; no historian whose documents have fallen into my hands has even hinted that such was the case; but we learn that during the belligerent days of the Italian Republics the mine of Monte Catini was worked, and reopened in 1469 by a Florentine goldsmith. In 1515, the Republic of Florence restored a great portion of the territory which they had acquired from Volterra, but made a clause reserving to themselves the mine of Monte Catini. Abandoned, and resumed by Cosmo I. in 1562, the operations were pushed forward by that sovereign, and new researches made by his son, Francis. The Grand Duke Francis I. paid a visit to Volterra in 1580, and being much interested in all which related to the fine arts and mineral industry, authors have handed down to us various incidents which occurred during his stay there; thus Giachi, in his *Saggio di ricerche sopra lo stato antico e moderno di Volterra*.

The Commissary of Volterra, Giovanni Rondinelli, gave Francis a description of the city and its environs, in which, speaking of Monte Catini, he shows his knowledge of the occurrence of masses of copper in that locality, in rolled and independent lumps, associated with steatite and ser-

pentine, and asserts that nodules had been even known to weigh as much as a ton. The old adit level was then (1580) nearly 2000 feet long. Malaspini, in his funeral oration on Francis I., made by order of the Florentine Academy, lays great stress on his having been a benefactor of mines, and states among other things that he gave exit by an adit level to the water which had previously compelled the abandonment of the mine of Monte Catini, and that he afterwards worked it. (Targioni Tozzetti *Viaggi in diverse parti della Toscana*, tom. II., p. 294.) Some years later I find that Cesalpino (*De Metallibus libri tres;* Rome, 1594) mentions that copper was then obtained in Tuscany from only two places, Monte Catini and the Caldani, where a warm spring flowed directly into the sea. It was rumoured that in 1630, when the plague broke out with fearful violence at Volterra, the mine was once more abandoned. Whether it attracted the least notice from any one till 1742, a century later, I have not been able to ascertain, but during that year Targioni Tozzetti visited the spot, described by him as Caporciano. That eminent naturalist relates that all was at a stand and looked the picture of desolation, but he employed workmen, and examined four ancient pits towards the east, so choked up as to be scarcely visible, and two others on the flank of the little eminence on which stood the castle of Gabbretto. He mentions that large quantities of slag were to be found near Monte Catini and Miemmo, and that in one or two instances the peasants had come upon masses of smelted copper, which he considers to have been left during the panic which seized the inhabitants in 1630. (Targ. Toz. tom. II., 293.) Little was done till 1827, when Signor Porte formed a company for opening the mine of Caporciano or Monte Catini, but 10 years rolled on without any very great results, when our countrymen, Messrs. Hall and Sloan, entered the field. The success which has repaid their labours (I believe after having been several times tempted to relinquish the undertaking), is such as to have rendered the mine one of the finest in Europe.

	Tons.	cwt.	lbs.	
During 10 years from 1827, to Sept., 1837, Messrs. Luigi Porte & Company raised ...	571	19	0	of ore.
Producing about ...	133	13	80	or 23·69 of copper.
In the 1st year, 1st Oct., 1837, to 30th Sept., 1838, Messrs. Hall and Sloan raised	182	16	52	of ore, yielding 23·85 of copper.
In the 2nd year, 1st Oct., 1838, to 30th Sept., 1839	335	5	0	of ore, yielding 31·18 of copper.
In the next 5 months they obtained more ore than during the 1st year	186	19	108	
Total in 29 months	705	1	48	

In 1844 the produce, according to Pilla, was 980 tons.

The ore thus smelted in Tuscany, appears not to have been the richest, for the portion sent to Swansea produced 33⅛ per cent. of copper. The population of the commune of Monte Catini, at that time, was 2881.—(Repetti, *Dizionario fisico storico della Toscana.*)

Professor Pilla, more than 15 years ago, when the works were far less advanced than they are now, stated it as his opinion, that though the size of the vein at the mine of Rammelsberg, in the Hartz, was larger, the mass of ore at Monte Catini was greater and more compact than was to be seen elsewhere, and in his patriotic enthusiasm for Italy, pronounces it to be *par excellence*, "the richest copper mine in Europe."—(*Breve cenne sulle richezze minerali della Toscana*, p. 56). The ore is found in a vein distinguished by Burat as "veins of contact," that is to say, having close relation to the junction of two rocks, and not traversing one rock, as in Cornish and other well known veins. At the surface, and during the entire history of the mine, down to the time of Messrs. Porte and Company, it appears that only detached masses of ore were known; but deeper search, prosecuted with most praiseworthy skill and untiring preseverance by the proprietors, and by Sig. Schneider, their able engineer, have within the last few years brought to light a considerable part of the vein.

The situation of the mine is very agreeable, lying on the southern brow of Monte Massi, overlooking the extensive plain of the Cecina. The name is derived from the communal village of Monte Catini, though the precise spot, as mentioned above, is called Caporciano. To see the air of luxury and cleanliness in the group of buildings belonging to the various gentlemen concerned in the administration, the pretty gardens surrounding them, the substantial church erected about a stone's throw to the east; were in themselves sufficient evidence to my mind of the success with which the undertaking had been prosecuted, and needed no comment from any one, nor was I in any way disappointed on descending the mine.

The predominant rock in the neighbourhood is *gabbor rosso*, which may be advantageously studied along the road side. It is schistose in places, and very friable, the strata are violently distorted and frequently nearly vertical; rendering it difficult to obtain a large specimen, as it so easily breaks up, and no sound masses are procurable; these characters will be perceived to be very favourable for working it. Sometimes *gabbro rosso* is variolated, when it is said to have so much the appearance of an eruptive rock, as to have led Pilla to classify it in the same category as serpentine, and Sig. Begni, only last autumn, tried to persuade me that such was the case. The reason which I would assign would rather be that the heat communicated to the sedimentary rock in immediate proximity to the serpentine, especially in the lower beds, where great pressure was also manifested, maintained the mass in a semifused state, and when, eventually, the serpentine burst through the adjacent rock and came to the surface, displacing the newly formed gabbro rosso on either side, the portion so highly heated had a tendency to re-arrange itself, like all viscid bodies; whence the formerly held notion of its being of eruptive origin, but which is no longer held by any of the leading geologists of Italy.

At the entrance of the mine are placed two marble busts, —in Italy the fine arts being everywhere seen,—one represents Targioni Tozzetti, the other Signor Porte, who were both interested in the working of this mine, the former as a naturalist, the latter as a speculator. For some distance the descent is by luxurious stone steps, inclined at an angle of about 45°, that is to say, along the line of fracture of the rock in which the indications of ore were first found. This space was filled with the slender dyke of serpentine without diallage, enclosing copper ores. After sinking about 400 feet, in the fourth *piano* or level, we reach the chapel, a spacious cavity, formerly occupied by a rich deposit of ore, known as the *deposito della capella*, from whence nearly 330 tons were raised. It is no longer possible to make any observations at this point regarding the manner in which the ore occurred, as the faces of the deposit have been built up or otherwise hidden, a remark holding good for the greater part of the way down. Lately, a second immense deposit has been brought to light in the fifth piano, some hundred feet below the former, and at least sixty feet in breadth.

The inclination of the dyke of serpentine may be better seen on approaching the bottom of the mine, and looking upwards, plunging as it does into the mountain towards the north, and extending east and west; the dyke fills a fracture in the *gabbro rosso*, and assumes much greater dimensions at the depth of one or two hundred yards than at the surface. It there also contains much asbestos and other allied minerals, and is accompanied by diorite, a species of holdblende, a very hard crystalline felspathic rock. The mode of occurrence of the copper in the serpentine is perfectly dissimilar to that in which we meet it in our own mines. Savi has given the name of *filoni impastati* to the veins. The ore is diffused in nodules or spheroidal masses, of varying dimensions, some being very large and rich, in a steatitic matrix passing into serpentine, and is found side by side with other

loose harder masses of serpentine, only distinguishable from it when broken open, or by its specific gravity, insomuch that the nodules of ore are wrapped up in a thin envelope of serpentinous mineral, which adheres firmly to them. The paste is frequently very soft, so that one of the greatest advantages in working the mine is the facility with which operations are carried on. In most parts I was enabled with great ease to break off pieces of the serpentine, and to dig out lumps of pyrites without much exertion. Richer ores are often met with, such as red oxide and grey copper; also, occasionally, excellent pieces of native copper, all enclosed in the same nodules, and accompanied by crystallized calcareous spar, and various interesting zeolites, of which the list is given in my paper quoted above, so that I shall not repeat it here, but only mention the fact that they all contain magnesia, which I suppose to have been derived from the serpentine.

The shaft called pozzo Luigi, is about 600 feet deep: an adit level of nearly a mile in length gives exit to the water. It is much to be regretted that the heat should should be so great in the remotest part of the mine, where, in fact, I found the atmosphere perfectly oppressive; a difficulty is experienced in breathing, a dense steam rising before one. I understood, however, that by the construction of another shaft it was intended to improve the deficient ventilation, which may be possibly already completed. The dimensions of the lower deposit are very great. The cavities at Campiglia may truly be called stupendous, but they were only filled with poor ores; the average of what is raised from this mine may probably be five or six times as rich. I saw a great deal of fragmentary pyrites in the steatitic matrix along with the larger nodules, and apparently in angular pieces, about the size of gravel, in other parts resembling coarse sand. An immense quantity of this has to be brought up to the surface with the loose serpentine, in order to be washed. I am rather inclined to the belief that, economically, this is better than the large nodules; first, because it is less firmly imbedded in the matrix; secondly, because, when it is brought to the dressing-house, it can be at once washed, thereby saving the expense of breaking up with hammers, or stamping, for which machinery is always necessary. At the time of my visit a new "gigging" apparatus, like those used in Cornwall, was being put up; and by such an improved method of washing these fine ores, I have little doubt they will be made very productive.

Little doubt could be entertained by anyone, after visiting this mine, as to the ore having been *brought up at the same time as the serpentine*, whether we look at the rolled form of the larger masses of ore, or the fragmentary condition of the smaller particles; or whether we examine the frequent occurrence of smooth, polished, and greasy surfaces of the steatite, a phenomenon which could only have been produced by friction; the precisely similar arrangement and form of the nodules of harder serpentine, all tend to this conclusion: the pyrites is not found, as with us, in soft condition, but is perfectly homogeneous and solid, presenting the same physical properties as are well known to belong to Bornite, into which it insensibly passes in the same specimen.

The ores are classified under four kinds:—

I. Purple copper, bornite; } in nodules.
II. Copper pyrites, chalcopyrites; }
III. Fragments of copper pyrites, like gravel.
IV. Sand, composed of copper pyrites, mechanically mixed with a large amount of steatitic serpentine.

Analysis of purple copper, from Monte Catini, by Berthier:—

Copper	67·2
Iron	6·8
Sulphur	21·4
Gangue	4·0
	99·4

Copper pyrites from Monte Catini, analysed by Le Blanc:—

Copper	32·168
Iron	32·794
Sulphur	32·392
Gangue	1·100
	98·454

(Savi; *Delle Rocce Ofiolitiche della Toscana*, cap. 6.)

Of the machinery, besides the gigging frames which were just being erected, there are two steam engines, one of 25 horse-power, the other of 18, both of English manufacture; and a Cornish boiler had just arrived.

The proprietors have shown their wisdom, to my mind, as much as in anything else, in the formation of a first-class macadamised road to the communal village of Monte Catini, by which they convey their ores to Prato, near Florence, where the greater part is smelted.

I much regret having passed close to Prince Poniatowski's farm, of Terriccio, near Castellina Marittima, without being able to visit it. For the present, I will only subjoin a few remarks from Prof. Pilla. He mentions that, many years ago, indications of copper ores were found in the metamorphosed *alberese* in the Valle di Gonnelino, in proximity to serpentine. After much digging, no vein had been discovered, but what for a long time was considered to be the head of a vein proved to be a wonderful mass of copper pyrites, which yielded no less than 16¾ tons of ore, and hidden at no great depth. Though the entire mass was not then removed (1844), I believe that nothing has been done there since; if otherwise it must have been kept very quiet, as I could not glean anything from the inhabitants.

Analyses of Copper Pyrites from various parts of Tuscany, by Bechi.

	Veins in Sedimentary Rocks.		In Amphibole Dykes.	In Serpentine and Gabbro Rosso.			
	Capanne Vecchie (Comp. of Grosseto.)	Val Castrucci (Comp. of Grosseto.)	Campiglia (Govt of Leghorn.)	Terriccio. (Govt. of Leghorn.)	Castellina Marittima (Govt. of Leghorn.)	Monte Catini (Govt. of Leghorn.)	Riparbella (Govt. of Leghorn.)
Copper ...	18·008	34·091	31·300	15·960	27·540	32·788	27·540
Iron.....	43·336	39·292	34·670	38·484	38·800	29·750	38·832
Sulphur...	30·348	35·617	34·030	41·306	30·072	36·155	30·092
Gangue ...	8 624	...	...	4·250	3·450	0·863	3·250
	100·316	100·000	100·000	100·000	99·862	99·556	99·714

Of late years the importation of copper ore from Tuscany has become an important item, and is rapidly on the increase, as may be seen by the Custom-house returns:—

Copper Ore Imported from Tuscany.

Years.	Tons.	Value.
1853	34	.....
1854	414	£5,175
1855	604	9,488
1856	794	8,464
1857	1,127	25,395
1858	1,124	21,307
1859	1,456	26,257
	5,653	£96,086

(*To be continued.*)

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 3rd*, 1860.]

Dated 23rd March, 1860.

762. J. Deane and J. Deane, jun., King William-street, London, and W. Harding, Forest-hill, Kent—Imp. in breech loading fire-arms. (Partly a communication.)

Dated 24th March, 1860.

772. J. Blackburn, 35, Parliament-street, Westminster—Imp. in the manufacture of iron and steel, in making iron castings.

Dated 28th June, 1860.

1571. W. Clark, 53, Chancery-lane—Imp. in machinery for cutting files. (A com.)

Dated 30th June, 1860.

1586. R. Laming, Clifton-villas, Maida-hill West, and C. Smith, 8, Gloucester street, Regent's park, Middlesex—Imp. in purifying certain gases and liquids from sulphuretted hydrogen.

Dated 2nd July, 1860.

1590. E. T. Hughes, 123, Chancery-lane—Obtaining colouring matter from the lentisc or mastic tree. (A com.)

Dated 4th July, 1860.

1620. J. Savage, Pelham-street, Nottingham—An improved means of or apparatus for threading needles.

Dated 6th July, 1860.

1636. B. Mitchell, Crowe Hall, Denver, Norfolk—An improved machine applicable for harrowing, weeding, hoeing, and other agricultural purposes.

Dated 9th July, 1860.

1646. L. C. Warneck, 11, Place du Pilori, Nantes, France—An improved method of treating the coffee husk for purposes of nutrition.

Dated 10th July, 1860.

1662. S. Zoubtchaninoff, 36, Boulevart Batignolles, Paris—An improved compound for the coating of wooden ships, boats, and other structures used at sea.

Dated 13th July, 1860.

1696. W. Allen, Great Alfred-street, and W. Allen, Carrington, Nottingham—Imp. in the prevention of incrustation and corrosion of steam engine boilers.

Dated 14th July, 1860.

1704. A. de Neviers, New Cremorne-road, Chelsea, Middlesex—Imp. in breech-loading fire arms.

1708. W. E. Newton, 66, Chancery-lane—An improved manufacture of waterproof leather. (A com.)

1710. L. Hope, 4, Bishopsgate-churchyard, Middlesex—Imp. in knot-stitch sewing machines.

Dated 16th July, 1860.

1712. F. L. H. Danchell, Great Queen-street, Westminster—Certain imp. in filters.

1714. A. Smith, Manchester—Certain imp. in the manufacture of velvet or other similar piled fabrics.

1718. A. Bain, Clerkenwell-green, Middlesex—Imp. in means, apparatus, or articles for holding and supplying ink.

1720. W. Birks, sen., and W. Birks, jun., Nottingham—Imp. in bobbin net, or twist lace machinery.

1722. W. E. Newton, 66, Chancery-lane—An improved covering for roofs and walls. (A com.)

Dated 17th July, 1860.

1724. C. Stevens, 18, Welbeck-street, Cavendish-square—An improved method of preserving potatoes cut in pieces by a machine for that purpose. (A com.)

1726. J. Fletcher, Accrington, Lancashire—Imp. in machinery or apparatus for regulating the supply and discharge of fluids to steam boilers, pipes, and other vessels, and for cleansing or cleaning the same.

1732. A. Eskell, 8, Grosvenor-street, Grosvenor-square—Imp. in beds, or bases for artificial teeth.

1734. J. Goulson, Ponsonby-terrace, Vauxhall Bridge-road, Westminster—Imp. in gas and other fluid meters.

Dated 18th July, 1860.

1736. J. Picksley and R. Sims, Bedford Foundry, near Leigh, Lancashire—Imp. in bone mills and logwood rasps.

1738. T. C. W. Pierce and G. F. S. Isherwood, Manchester—Certain imp. in power looms for weaving.

1740. R. Oxland, Plymouth—Imp. in the manufacture of gunpowder.

1744. J. H. Johnson, 47, Lincoln's-inn fields—Colouring matter and the means of obtaining the same. (A com.)

Dated 19th July, 1860.

1746. H. Holland, Birmingham—An imp. in the manufacture of steel tubular stretchers for umbrellas and parasols.

1748. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production of white lead, and in the machinery or apparatus employed therein. (A com.)

1750. A. B. Woodcock, Manchester—Imp. in the manufacture of moulded articles of vulcanised india rubber.

1752. J. Stenhouse, 11, Upper Brunswick-terrace, Barnsbury-road—Imp. in purifying coal gas.

1754. J. Saxby, Brighton—Imp. in apparatus for and in the mode or method of working and governing railway points and signals.

1755. W. Clark, 53, Chancery-lane—Imp. in valve apparatus for regulating the flow of steam and other fluids. (A com.)

1756. W. Clark, 53, Chancery-lane—Imp. in stamping or embossing presses. (A com.)

Dated 20th July, 1860.

1757. C. W. Hahnel, Manchester—Imp. in the construction of parts of umbrellas and parasols. (A com.)

1758. J. Dickinson, Pendleton, near Manchester—Imp. in machinery for retarding or stopping railway and other carriages, and for other purposes where breaks are applicable.

1759. J. Broad, Ulverston, Lancashire—An apparatus for economising coal and other fuel, to be used with hot or cold blast, in the smelting of iron ores and resmelting of pig iron.

1761. J. Kenny, 21, Litchfield-street, Soho, Middlesex—Imp. in sewing machines.

1763. H. W. Poulter, Thayer-street, Manchester-square, Middlesex—Imp. in the arrangement and construction of printers' composing cases, and in the frames used therewith.

1765. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of apparatus for regulating the force of electric currents. (A com.)

Dated 21st July, 1860.

1767. W. Lake, Old Kent-road, Surrey—An improved button or fastening for iron bedsteads and other purposes.

1769. J. H. Young, 66, Great College-street, Camden Town, Middlesex—Imp. in setting up (composing) and distributing type.

1771. S. Roberts, Hull Yorkshire—Imp. in harrows.

1773. W. E. Newton, 66, Chancery-lane—Imp. in looms for weaving. (A com.)

Dated 23rd July, 1860.

1775. R. Hewens, Leamington, Warwickshire—An imp. in kitchen ranges, which is also applicable to stoves in general.

1777. J. B. J. Noirot, Paris—An improved method of manufacturing india rubber tubes, and various articles.

1779. G. H. Birkbeck, 34, Southampton-buildings, Chancery-lane—Imp. in the construction of chimnies for lamps, or apparatus for transmitting light. (A com.)

1781. J. W. Sullivan, Adam street, Adelphi, Westminster—Improved machinery applicable in washing and churning, and the mixing of fluids. (A com.)

Dated 24th July, 1860.

1783. W. Clark, 53, Chancery-lane—Imp. in apparatus for setting and sharpening scythes and other like instruments. (A com.)

1785. L. Le Richeux, Sussex-road, Brixton, Surrey—Imp. in the means of attaching buttons or studs to articles of clothing or other similar articles, and in the buttons or studs to be adapted thereto.

1787. H. Hirsch, Bridge-road, Lambeth, Surrey—Imp. in screw propellers.

1789. R. Thomas, Bath-street, Tabernacle-square, Middlesex—Imp. in the tires of wheels for vehicles used on common roads.

1791. A. V. Newton, 66, Chancery-lane—Improved means for relieving the slide valves of steam-engines of unnecessary pressure. (A com.)

Patents Sealed.

[*From Gazette, August 3rd*, 1860.]

August 3rd.	
298. P. Robertson.	384. J. C. Haddan.
317. T. Tye and C. W. Andrew.	388. J. A. H. Ballande.
330. A. Dalgety.	394. W. Clark.
338. G. Whight.	477. V. E. Lecoupeur.
346. J. Carver.	484. J. H. Tuck.
356. T. W. Rammell.	513. J. Lightfoot.
368. D. Dietz.	1215. M. A. F. Mennons.
378. E. Humphrys.	1304. G. D. Jones.
	1352. T. Greenwood & J. Batley.

[*From Gazette, August 7th*, 1860.]

August 7th.	
341. J. E. Durand.	497. F. Boissau.
345. J. Langford and C. Chester.	523. J. E. Boyd.
357. P. Adie.	535. R. B. Cooley.
379. W. Mitton and J. Penney.	679. J. H. Johnson.
381. R. J. Cole.	753. I. Hayem, jun.
	1007. J. Harvey.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, August 7th*, 1860.]

August 2nd.	*August 4th.*
2111. C. Iles.	2111. T. Lyne.
2223. H. Cartwright.	

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, August 7th*, 1860.]

August 2nd.	*August 3rd.*
1843. R. Morrison.	1825. T. Moss.

Journal of the Society of Arts.

FRIDAY, AUGUST 17, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week (corrected)	£352,200	
Henry Guedalla, Gresham Club, City, E.C....	500	Commerce.
*Elliott Brothers, 30, Strand, W.C.	300	Arts.
*Thos. Tapling and Co., 1 to 8, Gresham-street, West, and 105, Wood-street, City, E.C.	1,000	Commerce.
*William Tagg, 49, Chichester-place, King's-cross, W.C.	100	Arts.
*E. Bax, 1, Charing-cross, S.W.	100	Manufactures.
Lord Willoughby d'Eresby, 142, Piccadilly, W.	500	Arts.
*Henry Ransford, Huron Lodge, Boltons, West Brompton, S.W.	100	Manufactures.
Robert Hollond, Stanmore Hall, Middlesex, N.W.	500	Arts.
Sutton and Sons, Reading	250	Commerce.
Major Munn, Throwley House, Faversham, Kent	100	Arts.
Alexander Zanzi, 30, Brompton-crescent, S.W., and 53, Old Broad-street, E.C....	100	Commerce.
William Aldam, Frickley Hall, near Doncaster	100	Arts.
John Gaskell, St. Nicholas-at-Wade, near Margate	100	Arts.
Captain Sir George Broke Middleton, Bart., R.N., C.B., Shrubland-park, Ipswich	500	Arts.
Colonel the Right Hon. William Fownes Tighe, Woodstock-park, Inistiogue, Ireland	200	Arts.
William H. Rumbold, The Grange, Tunbridge Wells	100	Commerce.
John Standish, Royal Nursery, Bagshot, Surrey	200	Commerce.
*J. and J. Colman, 26, Cannon-street, City, E.C.	1,000	Manufactures.
J. H. Robinson, A.R.A., New Grove, Petworth	100	Arts.
William Robertson Sandbach, Wellesbourne Hall, Warwick	100	Arts.
Right Hon. Lawrence Sulivan, Broom House, Fulham, S.W.	100	Arts.
Total	£358,250	

By Order, P. LE NEVE FOSTER, *Secretary.*

MINERAL RESOURCES OF TUSCANY.—No. III.

By William Paget Jervis, F.G.S.

(*Continued from page* 697.)

Metalliferous Minerals; including the History of the Mines on the Tuscan Mainland, from the earliest period down to the close of the Lorraine Dynasty, in 1859: and some Remarks on Etruscan Metal Work.

II. Lead Mines.

Lead has been worked from time immemorial in Tuscany. From the entire absence of papyri our knowledge of the Etruscans is only obtained from their works of art, snatched from the ruthless hands of peasants, whom I have en heard to say that they have thrown aside the useless "shords," or "scraps" of copper; or, perhaps, placed the metal on an anvil and beaten it out flat to see the nature of the object! Antonio Filippo Giachi, a chronicler of the last century, mentions among the antiquities of the then new museum of Volterra certain sheets of lead with Etruscan inscriptions, of which Gori (*Istoria litteraria dell' Italia*, 1748) has given some account, though he considered them worthy of being better illustrated, ranking them after the *Tavole Eugubine*, among the most remarkable antiquities of the kind. (Giachi: *Saggio di ricerche sopra lo stato antico e moderno di Volterra*, 1786, p. 199.) I have only seen one or two specimens of Etruscan leaden antiquities, though I procured at Volterra an ancient casting in lead, said to be Etruscan, apparently intended to represent a lizard; but the fact that they had a silver coinage at Pupluna, or Populonia, renders it highly probable that they not only worked the lead, but were able to

cupel it, in order to purify the silver. That art was then known, special allusion being made to it by the prophet Jeremiah as practised in his day in Palestine (Jer. vi., v. 29, 30), and the silver of Etruria could only be obtained commercially from lead ores, unless brought from distant countries, which is improbable. Cesaretti publishes an historical document of the 13th century, incidentally alluding to the silver (argentiferous lead) mines of Valle Bujo and elsewhere, in the territory of Massa Marrittima. (*Memorie sacre e profane dell'antica diocese di Populonia.*) Zaccheria Zacchio, writing in the 16th century, mentions that in his visit to Populonia he observed a large quantity of slag, *loppe*, which on being pounded and put into a crucible, yielded silver. (Ughel, *Ital. Sacræ*, tom. iii., 710, 712, 717). It is not positive whether these slags are Etruscan, or whether the Massetani smelted their lead there in the Dark Ages.

Very considerable quantities of ancient lead slag are found round the *Argenteria* at Montieri, near Chiusdino; Mons. Blanchard, having analyzed some of them, kindly gave me the following results of his experiments:—

Lead	4·000
Silver	0·002
Silicates	95·998
	100·000

If it could be proved that this is a fair sample of the entire quantity, it would be well worth while to cupel the silver.

The records relating to Montieri go back to the 9th century; its frequent mention in historical documents, in which special notice is made of the "silver" (argentiferous galena) mine about which I shall quote a few passages, would lead one to the conclusion that these must then have been very productive. Andrea Bacci (*De Thermis*, p. 214) quotes a former authority, who asserts, in a loose manner, (though not too much to be depended upon, as evidently not learnt from actual inspection,) that a certain Frenchman had discovered some silver mines in 1180 "in Agro Montis Æris," which he and his successors worked for many years, and that there were vast caverns and crypts (galleries) penetrating for a considerable distance into the mountain. Where are they now? In 1137 the Bishop of Volterra exchanged half the mine of Montieri with the Bishop of Sienna for some other property; and in 1151 the men of Montieri swore to preserve half the town, castle, and mine of Montieri to the Siennese. Not long after the republic of Massa Marittima put in a claim for half the mine of Montieri, on the ground that the Emperor Frederick Barbarossa had conferred it on them by a document in 1160, in recompense for services the Massetani had rendered him. On the other hand the Volterrani alleged their ancient right over Montieri, given them by the Marquis Adalbert, in the 9th century; while the Siennese Republic grounded their claim on the gift to them, by Barbarossa, of half his jurisdiction over the mine of Montieri under date 1180. Thus continued quarrels arose about this bone of contention. In 1181, Hugo, bishop of Volterra, gave a quarter of the entire mine to the Siennese Republic, and received in payment 330 lire. His successor, disapproving of this arrangement, would not rest till he had obtained a fresh diploma from Barbarossa, in 1188, by which, among other things, he was re-established in possession of the silver mine of Montieri; but the pertinacious Siennese, albeit their adversary held such high ecclesiastical rank, brought their claim before the Court of Rome, and were thrown, the Bishop of Florence, who was appointed judge, naturally giving a verdict in favour of a member of his own bench. The matter was not so easily calmed down, and it was only in 1214, that an accommodation was made, by which the bishops of Volterra agreed to pay the Siennese Republic the annual sum of 215 lire for the town and mine of Montieri. In 1258, the Bishop of Volterra gave permission to certain persons to farm the privilege of coining money at Montieri—they had another mint at Berignone, near Grosseto. During the year 1327 the Siennese laid hands on half the mine, because the stipulated annual sum was in arrear; with the silver which they took to Sienna they displayed so much magnificence that the bishop perceived, too late, the error he had committed, for although the Republic of Massa about this time sent a force to Montieri, besieged and took it, they were unable to retain it, and thus the town returned to the Siennese Republic, who held it without any impediment down to 1554, when that power fell by the victorious arms of Cosmo I., and was incorporated into the Grand Duchy of Tuscany.—Targioni, (tom. III., p. 30). Repetti, (*Dizionario Storico della Toscana*, tom. I., p. 193; and tom. III., p. 573.)

I believe that nothing has been done during the present century at Montieri, if, indeed, within the past two hundred years.

The whole hill side of the Cornate di Gerfalco, north of Montieri, is strewed with small fragments of limestone thrown out of ancient pits. I traced them for half a mile in a direct line, and nearly on the same level. Apparently there were not any deep workings; on the contrary, the rock has been only "scratched" at the surface, little cavities following each other every few fathoms. It would, no doubt yield a good return to anyone disposed to go over the ground systematically and lay open the bed of lead. Sulphate of baryta and fluor spar are the accompanying minerals, the latter quite white or colourless, also fluoriferous arragonite, constituting the new mineral Mossotite, is found in some of the cavities. I succeeded in picking up some pieces of rubbish containing traces of green carbonate of copper. As at Montieri, these beds or veins have been long neglected.

Regarding the lead mines of the Grossetano in the Maremme, we learn that Ugolino Scolare Visconti submitted to the Siennese republic in 1147, taking the necessary oaths of homage. He then gave over to the consuls and council of the republic (being no doubt compelled to do so) the fourth part of his share in the mines of lead, gold, silver, or any other metal which might be worked within the *castello* (fortified village), court, or district of Batignano and Monte Orsajo, both what he then possessed or might at any time acquire within certain boundaries, which he affixed at Roselle (an Etruscan city now completely destroyed), Monte Orsajo, Torri, and thence as far as the Ombrone, giving the Siennese the right of digging at any of the said places, excepting within the actual precincts of the castle of Batignano. Visconti then made the men of Batignano and Torri swear to the observance of the condition. The result, favourable as these terms might seem to the Siennese, turned out otherwise; in fact, the mines, no longer worked by the Counts of Batignano, were neglected by the republic, who soon found other more stirring occupations of a military character. (Tommasi; *Istoria di Siena*, Lib. III., p. 142.)

Galena is found at the ancient mine of Cava del Piombo, near Campiglia, in amphibole of a rusty green tint, associated with zinc. The ores are divided into three kinds, yielding 15, 27, and 42 per cent. of lead, which contains on an average 0·0015 of silver. I consider it more than probable that the Etruscans of Populonia obtained their lead and silver from this mine.

A lead mine is now in activity at Castellaccia, 4 or 5 miles from Massa Marittima, from whence a road has been made. I obtained from thence both galena and fine resinous looking blende, very similar to some worked near Galway. Seven new furnaces, *forni a manica*, have lately been erected at Castellaccia, in a line under the same roof. At the end is a cupel (*forno a cupelio*). These have now been in operation three years. The blast is supplied by a cylinder moved by a 14 horse-power horizontal high pressure steam engine, manufactured at Lincoln.

The metallurgical operations are very simple. The ore, after the preliminary preparation of stamping, roast-

ing, &c., is placed in the furnace with charcoal, and produces a "matt" (*metallina di prima fusione*) and metallic lead. The matt is then roasted, to oxidise it partially, and placed for two hours in a *forno a manica* with charcoal, by which process more lead and a second richer matt or *metallina* is extracted. All the lead passes through the cupel to be oxidised; the litharge, having run out at the side, leaves the metallic silver, which, as I was informed by the smelters, weighs from 16 to 56 ounces per ton of lead. The whole of the copper which accompanies the ore remains in the last matt. Wood charcoal is the fuel employed. The ores are conveniently dressed on the spot, a stream of water flowing through the deep valley at the foot of the slope on which the furnaces are built.

Let us now pass to the extreme north-west angle of Tuscany, formerly called the Versiglia, embracing the country around Seravezza, Camajore, and Pietra Santa, with all the valleys and mountains, as far as the late frontiers of Tuscany and Modena. It embraces the mineral districts in which I previously noticed the occurrence of so many splendid beds of marble, which early attracted the attention of the inhabitants. The resources of the Versiglia were held in great estimation by them in the time of the Romans, but the Senate, fearing that the people would proceed too rapidly and too eagerly to work, and thus exhaust the minerals, passed a general decree laying restrictions on the working of mines in Italy. Their object was, doubtless, for those times a wise policy, as the ancients seldom proceeded to great depths, and thus a locality soon became unproductive; while on the other hand these restrictions taught and compelled the citizens to develop the resources of their distant colonial possessions. And, in passing, I may be permitted to ask whether this induced spirit of colonial enterprise, now so peculiarly the trait of the British nation, may not be regarded as one of the reasons why Rome rose to the first place among the empires of the world. And may not Italy, under her destined King and Deliverer, by following the same example of extended commercial intercourse with foreign nations, hope for *similar grandeur* in the 19th century?

Two miles east of Seravezza, at a place called Gallena, on the right bank of the Vezza, is situated the lead mine of Bottino, which has long been of great importance; the ore is rich in silver, and sometimes contains antimony. The veins and beds occur in Palæozoic quartzose stea-schists, parallel to the stratification, or more probably cleavage planes of the rock. The direction of the veins is N.N.W. and S.S.E. They fill the fissures which have been evidently produced by the eruptive rocks in the act of upheaving these mountains, and are of very different origin to the dykes of magnetic iron at Stazzema, a few miles distant. The vein, varying from four to ten feet in width, is not entirely metalliferous; the band which contains the ore is from four inches to a foot wide, and is said to be perfectly continuous. It has been worked to a depth of at least 280 feet.

In the Middle Ages Bottino belonged to the Signori di Corvaja and Vallechia, who worked the ore on their own account; it subsequently passed into the rapacious hands of that shrewd Grand Duke of Tuscany Cosmo I., in 1540.

On the southern slope of Monte Gabberi, south of Bottino, with which they are probably geologically connected, are the mines of Argentiera or Sta. Anna, in the Val di Castello. The earliest account of them which I have been able to meet with is that by Muratori, who alludes to the working of them in 1203. Cosmo I. re-opened them likewise, and they were worked, along with Bottino, by his two immediate successors, Francis I. and Ferdinand I.

The following Table shows the produce of the lead mines of the Monte dell' Argentiera and the vicinity, in their most flourishing days, under the first three Grand Dukes of Tuscany:—

Years. (Florentine style).	Washed Mineral Smelted.			Metal Obtained from preceding Ores. Pig Lead. (*Piombo opera.*) Before cupellation.			Lead. After cupellation.			Silver.	Expense.
	tons.	cwt.	lbs.	tons.	cwt.	lbs.	tons.	cwt.	lbs.	lbs. avoir.	£.
1565	28	11	59	13	17	98	5	9	56	137·0	933
1568	26	1	44	15	14	87	6	17	35	140·3	871
1572	18	0	108	13	9	31	3	4	52	123·6	910
1573	13	4	4	9	13	87	3	5	17	88·1	983
1574	13	14	7	10	19	36	4	8	75	155·8	1,090
1581	15	10	93	9	16	10	3	5	62	141·5	1,331
1585	14	0	81	7	10	41	3	3	90	150·4	943
1587	23	14	67	5	19	49	1	15	88	63·3	1,037
1589	47	6	59	8	9	48	2	0	16	142·1	1,358
1590	41	3	59	5	0	38	1	15	91	78·2	812
1591	54	5	63	8	0	69	1	11	108	128·1	744
1592 } 18th Sept. }	24	16	0	3	2	30	1	1	50	46·7	447
	320	9	84	109	13	64	37	19	68	1393·1	£11,459

—(Repetti; *Diz. istorico della Toscana.* Tom. I., p. 130).

Much difficulty was experienced by the princes in obtaining the silver when extracted from these ores. A German engineer was, indeed, brought over to conduct the business, but still strong suspicions were entertained that a large proportion of the precious metal was systematically stolen, and Ferdinand I., acting on this supposition, in which he was doubtless perfectly correct, as may be seen by the almost incredible loss (even of the lead) by cupellation, exhibited in the foregoing table, resolved to have nothing more to do with the mines, and suddenly suspended the operations in 1593.

Coming down to our own times, Argentiera was re-opened for several years, but eventually closed in 1851, according to rumour, on account of bad management. Much mystery and secrecy is maintained respecting these mines. I was assured that new veins of considerable dimensions had been lately discovered in the Galleria Sta. Barbara, though they have not yet turned them to profit. A very complex and valuable grey copper, from Angina, Val di Castello, analysed by Kersten, gave:—

Copper	35·80
Antimony	27·47
Silver	0·33
Zinc	6·05
Mercury	2·70
Sulphur	24·00
	96·35

An assay of iron ore from Val di Castello gave:—

	oz.	dwt.	gr.
Silver	6	4	10
Gold	0	10	0

Bottino was also re-opened in 1830: for twelve years the result was rather unsatisfactory, but I understood that from 1842 to 1860 the produce has been very considerable. It is the only mine in the Versiglia which has been uninterruptedly in operation until the present time.

I was told that the lead contained 0·004 of silver, which is separated by cupellation, and has been hitherto sold at the mint at Florence at the rate of 130 to 132 *paoli* the Tuscan pound, or 4s. 3½d. to 4s. 4d. per avoirdupois ounce; while the price of the lead at Leghorn varies from 30 to 33 *paoli* the *cento* (£1 to £1 2s. per cwt.)

The silver of Val di Castello sent to Genoa realised 140 *paoli* per lb., or 6s. 1d. per avoirdupois ounce, because of the small proportion of gold which it contained. The lead was sold at Leghorn for £1 per cwt.

Bottino produces some rare and interesting minerals, among which I may mention Heteromorphite, or capillary sulphuret of antimony and lead; $2PbS + SbS^3$. It is associated with quartz and bitter spar. I procured some specimens in which the crystals were at least one inch in length, and others from Monte Tambura mine.

Meneghenite, $4PbS + SbS^3$, and Targionite, are peculiar to Bottino.

I was informed by the proprietor that there are some lead veins on the Alpe di Terinca, near Levigliani, five miles above Seravezza, which have not yet been worked: five have already been discovered parallel, and close to each other, and varying in width from 4 inches to 4 feet at the outcrop, which is at the junction of the limestone with the ancient rocks. An experiment made on 100lbs. of mineral produced 66lbs. of lead, containing 0·0037 of silver, and 0·000004 of gold per cent.

I have before me long and elaborate statistical returns of the produce of the various mines of the Versiglia whilst they were in activity some years ago, which I should willingly lay before my readers, just as furnished me on the spot, at my request, by a Tuscan gentleman, since they are tabulated in the most systematical manner, and embrace a variety of most interesting matter, financial and mineralogical, but I much fear they are utterly wanting in veracity. In carefully examining the figures, I am most reluctantly led to the belief that the whole has been a most ingenious fraud on my credulity; as such I much regret to add that I shall make no allusion to them as I had intended, nor to the gentleman who furnished them to me.

Not twenty miles from Massa Ducale,* in Modena, and a little north of the Tuscan frontier, rises the lofty peak of Monte Tambura. A lead mine has been opened in the limestone strata on its flanks, at a considerable height, but, owing to the entire absence of roads, it is almost impossible to reach it. Some lumps of argentiferous galena procured there were shown me; if fair samples, they were magnificent specimens; one solid lump of very argentiferous ore was two or three inches thick, and nearly a foot long and broad.

Assays of Lead from the Tambura Mine.

Containing per ton of ore:—

	per cent.		oz. dwt. gr.		oz. dwt.
	Lead, 50·0	Gold,	1 2 20	Silver,	0 0
	,, 50·0	,,	0 6 12	,,	0 0
	,, not estimated.	,,	1 9 9	,,	24 10
Upper vein ...	,, 50·0	,,	0 0 0	,,	45 16
Parallel to last	,, not estimated.	,,	0 0 13	,,	23 13
2nd vein rather disseminated in Schist ...	,, 36·0	,,	0 0 13	,,	12 1

Analysis of ore from Tambura Mine.

Lead	62·08
Sulphur	9·50
Protoxide of iron	0·50
Silica, free and combined	23·00
Loss	4·92
	100·00

III.—Iron Mines.

Compared with Elban iron mines, those of the Tuscan mainland are of very little importance, and almost too insignificant to be worthy of notice; nor are they active at the present time. In 1843, M. Bourlon, a French gentleman, opened a mine at Monte Valerio, below Campiglia. The ore is brown hæmatite. Professor Meneghini shows it to exist in the form of dykes, traversing the purple and reddish Oolitic schists, to which he has affixed the term *Scisti varjcolori*. Another mine was commenced at Gavorrano, in 1842; Pilla states that it was relinquished through the ignorance of the parties. In the Apuan Alps magnetic iron, apparently of very excellent quality, is found in several places; thus, two dykes occur about six miles above Seravezza, and one mile from Stazzema, on the northern flank of the hill, several hundred feet above the level of the valley. Previous to the year 1848 an Englishman named Forbes formed a company for utilizing this ore, which had been already worked by the ancients. The revolutions of that eventful year are said to have caused the enterprise to be altogether abandoned, though, to judge from the dimensions of the excavations for the little distance they have penetrated into the mountain, and the quality of several tons of ore piled up outside, I am rather surprised the undertaking has never been resumed, especially as iron furnaces are already in existence on the Vezza, within a few miles. The magnetic iron of Stazzema is of a steel-grey tint, in crystalline and somewhat granular masses. These dykes traverse the Liassic saccharoidal marble, and in some places have united the angular fragments which have been broken off the parent mass, forming a breccia with metalliferous cement, firmly binding together the calcareous particles. This breccia is excessively hard and strong, but difficult to polish. Savi and Meneghini have mentioned the formation of amphibolic minerals by the agency of the iron, and from that fact conclude its origin to be igneous; regarding the date of the intrusion, they show it to have been during the Eocene period, as is also that of the dykes at Monte Valerio and Gavorrano. Near the entrance of the gallery, or rather cavern—for such is its form—I noticed a huge mass of white crystalline marble, which had fallen from above, and was in a state of complete disintegration, so that it crumbled to pieces. This seemed to me difficult to account for, it being sheltered from the sun and rain. Other dykes of magnetic iron occur in the Val di Strettoja. The assays of the iron ores from Monte Arsiccio, near Val di Castello, yield fifty or sixty per cent. of iron. I have been unsuccessful in obtaining any statistics of what they produced.

Of the manufacture of iron at Follonica, in the Maremme, I shall reserve my description till I treat of the mines of Elba, from whence the ores are derived, as well as any notices of the ancient wrought-iron and steel furnaces at Populonia, &c.

IV. Mercury Mines.

At least four mines of cinnabar exist in Tuscany; only one of them is in operation just now, if even that one has not shared the fate of the rest.

The cinnabar mine at Selvena, near Sta Fiora, dates from the 13th century, for mention is made of its being worked in 1272 (Repetti, Tom. v., p. 241), and the reader who may desire to know the manner in which the metallic mercury was there separated in the Middle Ages may consult the drawings given by Mercatti; (*Metallotheca Vaticana.*)

The cinnabar mine at Torre di Jano, near Montajone, 12 miles north of Volterra, on the other hand, is of recent origin. It is in soft blueish carboniferous clays and schists, lately discovered by my friend Professor Meneghini, who was the first to announce the presence of Palæozoic fossils on the Italian continent. The fauna includes *Leptæna, Spirifer glaber*, and several other carboniferous brachiopods, besides a numerous flora characteristic of that period, including such ferns as *Neuropteris rotundifolia; Odontopteris schlotheimi; Pecopteris arborescens; P. acuta; P. cyathea; P. Bucklandi;* also *Annularia longifolia, Lepidodendron* (?) and *Calamites*. Torri still remains the only locality in the Peninsula where Palæozoic fossils are found, although rocks of that date have been proved by this discovery to form the greater portion of the Pisan hills, and to constitute considerable strata elsewhere in Tuscany, though now so altered by metamorphic action, as to have been rendered crystalline, whence not a trace of organic remains can now be seen. Though unable to procure any brachiopods at Jano, owing to the fall of a considerable amount of rubbish over the cliff, I found abundance of imperfectly preserved plant remains, the woody parts converted into anthracite; the largest stems I could obtain were an inch thick. They are with difficulty detached, being splintery, and often firmly adhering to the rock. The vegetable structure is indistinct, the trees ap-

* It is highly essential, once for all, to state that there are two towns called Massa; one in Tuscany, known as Marittima, the other in Modena, designated indifferently Massa Carrara or Ducale.

parently only a few individual trunks; in other cases, the shales are so pervaded with decomposing iron pyrites, that the softer parts of the plants are not easily preserved. Where a natural section or cutting of the shales is obtainable, they are seen copiously covered with an efflorescence of sulphur, imparting a pale yellow colour. The schists are in places sufficiently impregnated with cinnabar to have a red tinge, but I did not see any true vein; possibly it may be derived from some vein destroyed by the neighbouring serpentine in the act of eruption, when the vapour of the cinnabar diffused itself through the laminæ of the shales, as being the least solid rock in the locality; the pulverulent aspect of the cinnabar is, at any rate, very different from what one would suppose it to be if *in situ*. The ore was worked by galleries driven into the side of the hill; the great objection to this place is its entire seclusion, and the difficulty of access from any town. It may here be observed that most of the cinnabar used is procured from shales and other rocks of the Carboniferous system; thus that of Almaden, in Spain. An ancient gallery is reported to have been made near Jano, for the extraction of sulphur alone. Two furnaces served for the distillation of the cinnabar; the ore was introduced into cylindrical retorts, somewhat similar to those employed in the manufacture of gas. Such were the great ideas of the proprietor of those works, that he seems to have exhausted all his means in too prematurely erecting a fine establishment, furnaces, and sheds for sorting the ores, which swallowed up all his capital; consequently the works now lie in a dormant condition.

Far more promising are the cinnabar veins in the vicinity of Seravezza, where it would only require good management and an able director to turn the mineral to account. The mine of Levigliani is probably very ancient, but some old authors employ the same word to signify a vein as they do in speaking of a mine, which causes a little ambiguity. The circumstances which brought the mercury of Levigliani into notice are too interesting to be omitted. Cosmo III., as patron of the grand ducal printing establishment at Florence, was anxious to publish some ecclesiastical works in black and red, and learning that cinnabar existed near Seravezza, he sent Giuseppe Antonio Torricelli, one of the sculptors of the Imperial and Royal Gallery of *pietre dure* to examine the matter for himself, and if possible re-open the mine, in order to procure a brilliant vermillion ink. In a short time Torricelli, who appears to have been a very intelligent man, returned to the capital with 120 Tuscan pounds of splendid cinnabar, which he had himself obtained, adding that he had left an immense quantity behind. The Grand Duke was so delighted that, in 1718, he handed over to the printing establishment the right of working the mine for themselves, to aid in defraying the expenses of printing the books in black and red, though some hinted to him that, according to the version of Torricelli, he had been far too liberal. The new proprietors immediately made overtures to Torricelli to return and conduct the operations, but he was resolute, and could not be persuaded to go. As a last excuse, he proposed another man, but the latter during two summers made a very poor business of it, the expenses exceeding the proceeds. Even subsequently a superintendent going there under the royal patronage had very dubious success. Were it not for positive evidence we might be sceptical as to whether Torricelli ever procured the cinnabar in such large quantities, and in so short a time, for veins increase in richness as we descend, and cannot abruptly terminate; but Targioni, about 30 years afterwards, went to the spot and broke off specimens of cinnabar, and was informed by the village priest that he was an eye-witness of the discovery of Torricelli; and that, moreover, one day when the latter had sprung a mine, fluid mercury flowed out in such a constant stream for six minutes, that the men, having no more vessels in which to receive it, filled two of their caps with the pure liquid metal. (Targioni: *Viaggi in Toscana*, tom iv., pp. 120, 129.) So late as 1838 the mine was re-opened, and produced, according to Sig. G. Santini, $2\frac{2}{3}$ tons of cinnabar annually; in 1853 the great influx of Californian mercury caused it to be definitively abandoned. Such specimens as I procured are associated with quartz, and very rich.

At Ripa, two miles below Seravezza, veins of cinnabar run with a nearly horizontal course, occasionally 4 or even 9 inches thick; the average does not exceed an inch in thickness: they are situated on the western slope of the hill, which is composed of soft, greasy, whitish, Oolitic steaschists. The cinnabar was discovered in 1841, and in a short time three companies were engaged in extracting it, the *Società Idrargica*, Montemart e Peryer, and Hähner and Co.; previous to the summer of 1845 the two latter had obtained 20 tons of mercury, which was distilled at the mines. (Repetti, *Dizionario Istorico.*) Levels have been prosecuted for some distance into the hill, with cross workings, and tramroads constructed in them; the names of these levels are Gallerie Federiga, Santini, Sta Barbera, Enrichetta, Peryer, Montemart, and Sofia. I procured some truly splendid massive lumps at the mines; though the veins are small, the mineral is so pure as to be ruby-red and translucent in these specimens. The matrix is a soft rock, and easily worked; the soapy feel which it presents is remarkable; it often assumes the appearance of clay, the more so in certain thin beds between the more compact strata, the material from which can be easily moulded in the hand: a small quantity of cinnabar is disseminated through the rock itself. At the risk of repetition I may say that I received the anticipated answer, "the mine is stopped;" but I would ask, Why? Is it not from bad management or want of experience rather than a natural defect? The only reason assigned here was the great fall in the price of mercury during past years.

Approximate Yield of the Mercury Mines of Ripa worked by the Three Societies, as roughly estimated for me by Sig. G. Santini, who is alone responsible for the figures.

Years.	Cinnabar extracted.	Distilled Mercury obtained.			Value of foregoing.	Price per lb. avoird. at Leghorn.	
	Tons.	tons.	cwt.	lbs.	£	s.	d.
1842	99	2	0	12	666	3	0
1843	199	4	0	30	1,333	3	0
1844	332	6	13	75	2,222	3	0
1845	498	10	0	78	3,333	3	0
1846	664	13	7	40	5,333	3	7
1847	1,329	26	14	83	12,444	4	2
1848	1,329	26	14	83	12,444	4	2
1849	1,329	26	14	80	8,888	3	0
1850	1,329	26	14	80	3,333	1	9
1851	664	13	7	35	2,666	1	9

V.—Antimony Mines.

The few remaining mines are of very little importance. Antimony is found at Pereta, in the Maremme, not far from Grosseto, in long crystals of great beauty, affording some of the finest specimens in the world. I was shown a mass of at least a cubic foot, composed of the most splendid crystals of sulphuret of antimony, interlacing each other, procured from a cavity. It exists in nests in the *macigno* sandstone; the ground is soft, and has been decomposed by sulphurous emanations. Pilla states that while some of the masses are too small to work, others yield from 17 to 34 tons, and that the produce in 1844 was $53\frac{1}{2}$ tons; in 1845, $48\frac{1}{2}$ tons. The mines of Montauto in the Senese, in blackish clays resulting from the decomposition of the macigno, produced $43\frac{1}{2}$ tons of ore in 1844. (Pilla; *Cenne sulle richezze minerali della Toscana.*) Antimony also exists at Castagneto and Micciano, in the Volterrano, and I have seen good specimens from Selvena, near Sta Fiora, where it has long been known. A farmer at Cipolleri gave me a good piece of antimony ore, which

he had procured near his farm, about five miles from Massa Marittima, though no one has yet thought it worth while to pay attention to it. The lump in question is crystallised, and imbedded in a hard silicious matrix, evidently consolidated since the formation of the antimony; it very closely resembles in structure and occurrence the antimony of Elba, therefore, I presume it has been formed in the same manner.

VI.—Manganese Mines.

Manganese occurs in several parts of Tuscany, as at Capanne Vecchie, and Monte Nero, south of Leghorn: it has been recently worked at Torciliana, five miles south-east of Camajore, in the Compartment of Lucca. I cannot say why they have left off working the mine, but it seems that some difficulty was experienced in selling the ore, which may not be uniformly good: some of it is rather earthy, but again specimens of compact oxide would probably indicate the existence of better ore deeper down, if the explorations were prosecuted. Those who are interested in mineral veins would be well repaid by a visit to this place. Climbing up the steep face of the hill for about half way—probably 1,000 feet—through a fine oliveyard planted in terraces, we arrive at the bold bluff in which is the outcrop of the manganese vein. On approaching it on either side, I noticed a marked alteration in the strata by the intrusion of the manganese, so that, by the peroxidation of the iron they contained, the rock has become reddened, and completely lost its original structure, assuming the appearance of a hard metamorphic substance. To my mind there can be no doubt that the manganese was intruded in a heated condition, and not formed by mere chemical action. A few yards beyond, the rock changes to an extremely hard cellular grey limestone. At Beverone, near La Spezia, in the south of Piedmont, and some miles north of Seravezza, another manganese vein has been tried. Useful as this mineral is in the manufacture of bleaching-powder, &c., its extraction in Italy as a source of wealth is still, I think, an open question, but one well deserving attention.

VII.—Various Metalliferous Minerals.

Arsenic might be procured from pyrites in the vicinity of Pietra Santa. I was informed that it was known there as early as 1566.

Cobalt certainly exists near Seravezza, for a Swedish mining engineer, M. Angerstein, who made a report on the resources of the district, in 1751, found a vein himself near Sta Anna, in the Val de Castello; and Signor Vincenzo Santini, of Pietra Santa, assured me that Cosmo I. had worked it, though I cannot find any record of this circumstance in the books which I have hitherto read.

Chrome is very extensively distributed through the serpentine rocks, to which it has, doubtless, communicated the colour; the newer serpentine, or gabbro verde of Liguria was, in one instance, found by Vauquelin to contain as much as 2 per cent. of oxide of chromium. By the decomposition of some of these eruptive rocks this oxide has separated out, and probably produced the chromic minerals, such as chromate of iron, found near Jano. It is too diffused to have been turned to any account, though I doubt whether it might not be found in large masses by diligent search; certain it is that chromate of iron is generally met with in serpentine.

Etruscan Metal-work.

With a single exception—some coarse canvas discovered at Volterra—the whole of the Etruscan antiquities with which I am acquainted are made of mineral substances, either directly, as metal, stone, or pottery, or indirectly, as frescoes; these throw considerable light on the customs of this ancient people, for of their literature we have no remains. Having drawn from nature a variety of objects illustrating the state of art among the Etruscans, I append some engraved sketches here, as showing what metals they were in the habit of working. Excepting tin and gold, I have no doubt that all the metals employed in the manufacture of these articles were obtained from mines situated in Tuscany; they have, therefore, a direct bearing on my present paper.

Before commencing a special description of the objects engraved in the *Journal*, a few cursory remarks on Etruscan art may be acceptable. The Egyptian forms of the earliest Etruscan alabaster gods, no less point to their intercourse with Africa than the exquisite filigree work introduced by them from Egypt into Italy, where this art seems to have been preserved up to the present time, though, to my mind, the Etruscan ear-ring I have drawn is in no way inferior in point of taste and workmanship to similar productions which I inspected last year in the manufactories at Genoa. By a more thorough and thoughtful examination of their works of art, I feel persuaded that we might become far better acquainted with the social condition of the Etruscans. A mere glance at the graceful designs and fine features observable in their statues, leads one to form a very favourable opinion of the Etruscans as compared with the Egyptians. There is more action in their figures; a fine open brow, a handsome nose and well-chiselled mouth, and eyes which bespeak less of the sensuous and more of the intellectual, take the place of that stern fixedness of expression and the hard features so conspicuous in Egyptian types. In Etruria, too, we never find representations of monsters—half-man, half-beast—such as the Egyptian sphinxes. Many other circumstantial evidences might be adduced confirmatory of this remark; thus, their mode of writing. In Egypt, mysterious and difficult hieroglyphics were employed, in which, probably, the priesthood and government were alone skilled, while the masses were entirely ignorant of any method of embodying their thoughts in a material form.

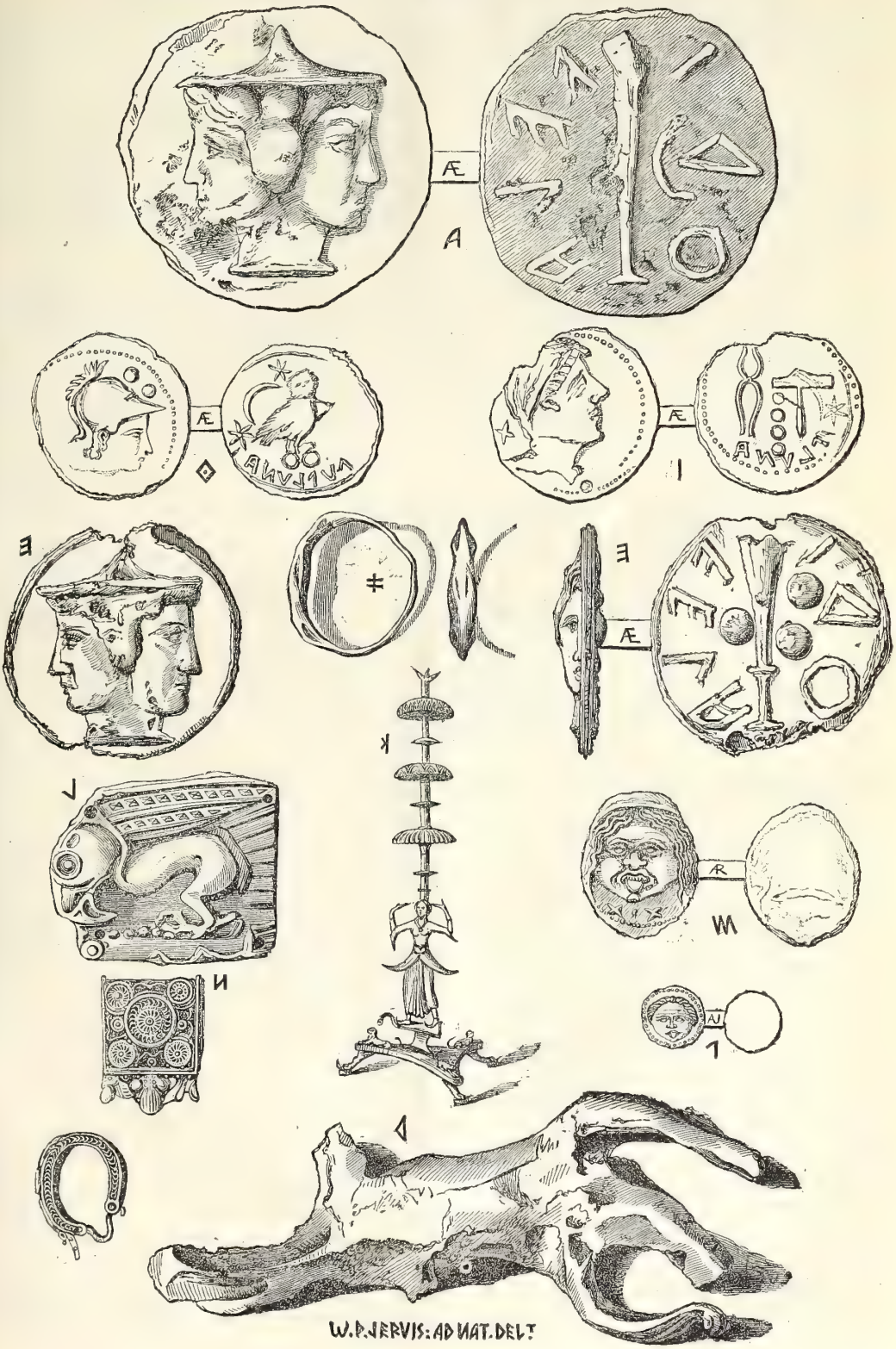
I am well aware some might object that this was during the infancy of knowledge and art, no better means of writing being yet known, but I would give a conclusive argument against such a theory, since the Israelites sojourned 430 years in Egypt, and we are acquainted with the simplicity of the characters they employed, so that the Egyptian hierarchy, or, at any rate the government, must have had great dealings with the Jews, at least during the time that they lived in the land of Goshen, and evidently preferred keeping the lower orders in ignorance and slavery, by enshrouding all knowledge under a veil of mystery. In Etruria, on the other hand, we see how, by the simplicity of their alphabet, they early brought the art of writing down to the level of the people. Finding, as we do, coins struck by numerous cities in Etruria, we learn that these possessed somewhat equal rank, incompatible with the idea that the princes who held sway were under a single despot, such as the Pharaohs. The Etruscans were, however, neither socialists nor republicans, for they honoured certain great individuals, statesmen, and warriors, and were prouder of perpetuating the memory of their virtues on tombs than were the Greeks, who, more fickle, and divided into numerous factions, could allow an unappreciated Solon to be banished, and witness a Socrates perish before their eyes, in the full vigour of his giant mind, without the least remorse. It is, indeed, to the tombs of the Etruscan chiefs that we must have recourse to find their productions, the majority of their best works of art being there deposited, as a grateful memorial to departed worth.

Etruscan art has been divided into three periods, corresponding with contemporaneous phases in their political history.

The *first period* of art in Etruria points to intercourse with Egypt, but it appears that it was the Pelasgi from Attica and Arcadia, who, leaving Greece and settling in Etruria, gave the inhabitants the idea of an alphabet and the principles of architecture. The statues and bronze work of this time are characterised by an inferiority of execution, though they exhibit an appreciation of beauty. The eyes are raised obliquely upwards, like those of the Tatars and Egyptians.

The *second period* was inaugurated about the time of

ETRUSCAN METAL WORK.

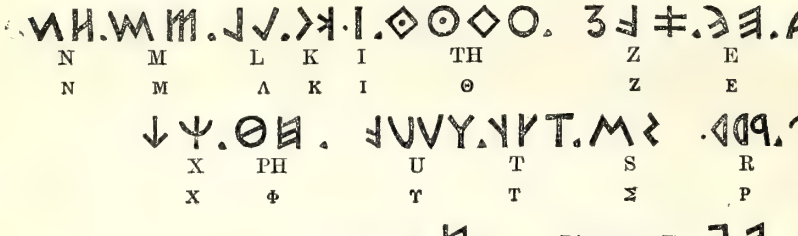


Solomon (B.C. 1000), by the arrival of fresh colonists from Greece. The country became too densely populated, so that the inhabitants divided into two portions. One branch emigrated eastward into Asia: the other remaining in Etruria, along the coasts of the Mediterranean, giving to that country the name of Tyrrhenia. Twelve cities, each governed by a chief, and collectively placed under an elective king, now rose to greatness, and even magnificence, while the arts arrived at a high degree of perfection. The statues made about this time are recognised by their energy of conception and execution. They had also a custom of representing their deities with wings, by which we are at once able to distinguish them from the work of all other people.

Third period (B.C. 500). Meanwhile the Romans, increasing in power, carried their victorious arms into Etruria, enfeebling the nation, so that a year after the death of Alexander the Great (B.C. 324), it was almost entirely subjugated, and the Etruscan language, after having blended with Latin, rapidly became obsolete. Soon after (B.C. 280), their last king, Elius Volturrinus, was killed in battle near lake Lucumo, and Etruria was formed into a Roman province.

About B.C. 265, the Romans took Volsinium (Bolsena), carrying away 2,000 statues. Bolsena is situated in the States of the Church, but in all probability other cities on the Tuscan territory were equally rich in similar productions, since metal statues and ornaments are so abundant in all their ruins. The influence of Greek art on the Etruscans now became apparent from the great similarity of style and of subjects. Thanks, however, to the Etruscan habit of writing inscriptions on their vases and metal-work, we are thus frequently able with certainty to distinguish these objects from Greek productions, when on other clue can be obtained. Some of the finest known specimens of art relating to this epoch are the candelabra, formerly held in such high esteem by the Romans; the lamps, often similar to those of the last named people, and the beautiful metallic mirrors with engraved groups of figures.

The alphabet of the Etruscans was read from right to left, but though the Romans, having eventually adopted it, wrote in the reverse direction, the Etruscans never appear to have fallen into their method. The Etruscan alphabet is the basis of our own, and as such I may subjoin it for comparison.



As a rather novel addition to our own artistic alphabets, I would propose one which has suggested itself to my mind by a study of the foregoing. I do not see why we should scorn the taste of the polished Etruscans of the days of Solomon, any more than that of the Saxons and and Goths, whose characters we adopt. Ours is at best but a *modified* Etruscan alphabet; the Roman numerals were also borrowed from the Etruscans:—

Explanation of Engravings.

1. Copper.

A. Cast copper coin of Volterra; *Semissis:* obverse; double-headed Janus, both young faces, (the Roman Janus having one face young, the other old,) capped by a *petasus:* reverse, (Felathri) with a club and a crescent moon.

B. Another cast copper coin of Volterra, smaller, *Quadrans;* similar obverse; reverse; same inscription, with the club, and three balls denoting its weight. Profile showing the great relief of the coin; upper part rather imperfect, from deficiency of metal.

It is probable that Volterra was founded by the Pelasgi-Tyrrhenians, who established themselves in Etruria. The name Felathri corresponds with that of Elatria, or Elateia (Ἐλατεια), a city of Epirus, whence a great part of the people who occupied Italy migrated, especially the Pelasgi. One of the principal cities of Phocis was called Elatria, and so was another in Thessaly. In a Greek inscription referring to the former of the two, the name is preceded by a digamma, thus, ϜΕΛΑΤΕΙΗ. Boeckmann (*Inscrip. Græc.*, tom. i., p. 741, pars. III.), and Millingen (*Considérations sur la Numismatique de l'ancienne Italie*, p. 167).

All the coins in Volterra—of which these are by no means the largest—are copper. This I attribute to the Etruscans having worked the mines of Monte Catini and others in the vicinity; indeed, Mr. Birch confirmed me in my belief, drawing my attention to a similar fact with regard to the gold mines of Philippi, since, from the great quantity of the precious metal extracted near that city, we find large gold money coined by Philip of Macedon. The series of cast copper coins of Volterra, *aes grave*, is very complete, it consists of the—

	Ounces.		Pounds.		
Dupondius...	24	or	2	*libræ*,	with two *obeli.*
As.....	12	,,	1	*libra*,	with one *obelus.*
Semissis.....	6	,,	$\frac{1}{2}$	,,	with a crescent moon.
Triens	4	,,	$\frac{1}{3}$	,,	with four balls.
Quadrans ...	3	,,	$\frac{1}{4}$	,,	with three balls.
Sextans	2	,,	$\frac{1}{6}$	,,	with two balls.
Uncia	1	,,	$\frac{1}{12}$	,,	with one ball.

The Etruscans, therefore, employed the *duodecimal system*, and not the *decimal*. The custom of casting their coins was only adopted by two other Etruscan cities; a few Roman copper coins are also cast.

C. Copper ring from Volterra; device, apparently a double-headed serpent, the mouths holding the thin portion of the ring.

D. Stamped copper coin of Populonia (site, near Piombino, department of Grosseto). Obverse; an owl, sym-

bolising wisdom, on two balls, with a crescent moon and two stars; inscription, PUPLUNA (Pupluna). Reverse: head of Minerva.

. Stamped copper coin of Populonia; obverse, head of Vulcan: reverse, hammer and tongs, with four balls denoting the weight. Same inscription as preceding.

My reason for selecting an imperfect coin was to illustrate a curious fact, namely, that the Etruscans, at least occasionally, recoined their old money, for on close inspection I perceived that this was stamped over one of the preceding coins. Thus, the moon and two stars may be traced very legibly on the reverse, as well as the circle of dots round the margin. On the obverse, we observe the ball under Minerva's head. Both these coins are of the third period of art.

2. Bronze.

. Bronze candelabrum of the second epoch of art; locality unknown. Shaft supported by a female winged divinity, resting on a tripod with lion's claws; a couchant lion at each angle of the tripod.

The candelabrum is about 18 inches high, and is the only reduced figure on the page; the rest being the natural size. This bronze is an alloy of copper and tin.

3. Electrum.

. Electrum beaten ornament from Vulci; exceedingly ancient and grotesque; first period of art; probably representing a bird with the wing outstretched. It is only a thin plate, and is pierced at each corner by a hole for suspension.

Electrum, the Greek ἤλεκτρον, is an alloy of four-fifths gold and one-fifth silver (Pliny), and is of a paler yellow than ordinary gold. According to some authorities, it would mean something bright and shining, and is usually connected with ἠλέκτωρ, the sun, to which Homer compares his electron.

4. Gold.

. Gold filigree earring, of the best execution, in style resembling the modern *filigrana* of Genoa; the wire evidently soldered together in precisely the same manner.

. Gold coin of Populonia: obverse, Gorgon's head, beautiful features and exquisite workmanship; reverse, *plain*, probably struck by a die on a flat anvil, with the tools represented above. Some doubts have been expressed as to whether this was an ornament, though I do not concur in that opinion, since the following coin is also plain on the reverse—a distinctive peculiarity in much of the Populonian money.

5. Silver.

. Struck silver coin of Populonia: obverse; very grotesque Gorgon's head, projecting tongue and prominent teeth; a fillet on the forehead; hair in parallel braids; a row of beads round the margin; two marks (XX) to designate the weight; reverse; *plain*. The silver most probably obtained from the argentiferous lead mines of *Cava del piombo*, to which I have referred. Populonia was the only city in Central Italy which has gold coins, except Rome in later times.

6. Lead.

. Leaden animal, a lizard (?), from Volterra; not only cast, but evidently sculptured subsequently, as is seen by parallel marks in several places. It is imperfect, but such antiquities are very rare, since lead resists with great difficulty the corrosive action of the carbonic acid present in the atmosphere.

7. Iron.

The Etruscans were famous for their iron-work, as well as for their chaste and beautiful bronze castings, so highly prized by the Romans. When Scipio went to the Punic War, he was supplied with iron by the Etruscans of Populonia, who then smelted the specular iron of Rio, as may be seen by the fine particles of ore on the beach near the site of that ancient seaport city.

I regret not to be able at present to figure any iron weapons or tools positively Etruscan, or made from Elban iron, but hope on another occasion to do so.

(*To be continued.*)

EXAMINATION PAPERS, 1860.

(*Continued from page* 682.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

GEOGRAPHY.

THREE HOURS ALLOWED.

The candidate is not allowed to answer more than *six* of the questions in each Section. It is imperatively required that either No. 6 or No. 10 shall be amongst those selected for answer in Section I.

Section I.

(1.) State with precision the localities of the following points in the British Islands, the Mendip Hills, the Wrekin, the Mourne Mountains, the Ochill Hills, Malin Head, Morecambe Bay, Spithead, St. Bride's Bay, Buchan Ness, and Dingle Bay.

(2.) On what rivers are the following towns? Perth, Durham, Stamford, Leicester, Newbury, Winchester, Kilkenny, Limerick, Cork, Bridgewater, Bristol, Leeds, Chester, Bath?

(3.) State the localities of Behring Strait, the Bay of Fundy, Cape Agulhas, the Chagos Islands, Jan Mayen Island, Mount Ararat, the River Amoor, Moreton Bay, Cape Palmas, the Loo-choo Islands, and Torres Strait.

(4.) Where are Concepcion, Kurachee, Port Lincoln, Tanjore, Bahia, Chicago, Irkutsk, Khartoom, Maritzburg, Nikolaev, Muscat, Triest, Rangoon, and Singapore?

(5.) Name the capital city, and also the chief seaport, of each of the following countries:—Peru, New Granada, Venezuela, Chili, Bolivia, Persia, Belgium, the Austrian Empire, Egypt, and Prussia. (Say what river, if any, each place is on.)

(6.) Make a sketch of either one of the following countries, showing the general direction of the coast lines, mountains, and chief rivers:—

(*a.*) France.
(*b.*) Sweden and Norway.
(*c.*) Spain and Portugal.

(7.) Write a brief account of the principal mountain systems of the New World, as to direction, extent, and altitude, naming the countries through which they pass.

(8.) Make a list of some of the principal rivers of the Old World, classifying them according to the seas or oceans into which they discharge.

(9.) Draw up a table of the British possessions in the different divisions of the globe, naming the chief town of each.

(10.) Draw, in rough outline, a map of the county in which you reside, marking on it the high grounds, rivers, and chief towns. (If any coal-field falls within its limits, indicate the locality and extent).

Section II.

(1.) State briefly the chief causes to which differences of climate are due, giving examples of particular countries or districts in illustration.

(2.) Write a brief account of the African Sahara, stating especially its meteorological phenomena and its general influence upon climate.

(3.) How do you account for the existence of currents in the ocean? State what you know respecting the currents of the Atlantic.

(4.) Over what parts of the globe do the trade-winds prevail, and what is their general direction?

(5.) In the case of either one of the following rivers, give a brief account of its course—general nature of basin—tributaries—and commercial bearings:—

(*a.*) Danube.
(*b.*) Mississippi.
(*c.*) Volga.

(6.) What portions of the globe are distinguished as regions of volcanic phenomena and of earthquake shocks? Say what you know concerning the geographical distribution of active volcanos.

(7.) Draw up a list of the coal-fields of England and Wales, and name the chief centres of manufacturing industry that are within the limits of each.

(8.) The indigenous productions (vegetable and animal) of the New World differ strikingly from those of the eastern half of the globe. Give some examples of this—stating, as well as you are able, the particular country or region whence each instance is derived.

(9.) In the case of the following countries, state, under the respective headings of imports and exports, the articles which enter most largely into the commerce of each: Britain, France, United States, China, India, New South Wales.

(10.) Write a brief account of either one of the undernamed British Colonies, stating the circumstances of origin, natural features, climate, and commercial productions:—

(*a*) British Columbia.
(*b*) The Cape Colony.
(*c*) Victoria.

ENGLISH HISTORY.

THREE HOURS ALLOWED.

1. What were the principal changes introduced into England by the Norman conquest?
2. Explain the nature of the dispute between Henry I. and Anselm.
3. Give a short history of trial by jury in England.
4. What were the principal provisions of Magna Charta.
5. Between whom, and in what reigns, were the battles of Cressy, Flodden, Naseby, Almanza, Fontenoy, and Corunna fought? Describe one of them.
6. Give, with dates, a short outline of the reign of Henry VIII.
7. Against what grievances was the Petition of Right directed?
8. Under what circumstances was the treaty of Utrecht concluded, and what were its principal provisions?
9. State briefly what circumstances led to the revolt of the American colonies?
10. Give a short life of Sir Walter Raleigh, of Oliver Cromwell, or of Sir Robert Walpole.
11. What sovereigns since the conquest have reigned out of the direct order of succession, and what have been their titles to the crown?
12. What were the British dominions under Henry II., under George I., and under George IV.?

ENGLISH LITERATURE.

THREE HOURS ALLOWED FOR THIS AND THE OTHER AUTHOR SELECTED BY THE CANDIDATE.

Spenser.

(The Faerie Queene.)

Book I.

(1.) State the connexion in which each of the following stanzas occurs, and briefly express the sense of it in plain prose.

(a.) And now it is empassioned so deepe
For fairest Unaes sake, of whom I sing,
That my frayle eies these lines with teares do steepe,
To think how she through guyleful handeling,
Though true as touch, though daughter of a king,
Though faire as ever living wight was fayre,
Though nor in word nor deede ill meriting,
Is from her knight divorced in dispayre,
And her dew loves deryv'd to that vyle witches shayre.

(b.) By this the northerne waggoner had set
His sevenfold teme behind the stedfast starre
That was in oceans waves yet never wet,
But firme is fixt, and sendeth light from farre
To all that in the wide deepe wandring arre;
And chearefull chaunticlere with his note shrill
Had warned once, that Phœbus fiery carre
In hast was climbing up the eastern hill,
Full envious that night so long his roome did fill.

(2.) State the connexion in which these passages stand; explain the allusions; notice the peculiar grammatical constructions, and give the modern spelling of such words as are spelt in the old manner:—

(a.) So as they traveiled, lo! they gan espy
An armed knight towards them gallop fast,
That seemed from some feared foe to fly,
Or other griesly thing, that him aghast.
Still, as he fledd, his eye was backward cast,
As if his feare still followed him behynd;
Als flew his steed, as he his bandes had brast,
And with his winged heeles did tread the wynd,
As he had been a fole of Pegasus his kynd.

(b.) That darksome cave they enter, where they find
That cursed man, low sitting on the ground,
Musing full sadly in his sullein mind:
His griesie lockes, long growen and unbound,
Disordered hong about his shoulders round,
And hid his face; through which his hollow eyne
Lookt deadly dull and stared as astound;
His raw-bone cheekes, through penurie and pine,
Were shronke into his jawes, as he did never dine.

(3.) Explain the following words, taken from the first Book of the Faerie Queene:—

enhaunst	rew	eslom
welke	stowre	essoin
mought	owches	libbard
carke	fone	faytor

(4.) Give a short account of the fourth Canto of the first Book.

(5.) State how King Arthur is introduced, and what is related of him in the first Book.

(6.) In what connexion is the description of the New Jerusalem brought in?

Section II.

(1.) Give an account of Spenser's letter, prefixed to the Faerie Queene, in which he states the general design of the poem.

(2.) What are the principal historical allusions in the first book?

(3.) Sketch the life of Spenser, and name his principal works.

Shakspere.

Julius Cæsar; Henry V,; Midsummer Night's Dream.

Section I.

(1.) State the connexion in which each of the following

passages occurs, and explain anything that may be peculiar in the words, or the grammatical construction.

(a.) Consideration, like an angel, came
And whipped th' offending Adam out of him;
Leaving his body as a Paradise
T' envelope and contain celestial spirits.

(b.) Why he that cuts off twenty years of life
Cuts off so many years of fearing death.

(c.) The course of true love never did run smooth.

(d.) Cowards die many times before their deaths;
The valiant never taste of death but once.

e.) Hoary-headed frosts
Fall in the fresh lap of the crimson rose;
And on old Hyems' chin and icy crown,
An od'rous chaplet of sweet summer buds
Is, as in mockery, set.

(f.) If they'll do neither, we will come to them,
And make them skirr away, as swift as stones
Enforced from the old Assyrian slings.

(2.) Express in simple prose, as briefly as you can, the sense of the following passages, and state the connexions in which they occur.

(a.) I would have had thee there, and here again,
Ere I can tell thee what thou shouldst do there.—
O constancy, be strong upon my side!
Set a huge mountain 'tween my heart and tongue!
I have a man's mind, but a woman's might.

(b.) Her vine, the merry cheerer of the heart,
Unpruned dies: her hedges even-pleached,
Like prisoners wildly overgrown with hair,
Put forth disordered twigs: her fallow leas
The darnel, hemlock, and rank fumitory,
Doth root upon; while that the coulter rusts,
That should deracinate such savagery.

(c.) I never may believe
These antic fables, nor these fairy toys,
Lovers and madmen have such seething brains,
Such shaping fantasies, that apprehend
More than cool reason ever comprehends.

Section II.

(1.) From what sources did Shakespere take the plot of Henry V? In what particulars does he deviate in it from historical fact?

(2.) Give an account of the plot of the first act of Julius Cæsar.

(3.) Compare the characters of Brutus and Cassius, and prove your answer, as far as you can, by quotations.

(4.) Briefly sketch the plot of the Midsummer Night's Dream—Compare the characters of Hermia and Helena.

(5.) Give some account of the early editions of Shakespere's plays, and state what you know respecting the texts of Henry V. and Julius Cæsar.

(6.) At what periods of Shakespere's life were Henry V., Julius Cæsar, and the Midsummer Night's Dream, probably written?

Bacon.

(Advancement of Learning.)

Book I.

(1.) Explain the following passages, and give the sense of any one of them in plain modern language:—

(*a*) But above all the rest, the gross and palpable flattery, whereunto many not unlearned have abased and abused their wits and pens, turning, as Du Bartas saith, Hecuba into Helena, and Faustina into Lucretia, hath most diminished the price and estimation of learning.

(*b*) Let him look into the errors of Phocion, and he will beware how he be obstinate or inflexible. Let him but read the fable of Ixion, and it will hold him from being vaporous or imaginative.

(*c*) So have the alchymists made a philosophy out of a few experiments of the furnace; and Gilbertus, our countryman, hath made a philosophy out of the observations of a loadstone.

(2.) Give some account of each of the persons mentioned in these passages:—

(*a*) Then did Sturmius spend such infinite and curious pains upon Cicero the orator, and Hermogenes the rhetorician, beside his own books of Periods and Imitation, and the like. Then did Car of Cambridge, and Ascham, with their lectures and writings, almost deify Cicero and Demosthenes.

(*b*) So hath Plato intermingled his philosophy with theology, and Aristotle with logic; and the second school of Plato, Proclus and the rest, with the mathematics.

(3.) What are the chief errors of learned men enumerated by Bacon, as having been prejudicial to the progress of learning?

(4.) Bacon says that arms and learning flourish in the same age. How does he support this assertion?

(5.) Give a brief analysis of the paragraphs which speak of the divine proofs of the dignity of human learning.

(6.) Explain the following words:—

Excusation.	Morigeration.	Vermiculate.
Digladiation.	Terrasse.	Pasquil.
Coarctation.	Pensileness.	Cavillation.

Section II.

(1.) Briefly state the purpose with which the Advancement of Learning was written, and the relation in which it stands to some other great works of Bacon.

(2.) Give some account of the early editions of the work, with the dates of their publication.

(3.) Name the other principal works of Lord Bacon, as early as you can, in chronological order.

Milton.

Comus; Samson Agonistes; Lycidas; L'Allegro; Il Penseroso; Hymn on Christ's Nativity; Sonnets.)

(1.) State the connexion in which each of the following passages occurs. Explain the allusions, the unusual words, the words used in peculiar senses, and the peculiar grammatical constructions. Notice (if you can) anything remarkable in the structure of the verse.

(a.) Ring out ye crystal spheres;
Once bless our human ears,
If ye have power to touch our senses so.

(b.) But now my task is smoothly done,
I can fly, or I can run,
Quickly to the green earth's end,
Where the bowed welkin slow doth bend.

(c.) Dagon hath presumed,
Me overthrown, to enter lists with God,
His deity comparing and preferring
Before the God of Abraham.

(d.) They also serve who only stand and wait.

(e.) Come and trip it as you go
On the light fantastic toe,
And in thy right hand lead with thee
The mountain nymph, sweet Liberty.

(f.) For we were nursed upon the self-same hill;
Fed the same flock by fountain, shade, and rill.

(2.) Give the sense of the following passages in prose, and explain anything you may notice as peculiar in the expressions, or in the versification.

(a.) And may at last my weary age
Find out the peaceful hermitage,
The hairy gown and mossy cell,
Where I may sit and rightly spell
Of every star that heaven doth shew,
And every herb that sips the dew;
Till old experience do attain
To something like prophetic strain.

(b.) Perhaps
God will relent, and quit thee all his debts;
Who evermore approves, and more accepts,
(Best pleased with humble and filial submission)
Him, who imploring mercy, sues for life,
Than who, self-rigorous, chooses death as due.

(3.) Write out and carefully punctuate any passage you may have committed to memory from one of the poems mentioned above, not exceeding twenty lines.

SECTION II.

(1.) Give some account of the circumstances which suggested the composition of Comus, and of Lycidas, so as to explain the references to matters of fact contained in those poems.

(2.) Briefly sketch the train of thoughts in L'Allegro and in Il Penseroso.

(3.) Name the principal writers of English Sonnets. In what respect does the structure of Shakespere's sonnets differ from that of Milton's?

(4.) Give a short sketch of Milton's life, and name his principal prose works.

WORDSWORTH.

(The Excursion.)

(1.) Express in prose the sense of the following passage. State the connexion in which it occurs and explain the allusions:—

The shapes before our eyes
And their arrangement, doubtless must be deemed
The sport of Nature, aided by blind Chance
Rudely to mock the works of toiling man.
And hence, this upright shaft of unhewn stone,
From fancy, willing to set off her stores
By sounding titles, hath acquired the name
Of Pompey's Pillar; that I gravely style
My Theban Obelisk; and, there, behold
A Druid Cromlech!—thus I entertain
The antiquarian humour, and am pleased
To skim along the surfaces of things,
Beguiling harmlessly the listless hours.

(2.) Give the connexion of each of these passages, so as to show how it belongs to the argument, or to the narrative, in which it occurs:—

(a.) "His body is at rest, his soul in heaven"
These were your words; and verily, methinks
Wisdom is oft-times nearer when we stoop
Than when we soar.

(b.) I have heard
From my good host, that he was crazed in brain
By unrequited love; and scaled the rocks
Dived into caves, and pierced the matted woods,
In hope to find some virtuous herb of power
To cure his malady.

(c.) Blest are they
Whose sorrow rather is to suffer wrong
Than to do wrong, although themselves have erred.

(d.) Oft have I marked him at some leisure hour,
Stretched on the grass or seated in the shade
Among his fellows, while an ample map
Before their eyes lay carefully outspread.

e.) Once while the name Jehovah was a sound
Within the circuit of this sea girt isle
Unheard, the savage nations bowed the head
To gods delighting in remorseless deeds.

(3.) Give a view of the argument of the fourth book entitled "Despondency Corrected," and illustrate it by quotations.

(4.) Which are the principal references, in the course of the poem, to contemporary events?

(5.) Write out, and carefully punctuate, any passage from the Excursion which you may have committed to memory, not exceeding twenty lines.

SECTION II.

(1.) Give an account of the design of the author in the composition of the Excursion.

(2.) Sketch the character of the Solitary.

(3.) Name Wordsworth's principal works, as nearly as you can, in their chronological order. What do you know of his life?

CRAIK.

(Outlines of the History of the English Language.)

1. Show, by means of a table, the mode in which the author divides the history of the English language into periods, and name a few of the chief writers in each period.

2. Illustrate, by examples, the manner in which the names of our old Towns, and those of our Mountains, Lakes, and Rivers, are memorials of the races which formerly inhabited our country.

3. Explain the terms Langue d'oc and Langue d'oil. How did the latter of these dialects contribute one great element to our language?

4. On what grounds has the author discarded the terms *Saxon* and *Anglo-Saxon?*

6. State some of the particulars in which the original English (or Anglo-Saxon) differed from modern English?

6. Describe, and illustrate by examples, the relation in which the languages spoken in Britain stood to each other in the time of the Norman sovereigns.

7. Give some account of Layamon's Chronicle, and of the Ormulum.

8. Mention some of the particulars in which Chaucer's English differs from that of our time.

9. What is the origin of the words—

Funnel.	Street.	Cloister.
Bishop.	Bride.	Leather.
Basket.	Saint.	Preach.

10. What are the subdivisions of the Gothic branch of the Indo-European family of languages? Explain the terms Indo-European and Gothic, as applied to the classification of languages.

TRENCH.

(Study of Words.)

(1.) It is stated that words are "fossil poetry", and "fossil history." Explain these terms and illustrate your explanation by examples.

(2.) Briefly state the main argument of the lecture "On the morality in words"—Explain *humility, martyr, integrity, miser, punishment, obligation,* in reference to this argument.

(3.) There are certain English words which indicate the relative positions of the Norman and Saxon races at one period of our history—Explain this statement, and give examples.

(4.) What is a synonym? State the uses of the study of synonyms. Distinguish:—

Imagination *and* Fancy.
Authentic *and* Genuine.
Opposite *and* Contrary.
Invent *and* Discover.
Charity *and* Love.

(5.) Explain the word *desynonymize,* and illustrate by examples the process in language which it denotes.

(6.) Give the derivations of the following words:—Dunce, Miscreant, Church, Pagan, Jovial, Saturnine, Candidate, Disaster, Nave, Slave, Scripture, Guilt, Indolence, Villain.

HELPS.

(Essays written in the Intervals of Business.)

(1.) Explain the following passages:—

(*a*) The oracles will Philippize as long as Philip is the master; but still they have an inner meaning for Athenian ears.

(*b*) The man who does not know when, or how much, or to whom to confide, will do well in maintaining a Pythagorean silence.

(*c*) Bacon says, "In this theatre of man's life, God and angels only should be lookers on; that contemplation and action ought ever to be united, a conjunction like unto that of the two highest planets, Saturn the planet of rest, and Jupiter the planet of action."

(*d*) Let not that balance of justice which Corruption could not alter one hair's breadth, be altogether disturbed by Sensibility.

(2.) What are the maxims to be followed by those in authority, which are given in the essay on Domestic Rule?

(3.) Give a brief analysis of the Essay on Secrecy, or of that on Self Discipline.

(4.) How is the following statement justified and illustrated:—

It is a maxim of prudence that when you advise a man to do something for your interest as well as for his, you should put your own motive for advising him full in view, with all the weight that belongs to it.

(5.) How are these propositions in the Essay on the Transaction of Business, maintained:—

(*a*) Delay is in some instances to be adopted advisedly.

(*b*) It is often worth while to bestow much pains in gaining over foolish people to your way of thinking.

(*c*) A man of business should take care to consult occasionally with persons of a nature quite different from his own.

(6.) What are the great evils arising from party spirit, and what are the causes which lead men to side with parties?

Section II.

(1.) Name, in chronological order, the greatest English essayists, and mention some of the principal works of each.

(2.) Compare one of Mr. Helps's essays with any one of Lord Bacon's, or of some other distinguished writer's, with which you may be acquainted, with a view to distinguish the two styles of composition.

(*To be continued.*)

Proceedings of Institutions.

Chelsea Athenæum.—Mr. Horatio E. Norfolk has again been elected Honorary Secretary to this Institution.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 10th*, 1860.]

Dated 26th April, 1860.

1044. J. C. Durand, Brydges-street, Covent-garden—A new system of drainage for towns when affected by the tide.

Dated 8th May, 1860.

1136. W. Mc Donald, Hyde-park Barracks, Knightsbridge—Imp. in military saddles and in stirrup irons to be used therewith.

Dated 5th June, 1860.

1372. J. Mabson, Sheffield—Imp. in metal life buoys, also adapted for holding water or other liquids.

Dated 20th June, 1860.

1490. A. Verney, 24, Saint Augustine-road, Camden town, Middlesex—Imp. in the proportions of ingredients and mode of manufacture of a chemical compound for softening water.

Dated 11th July, 1860.

1666. W. K. Hall, 36, Cannon-street—Imp. in gas regulators. (A com.)

Dated 13th July, 1860.

1690. C. T. Judkins, 22, Ludgate-street, London—Imp. in sewing machines. (Partly a com.)

Dated 14th July, 1860.

1706. J. Mechim, White Horse-road, Croydon, Surrey—Imp. in pianos and organs. (A com.)

Dated 16th July, 1860.

1715. S. B. Rogers, Newport, Monmouthshire—An imp. in the smelting of iron ores.

1716. W. Bauer, 36, Burton-street, Burton-crescent, London—An improved diving bell.

1721. J. Thiébaut, Whitechapel—Imp. in the ornamentation of textile fabrics.

Dated 17th July, 1860.

1728. F. C. Seyde, 55, Warren-street, Fitzroy-square, Middlesex—Improved mechanism for pulping, triturating, and comminuting for culinary and other purposes.

Dated 18th July, 1860.

1735. D. Skekel, West-square, Surrey—Imp. in pistons for steam engine and other cylinders, which imps. are also applicable to the buckets of pumps. (Partly a com.)

Dated 20th July, 1860.

1760. R. Pinkney, 18, Bread-street Hill, London—An improved pencil case.

1766. C. Bedells, Leicester—Imp. in the manufacture of braces.

Dated 21st July, 1860.

1768. E. Hollis, Birmingham—Certain imp. in muzzle-loading guns applicable for military and sporting purposes, parts of which are also applicable to certain descriptions of pistols and breech-loading guns, as also in the manner of fixing or connecting bayonets to military guns.

1774. A. R. Le Mire Normandy, Odin-lodge, King's-road, Clapham-park, Surrey—Imp. in connecting gas and other pipes.

Dated 23rd July, 1860.

1776. H. Green, Bolton-le-Moors, Lancashire—Imp. in charging and drawing the charge from gas retorts, and in the machinery employed in performing such operations.

1780. A. Turner, Leicester—Imp. in the manufacture of elastic fabrics.

Dated 24th June, 1860.

1782. H. Jones, Neath, Glamorganshire—Imp. in rails for railways.

1784. A. Robertson, Neilston, Renfrew, and A. Ritchie, Glasgow—Imp. in steam boiler and other furnaces or fireplaces, in pyrometers, and in the prevention of smoke.

1788. L. C. Macaire, Paris—A substitute for nitrate of silver, particularly applicable to photographic purposes.

1790. W. Brunner, Printing House-square, and W. H. Levett, Clare-street, Lincoln's-inn-fields—An improved apparatus for increasing the illuminating power of coal gas, also for economising the consumption thereof, and for regulating the pressure from street mains.

1792. R. A. Rumble, Trinity-square, Southwark—Improved apparatus for feeding fuel to fireplaces or furnaces.

1793. W. E. Newton, 66, Chancery-lane—An improved mathematical or plotting instrument, which he intends to denominate a protracting trigonometer. (A com.)

1794. Sir P. Fairbairn and J. Barrow, Leeds—An imp. in the construction of self acting lathes.

Dated 25th June, 1860.

1795. W. E. Taylor, Enfield, near Accrington, Lancashire—Certain imp. in looms for weaving.

1796. E. Hédou, 4, South street, Finsbury—Imp. in the manufacture of "tar paper," which imps. may also be applied to several other uses.

1799. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the processes of and apparatus for unwinding silk from cocoons. (A com.)

1800. M. A. F. Mennons, 39 Rue de l'Échiquier, Paris—Imp. in etching on zinc. (A com.)

1801. S. J. Wilkinson and G. F. L. Meakin, 14a, Saint Mary Axe, London—Imp. in the construction of boxes, trunks, or packing cases, to be called "The Plicabilis," or folding box trunk or packing case.

1802. T. Hartley, Bury, Lancashire—An improved fibrous material for manufacturing woven fabrics.

1803. J. Pilkington, Fish-street Hill, London—Imp. in means for protecting and making water tight exposed surfaces, such as railway arches, bridges, roofs, and other structures.

1804. H. C. Ash, 11, Claylands-terrace, Clapham-road, Surrey—Imp. in apparatus employed in freezing and cooling liquids.

1805. C. W. Lancaster, New Bond-street, Middlesex, J. Brown, and J. Hughes, Newport, Monmouthshire—Imp. in the manufacture of plates for coating or covering and strengthening ships, and other structures, and in fixing the same.

1806. J. L. L. Cembacérès, Paris—Certain imp. in treating fatty and oily matters.

1837. A. V. Newton, 66, Chancery-lane—An imp. in the process of concentrating and crystallising sugar. (A com.)

1808. W. Rose, Hales Owen, Worcestershire—Imp. in breech loading fire-arms and ordnance.

1809. R. T. Smith and T. Suckley Whitchurch—Improved apparatus for smutting and screening grain, and distributing other granular substances.

1811. L. Kaberry, Rochdale, Lancashire—Imp. in machinery or apparatus for preparing, spinning, and doubling cotton, and other fibrous materials.

Dated 26th July, 1860.

1812. T. M. Downing, Handsworth, Staffordshire—Certain imp. in tanks, vats, or vessels to be used for holding, keeping, or storing of malt liquors, wines, spirits, and other liquids for human consumption.

1813. J. Thompson, Britannia Works, Sheffield—An imp. in covers for jugs, also applicable to covers for other articles.

1814. M. Henry, 84, Fleet street—Imp. in engines for obtaining motive power. (A com.)

1815. G. Bonelli, Queen-square, Bloomsbury, Middlesex—Imp. in the manufacture of felted fabrics and paper. (A com.)

1816. A. Gélis, 29, Boulevart Saint Martin, Paris—Imp. in preparing compounds of cyanogen, and principally of prussiates, by means of sulphuretted carbamids or amids, which supply sulphurets of carbon, by their decomposition.

Dated 27th July, 1860.

1817. W. Campbell, Holinshead Hall, near Withnell, Chorley, Lancashire—Imp. in the form of steam ships.

1819. C. A. Grossetete, 11, Cranbourne-street, Leicester-square, Middlesex—An improved reversed conicle non-swerving spring mattrass.

1820. J. Bishop, 1a, Gloucester-street, Gloucester-gate, Regent's-park, Middlesex—Imp. in kitchen ranges, and their boilers, and ovens, some of which improvements are also applicable to kettles and other utensils, or apparatus for heating or cooking.

1821. E. Briggs, Castleton Mills, near Rochdale, Lancashire—The application of spun silk waste, made in winding and weaving to manufacturing purposes, and improvements in machinery employed in operating upon such silk waste.

1822. E. Dugdale, Soho Foundry, Blackburn, Lancashire—Certain imp. in looms for weaving.

1823. J. Renshaw, Ordsal-lane, Salford, Lancashire—Imp. in machinery or apparatus for finishing velvets, velveteens, and other pile fabrics.

1824. R. A. Brooman, 166, Fleet-street—Imp. in belts. (A com.)

1825. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of linseed oil and in apparatus for the same. (A com.)

1826. S. Terrill, Redruth, Cornwall—Imp. in open-air cooking apparatus.

1827. J. Olorenshaw, Coventry—An imp. or imps. in spectacle frames. (A com.)

1828. T. Wilson, Birmingham—Imp. in breach loading fire-arms and ordnance.

1829. J. Jeyes, 17, Cheyne-walk, Chelsea—Imp. in the manufacture of boots and shoes.

Dated 28th July, 1860.

1831. J. and G. Dakin, Heywood, Lancashire—Imp. in machinery employed in covering top rollers, used in preparing, spinning, and doubling cotton and other fibrous materials.

1832. H. Brown and B. Hodgson, Halifax—Imp. in the manufacture of a certain cloth or fabric, commonly called "Utrecht velvet."

1833. G. C. Hunt, Baltic Cottage, Rotherhithe, Surrey—Imp. in colouring bricks, tiles, and other similar articles.

1835. W. Morris, Lambeth, Surrey—Imp. in the construction of ships or vessels, and in the mode of propelling them.

1836. L. Lansdell, Ipswich, Suffolk—Imp. in the manufacture of harrows.

1837. J. Hamilton, jun., Liverpool—Imp. in vessels to be propelled by steam-power.

1838. G. H. Birkbeck, 34, Southampton-buildings, Chancery lane, Middlesex—Imp. in looms for weaving velvet or other cut pile fabrics. (A com.)

1839. J. P. Hodgson, Pilgrim-street, Newcastle-upon-Tyne—An improved coffee-pot.

1840. J. Ireland, Wambrechus, near Lille, France—Imp. in machinery or apparatus for treating hemp, flax, tow, and other fibrous substances.

1841. J. H. Pape, 39, Rue de l'Echiquier, Paris—Imp. in the construction of pianofortes.

1842. S. A. Carpenter, Birmingham—A new or improved adjuster for adjusting the backs of waistcoats and trousers, which said adjuster may also be used as substitute for the fastenings ordinarily employed in fastening gloves, garters, and belts.

Dated 30th July, 1860.

1843. L. Rome, Route du Pont de Fer, near Grenoble, France—A machine for the fabrication of fishing or other nets.

1845. J. Rahill, Ramsgate—Imp. in quadrants, sextants, or other similar instruments to which artificial horizons are applicable.

1847. W. E. Newton, 66, Chancery-lane—An imp. in brushes for the hair, or other purposes. (A com.)

1849. J. Nicholson, Chaple House, Kensingham, Whitehaven—Imp. in reaping and mowing machines.

1851. O. D. Henley, Newcastle-upon-Tyne—Imp. in obtaining motive power, and in evaporating liquids.

Inventions with Complete Specifications Filed.

[*From Gazette, August 10th*, 1860.]

1863. J. Roberts, 7, Old Jewry—A continuous or ratchet spanner. 1st August, 1860.

1869. R. Bodmer, 2, Thavies-inn, Holborn, London—Imp. in machinery for converting into down or fibres, capable of being spun, the remnants or cuttings or other waste pieces of silk or other fabrics. (A com.) 4th August, 1860.

Patents Sealed.

[*From Gazette, August 10th*, 1860.]

August 10th.

376. B. Purnell.
389. Thomas Shedden.
390. R. J. Cole.
391. J. Marsh.
398. J. Leach and T. Clayton.
399. W. Leatham.
405. W. Davis.
408. S. Rowbotham and G. H. Bolton.
412. J. Ronald.
422. T. Green.
423. G. Parsons.
436. S. Bury.
440. H. D. P. Cunningham.
441. W. Woodcock.
476. W. E. Newton.
504. R. A. Brooman.
514. E. T. Hughes.
542. R. Walker.
600. J. H. Johnson.
778. J. A. Maxwell.
904. T. A. Turner.
1262. J. Hickisson.
1264. J. Paton.
1349. R. Threlfall.
1380. G. Bower.

[*From Gazette, August 14th*, 1860.]

14th August, 1860.

415. T. Allen.
425. G. Cowdery.
435. A. Belpaire.
442. D. Irons.
444. J. Maude and L. Tindall.
446. P. A. Gillis.
447. P. E. S. Dulos.
450. J. Sanders.
451. M. Henry.
464. G. W. Townsend.
467. P. J. Weerts.
515. B. Annable and J. Blench.
516. J. Gillespie and J. Gillespie.
597. J. Sidebottom.
605. J. Howard.
638. J. Lister and J. Lees.
671. W. E. Newton.
683. E. V. Newton.
707. E. Cope, W. Cope, and W. G. Ward.
767. W. E. Newton.
882. W. Clark.
956. A. Accarain.
1090. H. Hutchison.
1320. T. Gullick.
2467. J. Moule.
1581. C. J. N. Rebour.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, August 10th*, 1860.]

August 8th.

2161. W. E. Newton.
2224. J. Daughlish.
2281. J. Gilbert.
2390. T. Grahame.

[*From Gazette, August 14th*, 1860.]

11th August, 1860.

2183. R. Hoe.
2221. V. H. Laurent.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, August 10th*, 1860.]

August 8th.

1914. E. Finch and C. Lamport.

[*From Gazette, August 14th*, 1860.]

9th August, 1860.

1862. T. MacSweny.
1863. S. Hall.
1903. J. H. Johnson.
1889. T. Allan.
1906. H. Hughes.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,275.	14 July.	A Reflector of Scenic Effects	William Calcott	Park-village East, Regent's-park, N.W.
4,276.	18 ,,	Crotchet Needle	Henry English...	Redditch.
4,277.	19 ,,	The Regulating Pencil	Thomas Edward Whiting ...	14 Owen's-row, Goswell road, E.C.
4,278.	21 ,,	Portable Combined Sitting Rifle-rest and Chair	George Sturrock	Brompton, Kent.
4,279.	23 ,,	A Pouch, or Purse, for containing Tobacco and other articles	John William Mott	Lea Bridge-road, Clapton, N.E.
4,280.	27 ,,	Scissors	Thomas Fletcher, and Joseph Fletcher...	Long Easton, Derbyshire. Ison-green, near Nottingham.
4,281.	1 August.	Syringe Ring	Victor Isaac Hazelton	The Duke's Arms, Upper Marsh, Lambeth, S.
4,282.	6 ,,	Needle Case	Morris and Yeoman	Astwood Bank, near Redditch.

Journal of the Society of Arts.

FRIDAY, AUGUST 24, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 (see next page) is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£358,250	
Arles Dufour, Lyons, France	2,000	Manufactures.
James S. Adam, 8, Philpot-lane, E.C.	200	Commerce.
Henry R. Sandbach, Hafodunos, Llanrwst	100	Arts.
I. P. Clarke, King-street Mills and Branch Mills, Belgrave-road, Leicester ...	100	Manufactures.
*Henry Creed, 33, Conduit-street, Bond-street, W.	100	Manufactures.
John Davies, Woodford, Essex	100	Arts.
*Thos. Goode and Co., 19, South Audley-street, W.	250	Commerce.
Prof. T. C. Archer, Superintendent, Industrial Museum of Scotland, Edinburgh...	100	Arts.
Thos. Henry Filmer, 28, 32, and 34, Berners-street, W....	100	Commerce.
*M. Pillischer, 88, New Bond-street, W.	100	Manufactures.
Total	£361,400	

By Order, P. LE NEVE FOSTER, *Secretary.*

GUTTA-PERCHA FROM BRITISH GUIANA.

Specimens of this material, collected by Dr. Van Holst, of Berbice, have been brought to this country by Mr. Walker, the Colonial Secretary of British Guiana, who has deposited them with the Society for investigation. In a letter which accompanied the specimens, Mr. Walker says:—

"I beg to hand you herewith samples of gutta percha, the produce of British Guiana. An experiment has been made in the colony to vulcanize a portion of this substance with great success; but Dr. Van Holst, of Berbice, the gentleman who has taken the pains to collect these specimens, is naturally anxious to have the benefit of other opinions as to the likelihood of its finding a remunerative market in this colony, assuming that it can be produced in sufficient quantities; and as I believe this is one of the objects which the Society of Arts undertakes to forward, I shall be much indebted if you can have these specimens tested by competent persons, and the probable value of a supply of such material ascertained.

"Dr. Van Holst is of opinion that he has discovered another tree yielding a similar substance, but at any rate he represents the tree commonly known to yield it as existing in great abundance and at no great distance from the settled parts of the country."

Professor Bleekrode, of Delft, in a letter just received by the Secretary of the Society of Arts, referring to this material, says:—

"I can communicate to you that the same was shown at the last Agricultural Exhibition of Paris, under the name of *Balatas*, collected from the *Sapota Mulleri*. A few months ago it was announced in the French journals that M. Serres, Pharmacien, at Paris, had been so fortunate as to prepare gutta percha from the Balatas of the sapotaceous plants in Guiana and Central America. A sample of it was offered to the Société d'Encouragement, etc. (Répertoire de Chimie de M. Barreswil, Juin, p. 174). MM. Serres et Leverd, at Paris, have received the silver medal from the jury of the Agricultural Exhibition.

"The same subject was brought before the meeting of the Société d'Encouragement, of 20th June, and M. Natalis Rondot took the opportunity of showing, by a sample of gutta percha from Surinam, that I am in the right in claiming the priority, as stated in my Dutch paper of 1857, the communication in the *Journal of the Society of Arts*,* and in the *Annales des Sciences Naturelles*. It appears also that the *Sapota Mulleri*, the tree producing the gutta percha of Surinam, is called Balata in French Guiana, Les Antilles, and elsewhere."

See *Journal*, Vol. V., p. 625.

PROGRAMME OF EXAMINATIONS FOR 1861.

PRELIMINARY NOTICE.

I. The primary object of the Examinations described in the following programme is to encourage, test, attest, and reward efforts made for self-improvement by adult members and students of the Mechanics' Institutions, Athenæums, People's Colleges, Village Classes, and other bodies of the like character, that are in Union with the Society of Arts. Such members and students are commonly mechanics, artisans, labourers, clerks, tradesmen and farmers not in a large way of business, apprentices, sons and daughters of tradesmen and farmers, assistants in shops, and others, of various occupations, who are not graduates or undergraduates of any University, nor following, nor intending to follow, a learned profession. To all such, male and female (not being under sixteen years of age), the Examinations are open on the general conditions explained below. (See paragraph 1, next page.)

II. There are, however, in many places where there are either no Institutions, or none possessing sufficient funds to enable them to enter into Union, a large number of persons for whose admission to the Examinations the Council have found it necessary to make other arrangements, the details of which are given at paragraph 1 (B) and (C).

III. Persons also of a higher grade in society than those mentioned in the opening paragraph, are found to be desirous of having their knowledge tested by the Society's Examiners; and it has been decided to admit them to Examination on payment of a fee of 10s. 6d. for each Candidate. (For details see paragraph 1 (D). Such persons, however, and also Certificated Teachers, and Pupil Teachers, though they may be examined and receive Certificates, are precluded from competing for the Prizes offered by the Society of Arts. (See paragraphs 112 to 118.)

LIST OF SUBJECTS AND EXAMINERS FOR 1861.

*** Candidates, before choosing their subjects, should refer to the Time table, at paragraph 20.

1. Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
2. Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
3. Algebra	J. J. Sylvester, Esq., M.A., F.R.S., Professor of Mathematics at the Royal Military Academy, Woolwich.
4. Geometry	Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.
5. Mensuration	John Sykes, Esq., M.A., Fellow of Pembroke College, Cambridge, Assistant Secretary to the Committee of Privy Council on Education.
6. Trigonometry	Rev. T. G. Hall, Professor of Mathematics in King's College, London.
7. Conic Sections	Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.
8. Navigation and Nautical Astronomy	John Riddle, Esq., F.R.A.S., Head Master of the Nautical Schools, Greenwich.
9. Principles of Mechanics	Rev. Jonathan Bates, M.A., Fellow of Gonville and Caius College, Cambridge, Vice-Principal of the Diocesan Training College, Chester.
10. Practical Mechanics	T. M. Goodeve, Esq., Professor of Mechanics at the Royal Military Academy, Woolwich.
11. Magnetism, Electricity, and Heat	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
12. Astronomy	James Glaisher, Esq., F.R.S., Roy. Observatory, Greenwich.
13. Chemistry	A. W. Williamson, Esq., Professor of Chemistry, University College, London.
14. Animal Physiology (in relation to Health).	John Marshall, Esq., F.R.S., F.R.C.S., Surgeon to the University College Hospital, and Lecturer on Anatomy in the Government Department of Science and Art.
15. Botany	Dr. Lindley, F.R.S., Professor of Botany in the University of London, and Hon. Sec. of the Horticultural Society.
16. Agriculture	J. C. Morton, Esq.
17. Mining and Metallurgy	J. Arthur Phillips, Esq., Civil Engineer, Graduate of the Imperial School of Mines of France, &c.
18. Political and Social Economy	Charles Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
19. Domestic Economy	The Very Rev. Richard Dawes, F.R.S., Dean of Hereford.
20. Geography	Wm. Hughes, Esq., F.R.G.S., Professor of Geography in Queen's College, London.
21. English History	C. H. Pearson, Esq., M.A., Professor of Modern History, King's College, London.
22. English Literature	Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea,
23. Logic and Mental Science	Rev. Wm. Thomson, D.D., Provost of Queen's Col. Oxf.
24. Latin and Roman History	Rev. F. Temple, D.D., Head Master of Rugby School,
25. French	Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.
26. German	Dr. Bernays, Professor of German, King's College, London.
27. Freehand Drawing	F. S. Cary, Esq.
28. Mechanical Drawing.	Thomas Bradley, Esq., Professor of Geometrical Drawing in King's College, London.
29. Theory of Music	John Hullah, Esq.

Terms of Admission to the Examinations.

1. Every Candidate for Examination must (*a*) be admitted through a Local Educational Board connected with the Society of Arts, and must (*b*) be at least sixteen years of age.

(*A.*) Members of, or students of classes in, Institutions in direct Union with the Society of Arts, are admitted	Free.
(*B.*) Members of, or students of classes in, "Small Institutions"* not in direct Union with the Society of Arts, but connected with a Provincial Union that is "in Union" with the Society, are admitted on payment of a fee of.....	2s. 6d.
(*C.*) In districts where there are no Institutions at all, or only "small Institutions,"* Local Educational Boards, paying one guinea a year to the Society of Arts, may admit candidates on payment of a fee of	2s. 6d.
(*D*). Persons of a higher class of society than those described in paragraph I (Preliminary Notice), are admitted to the Examinations on payment of a fee of	10s.6d.

N.B.—The Council in all cases leave it to the Local Boards to decide whether a candidate is or is not liable to this fee.

2. Candidates coming under the head (D), and teachers certificated by the Committee of Council on Education and Pupil Teachers, though they may be examined and receive certificates, cannot compete for the prizes of which details are given at paragraphs 112 to 118.

3. It will be seen that, in any locality, whether there be an Institution in union with the Society of Arts or not, the first thing to be done in order to enable any person to take advantage of the Society's Examinations, is the formation of a Local Educational Board.

Local Educational Boards.

4. The Managers of Institutions in Union with the Society of Arts, and other persons who may be desirous to co-operate with the Society in promoting the instruction of adults, are invited to form Local Boards. Each Local Board must consist of at least three members; and, with advantage, may be much more numerous. There must be a Chairman and a Secretary. The district for which the Board is to act should be defined; and every Educational Institution† within those limits ought to be represented in the Board. It is of great importance that each Local Board should include the representatives of more Institutions than one, and that there should not be more than one Local Board in each locality. The composition of the Board must be such as to command the respect and confidence of the neighbourhood. Where gentlemen of high literary and scientific attainments are willing to serve on the Board, their services are of great value; but the necessary work may be done by any well-educated persons of high character and good sense.

5. A detailed list of the chairman, secretary, and other members of each Local Board, giving not only their names but their addresses and designations, should be submitted to the Council of the Society of Arts before the 1st of January, 1861. In some cases the Local Educational Boards comprise such large districts that, for the convenience of the Candidates, Branch Local Boards have to be formed within the Districts. Wherever this is the case, the names and addresses of the members, both of the District Board and of its Branch Boards, must be forwarded to the Secretary of the Society of Arts. All changes in the composition of the various Boards now in existence, or to be formed hereafter, should be immediately notified to the Society of Arts.

6. Local Educational Boards in connexion with the Society of Arts need make no payment to the Society, unless they desire to exercise the power of admitting candidates (see par. 1 *C.*) where there are no Institutions in union with the Society of Arts; in which case a subscription of one guinea a year must be paid.

7. The object of the formation of these Local Boards will be more completely understood from the following paragraphs.

8. The Society's system of Examinations consists of (1) Previous Examinations by the Local Boards, and (2) Final Examinations by the Examiners of the Society of Arts, under the supervision of the Local Boards.

Previous Examinations by the Local Boards.

9. These Examinations are (1) to test the handwriting and spelling of the Candidates, their knowledge of English Grammar, composition, and the common rules of arithmetic, and (2) to ascertain whether their knowledge of those special subjects in which they seek to be examined by the Society's Examiners is such as to offer some fair prospect at least of their obtaining certificates.* The Previous Examinations may be either wholly written, or partly oral and partly written, at the discretion of each Local Board.

10. Handwriting.—A bold, even round-hand, without loops, long tails, or flourishes, should be preferred.

11. Spelling, English Grammar, and Composition.—An extract from some standard English author should be set, into which errors of spelling, grammar, and punctuation should be introduced. Some faulty grammatical constructions in common use, and vulgarisms, should be submitted for correction.

12. Arithmetic.—A knowledge of the elementary rules, including the Rule of Three, should be required.

13. No Candidate can be admitted to the final Examination without a certificate (see Form No. 4 in Appendix) from his Local Board, that he has satisfactorily "passed" its previous Examination in the elementary subjects specified in paragraphs 10, 11, 12, and in the special subjects in which he wishes to be examined by the Society's Examiners.

14. The previous Examinations must be held by the Local Boards sufficiently early in the year 1861 to allow the results to be communicated to the Council, on a Form which will be furnished on application (See Form No. 2 in Appendix) on or before the 2nd April, *i.e.*, four weeks before the commencement of the final Examinations.

15. Unreserved communications between the Society and the Local Boards will be requisite to secure to the "passes" of the various Local Boards throughout the Union such an uniformity of value as may be attainable; and it is hoped that their standard may be raised, carefully and gradually, from year to year.

Final Examination by the Society's Examiners.

16. The Forms (see Form No. 4, in Appendix), containing the names of the "passed" candidates, and the

* Small Institutions are defined as those which have an income of less than £75 a year.

† These Educational Boards, besides superintending the Examinations of the Society of Arts, may advantageously assist in promoting various other plans for the furtherance of Education in their districts (see note to Par. 9); it is, therefore, desirable that they should include representatives not only from the various Institutions for the promotion of adult instruction, but also from the principal schools in the locality.

* The following resolution was passed at the Conference between the Representatives of Institutions in Union and the Council, held on the 22nd June, 1860:—"That in the opinion of this Conference it is highly desirable that the Local Boards should hold Annual Examinations of persons under 16 years of age who are not in regular attendance at day schools, and grant on their own authority certificates and prizes." Local Boards will, however, understand that the "pass" to the Final Examinations must not be given to children under 16, or to any Candidates above 16 whom the Local Boards consider to have no chance of obtaining certificates from the Society's Examiners.

subjects in which they desire to be examined, having been returned to the Secretary of the Society of Arts, not later than the first week in April, 1861, the printed papers of questions in the various subjects will be prepared by the Society's Examiners, and will be forwarded to the Secretaries of the Local Boards.

17. The whole of the papers appointed for each of the evenings of the Examination, according to the subjoined Time Table, will be contained in a separate sealed envelope, which is not to be opened till the Candidates are present, at half-past six on that evening.

18. The details of the mode in which the Final Examinations are to be conducted, are given in the "Letter of Instructions," (see Form No. 5, in appendix) and every member of each Local Board should make himself thoroughly acquainted with them.

19. The final Examinations must be held *simultaneously on the days, and at the hours specified in the following Time-table*, at those places where Local Boards are established.

20. In choosing the subjects in which they desire to be examined, candidates must take notice of the arrangements of this Time Table, as they *cannot* be examined in *two* subjects which are set down for the *same* evening.

Time Table for 1861.

No Candidate may work more than one paper in each evening, and each paper must be worked on the particular evening appointed for it.

Tuesday, the 30th April, From 6 30 to 9 30 p.m.	Wednesday, the 1st May. From 6 30 to 9 30 p.m.	Thursday, the 2nd May. From 6 30 to 9 30 p.m.	Friday the 3rd May. From 6 30 to 9 30 p.m.
Arithmetic.	Book-keeping.	Algebra.	Geometry.
Trigonometry.	Navigation and Nautical Astronomy.	Practical Mechanics.	Mensuration.
Magnetism, Electricity, and Heat.	Conic Sections.	Astronomy.	Principles of Mechanics.
Agriculture.	Chemistry.	Physiology.	Botany.
Mining and Metallurgy.	*English Literature.	Political Economy.	Geography.
English History.	Music.	French.	Latin.
Mechanical Drawing.	Domestic Economy.	German.	Logic and Mental Science.
			Freehand Drawing.

* Two Papers of one hour and a half each in this subject are considered as one.

21. The Local Boards must see, and certify to the Council, in the form which the Council will furnish (see Appendix, Form No. 7), that the papers are fairly worked by each candidate, without copying from any other, and without books or other assistance; and must seal up and return the worked papers to the Council *immediately* on the close of each evening's Examination. The papers will then be submitted to the judgment of the Examiners, and certificates of three grades will be awarded.

22. The names of the candidates who obtain prizes and certificates will be published in the *Journal of the Society of Arts*, as soon as the Examiners have pronounced their judgment.

23. A candidate who has obtained from the Society a certificate of the 1st class in any subject, cannot again be examined in the same subject.

24. A candidate who has obtained a certificate of the 2nd or 3rd class may, on the recommendation of the Local Board, be examined in the same subject, in a subsequent year, without again passing the previous examination of the Local Board, but his name must always be returned in the proper form (No. 4 in the Appendix).

25. A candidate who, having obtained a certificate in any subject, desires to be examined in some other subject, in a subsequent year, may be "passed" by the Local Board, after examination in that subject, without re-examination in the elementary subjects, specified in paragraphs 10, 11, 12.

SUBJECTS OF EXAMINATION FOR 1861.

26. In the following paragraphs will be found a brief outline of the portions of the respective subjects in which the candidates will be examined, and their attention is especially drawn to this part of the programme. Though in most instances the Examiner has set down certain Text-books, in so doing he pronounces no opinion as to their merit. Real knowledge, however or wherever acquired, will be accepted by the Examiners.

I.—Arithmetic.

27. Practice — Simple and Compound Proportion — Interest — Discount — Insurance — Vulgar and Decimal Fractions; with the principles of a Decimal Notation in money on the basis of the pound unit.

28. The Examiner will take into account not only the correctness of the answers, but also the excellence of the methods by which they are worked out, and the clearness and neatness of the *working* (which must always be shown). Round, compact figures, as nearly like as possible to old-fashioned printed numerals, will be preferred.

29. Text Books:—Any of the Modern Treatises on Arithmetic, such as Hunter's Text Book (*National Society*), Colenso (*Longmans*), or Barnard Smith (*Macmillan*).

II.—Book-keeping by Double Entry.

30. Candidates should be prepared to answer questions as to the nature and use of the different books usually kept in a merchant's office. They should be prepared to journalise a series of transactions from a waste book, and, having posted the entries to the ledger, to balance the accounts, to prove them by a trial-balance, and finally to exhibit an account of profit and loss, with a balance-sheet.

31. Candidates should be prepared to draw the usual commercial forms, such as receipts, bills of exchange, promissory notes, invoices, account sales, accounts current, bills of parcels, and to explain the meanings of technical terms used in general business.

32. Text Books:—Book-keeping, Irish School Series. (*Groombridge.*)
Rudimentary Book-keeping. (*Weale's Series.*)
Kelly's Elements of Book-keeping. (*Simpkins and Co.*)

III.—Algebra.

33. Elementary Operations and Fractions. Simple and Quadratic Equations and Problems leading to them. Involution and Evolution. Surds. Arithmetical and Geometrical Series.

34. Text Books:—Todhunter's Algebra (*Macmillan*); Colenso's Algebra (*Longmans*), or any other modern treatise on Algebra.

IV.—Geometry.

35. A facility in solving geometrical theorems and problems, deducible from the first six books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

36. Text Book:—Euclid, Books I., II., III., IV., VI., XI., and XII. Potts' smaller edition (*Parker*).

V.—Mensuration.

37. The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines, and the surfaces and solid contents of cones, cylinders, spheres, &c. Candidates will be expected to be familiar with the different rules for measuring and estimating artificers' work, such as joiners', bricklayers',

masons', slaters', and plumbers' work, and to be able to prepare estimates of such work from given quantities.

38. Text Books:—Tate's Mensuration. Young's Treatise on Mensuration (*Simms and M'Intyre*).

VI. Trigonometry.

39. In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangl s, and the use of logarithmic tables, &c.

40. Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

41. Text Books:—Snowball's Trigonometry (*Macmillan*), Hall's Trigonometry for Schools (*Christian Knowledge Society*), or any of the modern treatises on Algebraical Trigonometry. Mathematical Tables (*Chambers' Series*).

VII.—Conic Sections.

42. The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

43. Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

44. Text Books:—Puckle's Conic Sections (*Macmillan*). Todhunter's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans*). Drew's Conic Sections (*Macmillan*). Whewell's Conic Sections (*Parker*).

VIII.—Navigation and Nautical Astronomy.

45. A good knowledge of Plane and Spherical Trigonometry, of the definitions and terms used in Nautical Astronomy, and of the various measurements of time and their mutual conversions will be required, as well as skill in the use of logarithmic tables, and neatness, order, and accuracy in the numerical solutions of problems. The candidate should understand the construction of charts; the nature and laws of circular storms; great circle sailing, &c.; the methods of determining the latitude, longitude, variation of the compass, and error and rate of a chronometer by astronomical observations, with the demonstrations of the formulæ employed; the use of Nautical Astronomical Instruments, &c.

46. Text Books:—The Nautical Almanac. (*Murray.*) Riddle's Navigation and Nautical Astronomy. (*Law*, Essex-street.)

IX. Principles of Mechanics.

47. The properties of matter, solid, fluid, and gaseous.

48. Statics: The composition, resolution, and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

49. Dynamics: Gravitation; collision; constrained motions; projectiles; oscillations.

50. Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

51. Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

52. Hydrodynamics: Motion and resistance of fluids in tubes, &c.: waves and tides.

53. Pneumatics: Mechanical properties of the air; the barometer.

54. Text Books:—Todhunter's Statics, or Parkinson's Mechanics. Goodwin's Mathematics. Miller's, Phear's, or Webster's Hydrostatics. Webster's Theory of Fluids. The treatise on this subject in Orr's Circle of the Sciences. Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*). Lardner's Handbooks on Natural Philosophy.

X.—Practical Mechanics.

55. The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

56. Text Books:—Lardner on the Steam Engine. Scott Russell on the Steam Engine. Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery. (*Weale.*) Goodeve's Elements of Mechanism. (*Longmans.*)

XI.—Magnetism, Electricity, and Heat.

57. Construction and Properties of Magnets; Magnetic Instruments; Terrestrial Magnetism; Diamagnetism.

58. Statical or Franklinic Electricity; Voltaic Electricity; Electro-dynamics; Electro-telegraphy; Electro-metallurgy; Thermo-Electricity; Organic Electricity.

59. Conduction, Convection, and Radiation of Heat Instruments for Measuring Heat; Specific and Latent Heat; Reflection and Refraction of Heat; Diathermancy.

60. Text Books:—Lardner's Handbooks of Natural Philosophy. (*Walton and Maberly.*)

Golding Bird's Elements of Natural Philosophy, by C. Brooke. (*Churchill.*)

Herschel's Discourse on the Study of Natural Philosophy (*Longmans*) for a *general* view of the subject.

XII. Astronomy.

61. The principles of Plane Astronomy.

62. Text Books:—Herschel's Astronomy. (*Longmans.*) First chapters.

Airy's Lectures on Astronomy.

Maddy's Elements of Astronomy.

XIII.—Chemistry.

63. Physical. Elementary laws of heat, light, and electricity, in connection with chemical action.

Inorganic. Chemistry of the metalloids and metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

64. Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron, and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

65. Text Books:—Fownes' Manual of Elementary Chemistry. Miller's Elements of Chemistry.

XIV.—Animal Physiology, in relation to Health.

66. The general principles of Animal Physiology and the application of them to the preservation of health and to the wants and emergencies of daily life.

67. Text Books:—Carpenter's Animal Physiology, 1859. (*Bohn.*)

Lardner's Animal Physics. (*Walton and Maberly.*)

Translation of Milne Edward's Manual of Zoology. (*Renshaw.*)

Marshall's School Physiology (*Longmans*), to be published before Christmas, 1860. Marshall's Description of the Human Body, with Atlas (*Day and Sons*), for details of Anatomy.

XV.—Botany.

68. Sect. I. Vegetable Physiology. The general Structure of a Plant. The manner in which the organs perform their several functions; and the external agents which influence them. The nature of the tissues employed in manufactures. The application of such facts to practical purposes.

69. Text Books:—Lindley's Theory and Practice of Horticulture (*Longmans*); or the same author's School Botany, the edition of 1854, or any later one. (*Bradbury and Evans.*)

70. Sect. II. Practical Botany. The Meaning of Botanical Terms. The general facts relating to Botanical Classification, excluding that of Linnæus. The Distinctions of some of the principal English Natural Orders of Plants. Naming Plants at sight. The art of Describing Plants correctly. (For this living specimens will be provided.)

71. Text Books: Lindley's School Botany, and Descriptive Botany. (*Bradbury and Evans.*)

72. Candidates will be expected to answer correctly six questions in Section I. and eight questions in Section II.; each Botanical description standing for one answer. The questions in both sections will have reference exclusively to subjects having some practical application. No one can pass who is not able to answer fairly the questions in Section II., proficiency in which will be rated higher than in Section I. Students are recommended to study diligently "Descriptive Botany" and the Physiological Aphorisms at the end of "School Botany."

XVI.—Agriculture.

73. The Examination in the theory of agriculture will include both the advantages and results of tillage operations, and the influence and operation of particular manures and foods. The questions on farm practice will test a knowledge of the cultivation of our most important crops, and of the management of our principal domesticated animals.

74. Text Books:—Low's Elements of Practical Agriculture. (*Longmans.*)

Johnston's Agricultural Chemistry. (*Blackwood and Sons.*)

Morton's Cyclopædia of Agriculture. (*Blackie and Son.*)

Stephens' Book of the Farm. (*Blackwood and Sons.*)

XVII. Mining and Metallurgy.

75. Candidates should be able to identify with facility the ores of the more common metals and should be acquainted with their chemical compositions. The forms of occurrence of the various metallic ores, and the usual methods employed for their extraction and subsequent purification by crushing, stamping, and washing, &c. Underground surveying, principles of ventilation, particularly as applicable to collieries. A knowledge of furnace assaying, and a general acquaintance with the metallurgy of the more important metals.

76. First-class certificates can be given to those only who have either acquired some practical knowledge of mining, or who possess a special acquaintance with the metallurgy of at least one of the useful metals.

77. Text Books:—Dana's Mineralogy (*Trübner and Co.*, Paternoster-row). Mitchell's Assaying (*Baillière*). Manual of Metallurgy (*Griffin*). Useful Metals and their Alloys (*Houlston and Wright*). Ure's Dictionary of Arts, Manufactures, and Mines (*Longmans*).

XVIII.—Political and Social Economy.

78. Text Books:—Elements of Political Economy, by James Mill. Principles of Political Economy, by John Stuart Mill.

The Phenomena of Industrial Life. Edited by the Dean of Hereford. (*Groombridge.*)

Whateley's Lectures on Political Economy. (*Parker.*)

79. Some knowledge of the Commercial, Financial, and Statistical History of the United Kingdom will be required, for which "Porter's Progress of the Nation," and "M'Culloch's Commercial Dictionary" may be consulted.

N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first-class Certificate.

XIX. Domestic Economy.

80. By this is meant a knowledge of the management of household matters, and the principles on which they are conducted; the "why and the wherefore" of everything under this head. For instance, as regards food, animal and vegetable, how differing in nutriment, &c., cookery, &c.

81. Clothing of various kinds, how best fitted for varying climates, seasons, and occupations, &c.

82. The Sanitary regulations of the house, such as ventilation, warming and lighting, drainage, &c. A knowledge of the weights and measures by which the prices of provisions, &c., are regulated. In fact, how to make the most of a small income.

83. A knowledge also of the principles of the Savings' Bank, and of the accumulation of small savings, of the Benefit Society, of present and deferred annuities.

84. Text Books:—A Manual of Domestic Economy, by Tegetmeier. (*Home and Colonial School Society.*)

Good Times, or the Savings Bank and the Fireside. (*Groombridge and Son.*)

Domestic Economy, by Esther Copley. (*Groombridge and Son.*)

XX.—Geography.

85. All candidates will be expected to possess a sound knowledge of Elementary Geography, both physical and descriptive. Such knowledge will of necessity embrace an acquaintance with at least the outlines of the great natural features of the globe, the political divisions of countries, and the localities of towns and other places of importance. This kind of knowledge will be looked for in fuller extent with regard to the British Islands, and the various portions of the British Empire, than in respect of other countries. Among the tests applied to it, will be the requirement of the candidate to make, from memory, a sketch, showing the chief features of any particular country in Europe named by the Examiner, and also to sketch a map of the county in which the candidate may be resident. It will not of course be expected that such sketches should show accuracy of detail, but they should at least show the general direction of coast-lines, mountain-chains, or river-courses, with the localities and names of the principal towns. The map of any particular locality should embody the chief natural features which the district may include (with the situation of coal-fields, if any), and should have marked upon it any localities which are distinguished as seats of manufacturing or commercial industry.

86. In addition to the above, candidates who aim at the highest class of certificate should be prepared to answer questions bearing upon Geography in its relation to the Physical Sciences and the History of Mankind—such questions, that is, as involve a general acquaintance with the subject of Climate, the laws of Meteorology, the Distribution of Plants and Animals over the Globe, the leading outlines of Geology, the Ethnographic Division of the Human race, and the commercial resources of different lands. This kind of knowledge is looked for, not in place of geographical knowledge of a more elementary kind, but as supplementary to the latter, and throughout based upon it.

87. Text Books:—

Manual of Geography, by William Hughes. (*Longmans.*)

Guyot's Earth and Man. (*Parker and Son.*)

Mrs. Somerville's Physical Geography. (*Murray.*)

Physical Geography of the Sea, by Maury. (*Philip & Son.*)

Page's Introductory Text Book of Geology. (*Blackwood.*)

The General Atlas (*published by the National Society.*)

The School Physical Atlas (*either Johnstone's or that published by the National Society.*)

Maps illustrating British Geography (*published by the National Society.*)

XXI.—English History.

88. A general knowledge of the outlines of English History. A special knowledge of English History during the reign of Charles I.

89. Text Books:—Guizot's History of the English Revolution (*Bogue.*)

Creasy's Rise and Progress of the English Constitution. (*Bentley.*)

The Student's Hume (*Murray.*)

XXII.—English Literature.

90. Any two, but not more than two, of the authors in the following list may be taken up for examination:—

Chaucer. The Knightes Tale.

Shakspeare. Othello; Richard III.; As you like it.
Bacon. Essays.
Milton. Paradise Lost, Books I. to VI.
Pope. Essay on Man; Essay on Criticism; Rape of the Lock.

91. Or one of the following works may be taken, with one of the above-mentioned authors:—
Craik's History of the English Language.
Trench's English Past and Present.

92. Candidates are recommended to make a very careful study of the text of the authors they may select. The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject-matter and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXIII.—Logic and Mental Science.

93. Logic: Candidates will be expected to answer questions on the different processes of thought, and on the connexion of thought and language. Every Candidate must attempt to analyse examples of reasoning, and to detect fallacies.

94. Text Books:—Whateley's Elements of Logic, or Thomson's Outline of the Laws of Thought.

95. A Candidate for a second or third-class Certificate will be expected to prepare, in addition, any one of the following books which he may select:—Bacon's Novum Organum, Book I. (English Translation); Bishop Butler's Sermons; Paley's Moral Philosophy; Dugald Stewart's Philosophy of the Human Mind, Volume I.

96. A Candidate for a first-class Certificate will be expected to prepare any two of these works which he may select.

XXIV.—Latin and Roman History.

97. Livy, Book iii.
Virgil. Æneid, Book viii.
Roman History to the death of Augustus Cæsar.

98. Text Book:—Liddell's History of Rome (in one volume.)

XXV.—French.

99. The Examination paper will be divided into three parts.

100. The first will comprise questions on any portion of the French Grammar (to be answered in French, if possible), and an extract from a modern French writer to be translated into English. Candidates, in order to obtain a 3rd class certificate, should do full justice to this first part.

101. The second part will comprise an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English, or *vice versâ*. This should be done satisfactorily by the candidate who aims at a second class certificate.

102. In the third part, candidates for the 1st class certificate will have, in addition to the above, to answer properly some *elementary* questions on the three following subjects:

(1.) French literature in the 17th century (from Malherbe to Massillon).

(2.) French Weights and Measures, as compared with the English.

(3.) The Reigns of Henri IV. and Louis XIII.

103. Books recommended:—Roche, Ecrivains Français. (*Williams and Norgate*, London and Edinbro'.) Durny: Histoire de France. (*Williams and Norgate.*)

XXVI.—German.

104. Schiller's Geschichte des Dreissigjahrigen Krieges.
Schiller's Braut von Messina.
Göthe's Egmont.
Kohlrausch's Deutsche Geschichte.

105. Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First-class certificates will be given to those only who translate well from English into German, and write in German a good essay relating to German history since the Reformation, the subject of which will be given to them when they come up for examination.

XXVII.—Freehand Drawing.

106. In freehand drawing the candidate will be required to show a practical knowledge of the principles usually applied to the imitation of natural and artificial forms, such as geometrical models, furniture, manufactured articles, foliage, and the human form.

XXVIII. Mechanical Drawing.

107. Mechanical or Geometrical Drawing required by the Mechanist, Engineer, Builder, and all in any way employed in the arts of construction. The candidate will be examined in Practical Plane Geometry, right line figures of given areas, curve lines required in the arts, &c., in Practical Solid Geometry, Elementary Problems on the line and plane, and their combinations, the representation by orthographic projection of simple solids from conditions, and in the principles of Development as used in the construction of Maps, &c., and in Elementary Perspective Projection as far as it is required by the Architect.

108. Text-books:—Geometry, Plain, Solid, and Spherical (*Library of Useful Knowledge*) is especially recommended as a work to be studied on Theoretical Geometry. Practical Plane Geometry.—Burchett's Practical Geometry, Practical Geometry, Linear Perspective and Projection (*Library of Useful Knowledge*). For Descriptive Geometry.—Hall's Elements of Descriptive Geometry for Students in Engineering. Heather's Descriptive Geometry. Also the following French Works, which are mentioned in consequence of the great deficiency of English Works on Geometrical Drawing:—Elémens de Géométrie Descriptive, par S. F. Lacroix; Traité de Géométrie Descriptive, par Levebure de Fourcy; Nouveau Cours raisonné de Dessin Industriel, par Armengaud, ainé, et Armengaud, jeune, et Amouroux; Bardin's Works on Descriptive Geometry.

XXIX.—Theory of Music.

109. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

110. The Elements of Harmony.

111. Arrangements must be made, in the Previous Examination by the Local Boards, to test Candidates, by oral examination, in their knowledge or appreciation of the *sound* of musical successions and combinations. A form of the test to be used for this purpose by the Local Board at the Previous Examination will sent by the Council to such Local Boards as may *apply for it*, in due time before the Examination.

PRIZES FOR 1861.*

112. The following Prizes are offered to the Candidates, viz.:

One First Prize of £5, and one Second Prize of £3, in each of the twenty-nine subjects of Examination.

113. No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

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* The fund for the prizes is raised annually by subscription from Members of the Society of Arts, and others interested in the success of the Examinations. Annual subscriptions and donations to the Prize Fund may be forwarded to Mr. Samuel Thomas Davenport, the Financial Officer, Society of Arts, John-street, Adelphi, London, W.C.

114. The Prize will be given in money or in books, at the option of the Candidate.

115. The following Prizes are offered to the Institutions, viz. :—

To the Institution whose Candidate obtains the above-mentioned First Prize of £5 in any of the 29 Subjects, one Prize of £5. An Institution can take more than one such Prize: but no such Prize can be taken by an Institution unless the Council of the Society of Arts is satisfied that the Candidate, in respect of whom the Prize is claimed, has received in a class at the Institution systematic instruction in the subject for a period of not less than three months.

116. The following Prizes are offered to the Local Boards, viz :—

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than twenty), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £10.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than sixteen), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £8.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than twelve), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £6.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than eight), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £4.

117. No Local Board can receive more than one of these Prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted.

118. No Prize of any kind can be awarded to, or in respect of, any certificated teacher, any pupil teacher, or any person belonging to a higher grade of Society than those referred to in paragraph I. of the Preliminary Notice.

APPENDIX.

This Appendix, which is attached to the separate copies of the Programme printed for distribution, contains the forms that will be forwarded at the proper time to the Local Boards, but as these do not differ materially from those of last year, they are not here reprinted in the *Journal*. The Appendix also contains the Lists of Prizes and Certificates Awarded, and tables of the results of last year's Examinations, with the remarks of the Examiners. These have already appeared in the *Journal*, pages 578, 590, and 627.

THE MINING RECORD OFFICE.

A testimonial, consisting of a handsome tea and coffee service and silver salver, with a purse of 200 guineas, has been presented to Mr. Robert Hunt, F.R.S., Keeper of the Mining Records, by a number of gentlemen interested in the mineral industries of the empire. Mr. Josiah Berry, F.R.G.S., was deputed to present the testimonial, and in doing so stated that to Mr. Hunt was due the merit of having initiated and continued the collection and arrangement of the only official statistics in existence of the mineral produce of the British Islands, and that he had undertaken, and with vast labour and experience completed, the compilation of this admirable series of tabulated information. He had also rendered valuable services for a period of many years to the various departments of industrial science.

WATER CISTERNS IN VENICE.

The French Academy of Sciences has received a communication from M. G. Grimaud, on the manner in which the Venetians construct their cisterns, a plan which he thinks might be advantageously introduced on the heights which overlook Paris, and are occupied by large establishments and a numerous population, and which would greatly benefit by them. Venice occupies a surface of 5,200,000 square metres (1,300 acres), exclusive of all the great and small canals which intersect it. The annual average of rain is 31 in., the greater part of which is collected in 2,077 cisterns, 177 of which are public. The rain is sufficiently abundant to fill the cisterns five times in the course of the year, so that the distribution of water is at the rate of 16 litres ($3\frac{1}{2}$ gallons) per head. To construct a cistern after the Venetian fashion, a large hole is dug in the ground to the depth of about 9 feet, the infiltration of the lagoons preventing their going any deeper. The sides of the excavation are supported by a framework made of good oak timber, and the cistern thus has the appearance of a square truncated pyramid with the wider base turned upwards. A coating of pure and compact clay, 1 ft. thick, is now applied on the wooden frame with great care; this opposes an invincible obstacle to the progress of the roots of any plants growing in the vicinity, and also to the pressure of the water in contact with it. No crevices are left which might allow the air to penetrate. This preliminary work being done, a large circular stone, partly hollowed out like the bottom of a kettle, is deposited in the pyramid with the cavity upwards; and on this foundation a cylinder of well-baked bricks is constructed, having no interstices whatever, except a number of conical holes in the bottom row. The large vacant space remaining between the sides of the pyramid and cylinder, is filled with well-scoured sea sand. At the four corners of the pyramid, they place a kind of stone trough covered with a stone lid pierced with holes. These troughs communicate with each other by means of a small rill, made of bricks, and resting on the sand, and the whole is then paved over. The rain water coming from the roofs runs into the troughs, penetrates into the sand through the rills, and is thus filtered into the cylinder or well hole by the conical holes already described. The water thus supplied is perfectly limpid, sweet, and cool.

Proceedings of Institutions.

Blackburn Literary, Scientific, and Mechanics' Institution.—The Sixth Annual Report shows that great success has been achieved during the past year. The statement of the number of members at the close of each quarter exhibits a satisfactory increase. The educational department has been the cause of much anxiety to the directors. The great increase of the class members has made the labours of the teachers more arduous, and attendance at the classes has been generally equal to the accommodation. The examination and prize schemes of the Lancashire and Cheshire Union of Institutions, and the Society of Arts Examinations, have proved a useful

stimulus to the members of these classes. Their attendance has been more regular, and their zeal in their studies has been more marked and constant. The number on the respective class rolls was as follows:—

	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.
Writing and Arithmetic	90	112	130	104
Grammar	64	67	75	70
Reading	43	28	51	58
Geography	43	25	40	30
Drawing	2	2	11	4
French	10	3	10	3
German	3	0	6	0
Female	13	13	20	16

The following lectures have been delivered:—Mr. W. Fairbairn, C.E., F.R.S., "The System of Education best calculated to improve the Condition of the Working Classes. Mr. H. W. May, L.C.P., "A Literary and Musical Entertainment:" Part I., "The Wit, Humour, and Poetry of Tom Hood:" Part II., "Recitations from various Authors, diversified by Vocal Music, with Pianoforte Accompaniment." Mr. John Oldham, "The Electric Telegraph; its Rise and Progress up to the Present Time, illustrated by Telegraphic Apparatus." Mons. F. Wolff, Ph. D., "The French at Home: their Manners, Habits, Literature, and Household Economy, &c." Mr. John Skaife, M.R.C.L., "Introduction to Natural History." Rev. C. W. Woodhouse, M.A., "The Tin and Copper Mines of Cornwall," with illustrations. Mr. J. B. Marsh, "Rare Old Chester," with illustrations. Rev. H. Cock, "Newspaper Literature." Mr. David Morris, "A Night with Lancashire Poets," with Vocal Music. Dr. Withrington, "A Sketch of the Border Land of the Organic Kingdom." Rev. A. Fraser, M.A., "Epitaphs." Mr. W. Gourlay, "Cowper:—His Life and Writings." In the Library department the directors have added, by purchase during the year, 364 volumes of standard works, besides forty volumes of miscellaneous works which have been presented. The demand for books is on the increase, which necessitates the continual purchase of new works, and it is hoped that the friends of the Institution will afford the directors that pecuniary assistance which will enable them to meet the growing wants of the members. The total number of books now in stock is 3,651 against 3,249 last year. The following statement shows the issue of books during each quarter of the year, together with the number of readers:—

	1st Qr.	2nd Qr.	3rd Qr.	4th Qr.
Vols. issued	3,004	2,919	3,573	3,111
Number of Readers	384	363	446	496

The members of the Engineers' class have been assisted by the purchase of a number of valuable works and models.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 14th and 16th July, 1860.

247. Bills—Union of Benefices—(Amended).
259. „ Nuisances Removal and Diseases Prevention (as amended in Committee, on Re-commitment, and on Consideration, as amended).
258. „ Anchors and Chain Cables.
261. „ Metropolitan Local Management Act Amendment (as amended by the Select Committee).
264. „ Landed Property Improvement (Ireland).
265. „ Local Government Supplemental (No. 2).
266. „ Theatres and Public Houses.
267. „ Bank of Ireland (No. 2).

Delivered on 17th July, 1860.

407 (1). Packet and Telegraphic Contracts—Appendix No. 2, Report from Committee.
447. Fire Insurance—Return.
250. Bills—Weights and Measures (Ireland).
260. „ Peace Preservation (Ireland) Act (1856)—Amendment.
263. „ Rifle Volunteer Corps.

Delivered on 18th July, 1860.

450. Vessels and Tonnage, &c.—Return.
454. Convicts (Western Australia, &c.)—Returns.
457. Ceylon Railway—Return.
417. Gas (Metropolis) Bill—Minutes of Evidence.
269. Bill—Militia Ballot.
Emigration from Canton—Correspondence.

Delivered on 19th July, 1860.

458. Manchester and Salford Churches—Return.
373. Corporal Punishment.—Return.
268. Bills—Clearance Inwards and Lien for Freight—(Amended).
270. „ Sale of Gas Amendment (No. 3)—(as amended by the Select Committee).
271. „ Coroners (No. 3)—(amended).
272. „ Industrial Museum (Scotland)—(as amended by the Select Committee).
Births, Deaths, and Marriages—21st Report of the Registrar General.

Delivered on 20th July, 1860.

262. Bills—Poor Relief, &c. (Ireland)—(amended).
273. „ Spirit Duties.
274. „ Census (Scotland).
275. „ Excise Duties.
276. „ Gas (Metropolis)—(as amended by the Select Committee.)

Delivered on 21st and 23rd July, 1860.

441. Military Organisation—Report from Committee.
452. Volunteer Riflemen, &c.—Returns.
460. Foreign Shipping—Account.
467. East India (Army)—Return.
468. East India (European Local Troops)—Return.
471. East India (Army)—Correspondence during the year 1858.
472. East India (Appointments)—Return.
473. National Defence—Copy of Minute by the Defence Committee.
378. York Assizes—Return.
439. Cambridge University—Papers.
279. Bills—Game Certificates, &c. (Amended in Committee and on Re commitment.)
278. „ Local Government Act (1858) Amendment (as amended in Committee and on Re-commitment.)
280. „ Jews Act Amendment (as amended by the Lords).
281. „ Ionian Islands (Marriages).
282. „ Sheriff Court Houses (Scotland) (amended).
283. „ Corrupt Practices Prevention Act (1854) continuance.
285. „ Leases Confirmation (Ireland).
286. „ Metropolis Local Management Act Amendment (No. 2) (amended).

Delivered on 24th July, 1860.

287. Pilotage—Abstract of Returns.
459. Dublin Superior Courts of Law—Returns.
462. Sale of Gas Act (No. 2) and (No. 3) Bills—Minutes of Evidence.

Delivered on 25th July, 1860.

434. Electric Telegraph Companies—Returns.
461. Civil List Pensions—Accounts.
465. Chelsea New Bridge—Return.
469. Public Income and Expenditure—Account.
475. Westminster New Palace—Return.
476. Rates for Government Property—Estimate.
277. Bills—Gunpowder, &c. (amended).
287. „ Sheriff Court Houses (Scotland) (as amended in Committee and on Re commitment.)
289. „ Law and Equity.
Syria—Papers relating to the Disturbances.

Delivered on 27th July, 1860.

455. Elective Franchise in Counties and Boroughs—Lords' Report.
478. Islington Tolls, &c.—Return.

Delivered on 28th and 30th July, 1860.

85. Harbour, &c., Bills (11, Galway Harbour (No. 2))—Board of Trade Report.
444. Reformatory Schools—Return.
484. Caledonian Canal—55th Report of the Commissioners.
487. Public Monies—Return.
488. Fortifications—Estimate.
479. National Gallery—Return.
482. Baron de Bode—Rords' Report.
295. Bills—East India Stock Transfer, &c. (amended).
296. „ Excise Duties (amended).
297. „ Sale of Gas Act Amendment.
298. „ Agmentation of Small Benefices (Ireland).
299. „ Ecclesiastical Commission, &c. (amended).
Manufactures, Commerce, &c.—Report of Her Majesty's Secretaries of Embassy and Legation (No. 3.)
Public General Acts—Cap. 35 to 53.

Delivered on 31st July, 1860.

489. National Education (Ireland)—Return.
491. Militia—Return.
492. New Zealand—Papers.
300. Bill—Endowed Charities (amended).

Delivered on 1st August, 1860.

485. Navy (Steam Coal)—Return.
301. Bills—Industrial Schools Act Amendment.
302. Bills—Savings Banks and Friendly Societies Investments (as amended in committee and re-commitment.)
France—Second Additional Article to the Treaty of Commerce.
Switzerland—Letter addressed to the British Plenipotentiary at Vienna by the Deputies from Geneva.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 17th*, 1860.]

Dated 18th April, 1860.

974. J. Fowler, jun., Cornhill, W. Worby, Ipswich, and D. Greig, New Cross, Deptford—Imp. in tilling land, and in actuating agricultural implements by steam power, and in apparatus employed therein. (Partly a com.)

Dated 15th June, 1860.

1458. B. Predavalle, Bloomsbury-street, Bloomsbury-square — A new mode of and apparatus for producing and obtaining motive power.

Dated 13th July, 1860.

1694. A. Strathern, A. Strathern, jun., and A. Strathern, Glasgow—Imp. in stop cocks or valves for regulating the flow of fluids

Dated 17th July, 1860.

1730. A. C. Bamlett, Myddleton Tyas, near Richmond, Yorkshire—Imp. in reaping and mowing machines.

Dated 19th July, 1860.

1749. I. N. Davis, Brentford, Middlesex—Producing spirit from rice, maize, barley, or other grain. (A com.)

Dated 20th July, 1860.

1761. C. C. J. Guffroy, Lille, France—Imp. in preparing the livers of salt-water fish. (A com.)

Dated 25th July, 1860.

1797. M. R. Leverson, 12, St. Helen's-place, London—Imp. in applying springs to locomotive engines, and to railway and other carriages. (A com.)

Dated 27th July, 1860.

1830. H. Jackson, Oak-lane, Limehouse, Middlesex—Imp. in fire-bars.

Dated 30th July, 1860.

1846. W. Gough, Birmingham—An imp. or imps. in balancing mill-stones.
1848. H. Greaves, Oldham, Lancashire—Imp. in hecks, or mechanism, or arrangements, used in warping yarns or threads.
1850. W. Spence, 50, Chancery-lane—Imp. in the manufacture of hats. (A com.)

Dated 31st July, 1860.

1852. A. V. Donnet, Lyons, France—An improved registering water meter.
1853. J. M. Douglas, Cupar, Fife, Scotland—Imp. in the delivery of the cut crop from reaping and mowing machines.
1855. H. W. Ford, Gloucester—Imp. in elastic buffing and drawing apparatus suitable for railway vehicles.
1856. J. Goucher, Worksop, Nottinghamshire—An imp. in beaters for thrashing machines.
1857. J. S. Jarvis, Wood-street, London—An improved scarf or neck-tie.
1858. W. Pickstone, 32, York-street, Manchester—Imp. in the manufacture of tubes or pipes.
1859. F. H. Trevithick, Guildford-road, Clapham, Surrey, and R. Jones, Botolph-lane, London—Imp. in means or apparatus to be used in effecting the preservation of animal and vegetable substances.
1860. J. Willcock, 19, Chancery-lane—Imp. in photographic apparatus. (A com.)

Dated 1st August, 1860.

1861. J. Jackson, 29, Queen-street, Wolverhampton—Purifying and cooling water and atmospheric air, which he calls "The carbonic aerial water and air purifier and cooler.
1862. E. O. W. Whitehouse, Brighton, Sussex—Imp. in testing insulated conductors.

Dated 2nd August, 1860.

1865. A. Ripley, 42, Bridge-street, Blackfriars—Imp. in the mode and process of treating the waste and refuse of leather, and in the mode of treating and operating upon these in order to form a new article or fabric.
1867. E. Partridge, Stourbridge, Worcestershire—Imp. in axles and axle boxes.
1868. J. Grant, Hyde-park-street, Middlesex—Imp. in breech loading guns.
1869. W. Ford, and T. Procter, Derby—Imp. in sewing machines.
1871. W. E. Newton, 66, Chancery-lane—Imp. in knitting machinery. (A com.)
1872. J. C. Haddan, 14, Bessborough-gardens, Pimlico, Middlesex—Imp. in the manufacture of rifled cannon, and of projectiles to be used in rifled cannon.

Dated 3rd August, 1860.

1873. J. T. Pitman, 67, Gracechurch-street—An improved process in the vulcanisation of india rubber, and other similar substances under pressure. (A com.)
1874. B. Arnold, East Greenwich, U.S.—Imp. in machinery for netting.
1875. J. T. Pitman, 67, Gracechurch-street—An improved press. (A com.)
1876. J. Hall, Blackburn, Lancashire—Imp. in sewing machines.
1877. E. Billington, Manchester—Imp. in machinery or apparatus for combing cotton, wool, flax, tow, silk, and other fibrous materials, and in machinery or apparatus for preparing the same to be combed or carded.
1878. F. X. Kuala, Pentonville-road, Middlesex—An improved self-regulating gas burner.
1879. J. Higgin, Manchester—Imp. in railways, in railway carriages, and in the mode of retarding and stopping railway carriages.
1881. Capt. E. Armand, Paris—Imp. in horses' bridles.
1882. W. E. Newton, 66, Chancery-lane—A new or improved musical instrument. (A com.)
1883. W. E. Newton, 66, Chancery-lane—An imp. in wooden-soled boots and shoes or clogs. (A com.)
1884. W. E. Newton, 66, Chancery-lane—Imp. in washing machines. (A com.)
1885. W. Clark, 53, Chancery-lane—Imp. in embroidering machines. (A com.)
1886. J. Stephens, 3, Augusta-place, Lyncombe-hill, Bath—Imp. in the arrangement of wheeled carriages, to facilitate their movement on soft or uneven land.
1887. J. Rives, 15, Rue des Enfants Rouges, Paris—Imp. in looms for weaving, and in preparing cards for the same.

Dated 4th August, 1860.

1890. W. Taylor, J. Pendlebury, T. Bailey, and R. Harrell, Preston Lancashire—Imp. in "temples," used in weaving textile fabrics.
1891. W. E. Gedge, 11, Wellington-street, Strand—An improved cork-cutting machine. (A com.)
1892. J. Hunter, Cambusnethan, Lanark—Imp. in machinery or apparatus for boring and winding for mining purposes.
1893. J. F. Klintin, Stockholm—Imp. in ships' logs.
1895. J. Higgins and T. S. Whitworth, Salford, Lancashire—Imp. in carding engines.
1896. T. Webb, Smallwood Manor, Uttoxeter, Staffordshire—Imp. in gates.

Dated 6th August, 1860.

1897. W. Redgrave, 24, Wood-street, Lambeth, Surrey—An improved inflated undulating artificial bust.
1899. H. De Mornay, Bayswater, Middlesex—Imp. in apparatus for sorting and preparing tea for the market.
1900. G. Jeffries, Norwich—Imp. in machinery or apparatus for filling cartridges.
1901. F. Schwann, 4, Gresham-street—Imp. in dressing and stiffening fabrics and yarns.

Dated 7th August, 1860.

1903. F. Hudson, 227, Blackfriars-road—Imp. in spring rollers for window blinds.
1905. C. L. Davies, 37, Queen's-square, Bloomsbury, Middlesex—Improved apparatus for printing and embossing.
1907. W. E. Newton, 66, Chancery-lane—Improved apparatus for retarding carriages. (A com.)

PATENTS SEALED.

[*From Gazette, August 17th*, 1860.]

August 17th.
2762. W. E. Newton.
202. T. W. Plum.
457. A. Teissere.
459. T. Hoyle.
463. R. A. Brooman.
465. Sir C. T. Bright.
475. C. Schiele.
488. W. Haynes.
512. T. North.
530. C. F. J. Fonrobert.
608. T. Cox and W. Holland.

[*From Gazette, August 21st*, 1860.]

21st August, 1860.
485. P. A. J. Dujardin.
493. R. A. Brooman.
494. J. Pegg.
495. J. Redfern.
499. E. Mucklow.
500. S. Roberts.
505. J. J. Baranowski.
527. T. Silver and J. Hamilton.
529. J. Lee.
543. E. I. Asser.
547. J. W. Midgley.
555. J. Rickard and W. Rickard.
559. H. Swan.
577. J. M. Blashfield.
673. C. Baptiste.
831. J. Sheridan.
850. W. A. Gilbee.
1081. E. Southern.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, August 17th*, 1860.]

August 13th.
2182. P. Carmichael.

August 15th.
2196. S. Bottomley, J. Bottomley, and T. Bottomley.

Journal of the Society of Arts.

FRIDAY, AUGUST 31, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 (see next page) is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£361,400	
The Mayor of Lancaster (William Whelon) Westfield House, Lancaster ...	100	Arts.
J. Cumberland Part, 186, Drury-lane, W.C...	100	Commerce.
*George Bendon, 50, High Holborn, W.C.	100	Manufactures.
Charles Parker, Binfield-grove, Bracknell, Berks	300	Arts.
*S. R. Solly, F.R.S., Serge-hill, Bedmond, Hemel Hempstead, and 10, Manchester-square, W.	200	Arts.
*Basil T. Woodd, M.P., Conyngham Hall, Knaresborough, and 14, Great Cumberland-street, W, ...	250	Arts.
H. D. P. Cunningham, R.N., Bury, near Gosport	100	Arts.
Total	£362,550	

By Order, P. LE NEVE FOSTER, *Secretary.*

MINERAL RESOURCES OF TUSCANY.—No. IV.

By William Paget Jervis, F.G.S.

(*Continued from page* 707.)

Metalliferous Minerals; including the History of the Mines of the Tuscan Archipelago, from the earliest period down to the close of the Lorraine Dynasty, in 1859.

I. Elban Iron Mines.

The whole of the Elban iron mines are the property of the Tuscan Government, who worked them on their own account up to 1851, when a lease was granted to Messrs. Bastogi and Co., of Leghorn, for thirty years, on payment of £20,000 sterling per annum, with a certain per centage on the profits—the smelting establishments on the mainland being given as a mortgage. The mines are under the immediate superintendence of the Minister of Finances, to whom the Director hands in his reports.

The metallurgical department is under Mons. Ponsard, at Follonica, who has been very recently appointed, and from whose scientific skill great improvements may soon be anticipated. There is no engineer on the island, but the affairs are managed by Mons. Ulrich, a French gentleman, residing at the Marina di Rio, who, with the title of *Administratore all' Isola*, has charge of the accounts, the superintendence of the various mines, and sees the ore shipped off. The company is divided into 24,000 shares, each of 1,000 Tuscan *lire*, or £33 6s. 8d. sterling: half of these are reserved for the Government. The Director-general of the company has a fixed salary of 10,000 *lire* (£333 6s. 8d.), and a certain per centage on the profits.

The largest mine is that of Rio, the only one permanently worked by the Government up to 1851: since that period a very considerable excavation has been made at Capo Calamita; other smaller mines have been in activity for several years at Terra Nera, and Rio Albano; one at a spot called the Vigneria, though still distant half a mile from Rio, may be geologically considered as part of it—the former is worked from the seashore — the latter is considerably higher up the hill. Such are the localities hitherto in operation; they each present peculiar features of interest, which render it convenient to consider them apart, after taking a more general view of the subject.

All the iron ore extracted in Elba is remarkable for its purity and richness; fifty-two per cent. is considered poor by the islanders—the average being sixty-five per cent. It is absolutely free from the impurities so commonly found in British iron ores, especially in our clay-iron stones.

such as phosphorus, sulphur, &c., small portions of which are extremely detrimental to the quality of the metal they produce. While the quality of the Elban ores is second to none in the world, the quantity is so prodigious that, notwithstanding I had heard so much about it before my visit, and consequently had formed high expectations, they proved to be anything but overrated. Elba is truly an island "whose stones are iron, and out of whose hills thou mayest dig brass." In order to proceed as systematically as possible, I will ask my readers to permit me to take a rapid topographical *reconnaissance* of the island of Elba, especially the eastern portion, to which the iron mines are entirely confined.

Let us suppose the island to be submerged 50 feet, we should then find it to present a totally different outline. The Western portion, constituting Monte Capanne, would appear as a lofty and rugged granitic mountain, either forming an island, or united by a narrow beach or sand-bank to a second group of hills, entirely differing from itself in origin and appearance. In fact, the former is a precipitous igneous mass, with an iron-bound coast; the latter a series of gently undulating limestone and schistose hills, pierced in various directions by dykes and intrusions of serpentine and allied eruptive rocks. To the north of this we should find several small islets, formed of porphyritic rocks, altered granites, pegmatite, schist, and serpentine; one of these would correspond to the hill on which stands the fort of Portoferrajo, and several others to those on which the Tuscans have established coast-guard stations; the harbour of Portoferrajo would no longer exist, and the site of the town be for the most part under water; while a narrow arm of the sea would pass from the harbour of Portoferrajo on the north to the Golfo di Longone on the east, and the Golfo della Stella on the south, cutting off to the east two large islands, of which I am about more particularly to treat, as containing all the treasures of iron ore.

Commencing at Monte la Sera, a chain of lofty hills runs southward for several miles to Monte Serato, flanked on the east by lesser hills; upon one of these is built the chapel of Sta. Catterina, the rock being serpentine in contact with limestone. A mile beyond is the conical peak, on whose summit stand the dismantled ruins of the Torre di Giove. If we ascend to the top of Monte Giove, we shall enjoy a good view of the relative positions of the mines of Rio and Rio Albano; the former about a mile to the south, the latter at an equal distance in a north-easterly direction; the little excavation of Vigneria lies rather nearer to the south-east, but though hidden, its position may be easily guessed by the little boats which lie off the beach. Carrying the eye southward we are not able to see very far, for two lofty outlying hills, Monte Fico, and the limestone ridge of Monte Arco, completely shut out the view. Behind this latter eminence, 4½ miles in a direct line from where we are supposed to be standing, is the mine of Terra Nera, situated on the slope immediately overlooking the Gulf of Longone. These mines have been formed in places where the quantity of the iron was supposed to be the greatest and easiest of access, but veins frequently traverse the rock in the intermediate spots; some are excellent peroxide of iron, others silicates, hitherto considered of no industrial importance. The general direction, drawing a line through these various points, will be a little east of north to west of south.

Whether accidentally or not, I am unprepared to state, but following precisely the same course southward across the Gulf of Longone, we arrive at the other interesting group of iron workings at Capo Calamita and Monte Calamita (the loadstone cape and mountain), so called because the mass of the ore is magnetic iron. I am not aware of any iron ore being found on the northern flank of Monte Calamita, but the opposite side down to the sea level is almost entirely covered with a deep deposit of the best mineral, with little intermixture of inferior ores. Such is the position of the five iron mines, which I shall presently describe in succession at greater length.

The first authentic mention of the Elban iron mines is by Hecatæus, a few years after the death of Tarquinius Superbus, last King of Rome, and therefore verging on 2,400 years, a period, which if doubled, would carry us back to the youth of Methuselah.

"Ilva was celebrated in ancient times, as at the present day, for its iron mines: these were probably worked, from a very early period, by the Tyrrhenians of the opposite coast, and were already noticed by Hecatæus (circum 520 B.C.), who called the island Αἰθάλη, indeed its Greek name was generally regarded as derived from the smoke of the numerous furnaces employed in the smelting of iron." (Diod. Sic., v. 13.)

The Greeks were previously acquainted with Elba under the name of Æthalia, Αἰθάλην; αἰθάλη signifies *soot*, and Cerda says that the name was derived from the furnaces employed for smelting iron, a metal in which it was very rich. I attribute the origin of the iron mines to the successors of the Argonauts; Portoferrajo was called by the Greeks Λιμὴν Αργους, or Portus Argous, from *Argo*, the vessel which conveyed Jason and his 54 Thessalian heroes: and Strabo distinctly believed they landed in Elba. We may infer that the Etruscans must have very early worked iron in Elba, since I heard, during my stay at Portoferrajo, that Etruscan iron coins had been discovered in the island. Virgil, alluding to the troops which accompanied Æneas from the Tuscan coasts, sings of Ilva, the noble island, blessed with inexhaustible ores of steel (ores from which steel was then manufactured). His account is just such as I should myself give; never was he less fanciful:—

> "Sexcentos illi dederat Populonia mater
> Expertos belli juvenes; ast, Ilva trecentos
> Insula, inexhaustis chalybum generosa metallis."
> (*Æneid*, lib. x., l. 172.)

Varro (born B.C. 116) says that iron ore is indeed abundant in Elba, but in order to be smelted it has to be taken to Populonium, a city of Etruria, not far from the island. About the Christian era, Strabo alludes to the iron mines of Elba as nothing new, and specially mentions that the ores were taken to Populonia to be smelted, since the island did not afford facilities for the requisite metallurgical operations. What the hindrances were he does not inform us, though I conceive the want of forests, which had been previously cut down, quite a sufficient reason.

Populonium is the best starting point for those who sail for Elba, Corsica, and Sardinia. These islands were visible on ascending the heights above Populonium,* and also certain abandoned mines; we likewise fell in with some of the men who work the iron ore brought from Æthalia, as they cannot smelt it in furnaces in the island itself, so that, when extracted, it is at once shipped to the continent.

"Optime a Populonio solvunt tres illas insulas (Æthaliam, Corniam, Sardiniam,) petituri, quas et nos vidimus Populonio conscenso et metalla quædam ibi locorum deserta: vidimus etiam qui ferrum ex Æthaliâ allatum elaborarent. Non enim eâ in insulâ fornacibus liquari potest; sed statim atque effossum est in continentem perfertur." (*Geographiæ*, lib. v., cap. ii., § 7.) This explains the passage in Aristotle (born B.C. 384) which alludes to *Populonio ferro*; *i.e.*, Elban iron, smelted even in his time at Populonia. The intercourse of the Romans with Elba may be inferred from their coins found from time to time: I believe they chiefly belong to Constantine, more rarely to Augustus, Trajan, and Nero. In every part of the island ancient slags may be observed, considered to have been produced in the metallurgical operations of the Romans. Little furnaces were evidently established at some remote time wherever abundance of wood and a small stream of water were procurable within easy access of the beach. Such

* With due deference to the authority of Strabo, he is mistaken in asserting that he saw *Sardinia*; the islands visible from Populonia are Elba, Corsica, *Capraja*, with others of less importance.

slags I picked up in considerable quantities in a wood at S. Giovanni, near Portoferrajo; the fragments are about two or three inches across, and may be found by slightly scratching the surface of the ground, and in draining a field at S. Giovanni just before my visit, many fragments of specular iron were turned up, so that I was for a short time puzzled to account for the way in which they came there. Similar little pieces of ancient slag are seen at the Golfo dell'Ancona, the Golfo della Biodola, east of the Punto del Pinello, on Monte Orello, at Fabrello, Magazzini, Treacque, Acquaviva, Procchio, Bagno di Marciana, Capo S. Andrea, Patresi, and Casaccia near Portoferrajo, but no place offers more historical and archæological interest than Capo Castello, where I perceived a deep bed of slag exposed in section by a small winter torrent, just as it reaches the beach. Adjoining this is a field, in which the proprietor has prohibited anyone from digging in search of the numerous buried objects of antiquity. Some years ago a long leaden water-pipe was discovered there, intended for the supply of the fort at the extremity of the cape, whence it derives its name of Capo Castello. The pipe was traced onward to ancient ruins. Strong walls are still plainly visible in several places; the irregular stones of which they are composed being so strongly cemented together that, rather than separate them from the mortar at the original joints, it is easier to break off large masses. A beautiful inlaid pavement is partially laid bare, consisting of lozenge-shaped pieces of Elban *Cipolino* marble and other varieties: bricks and tiles are also procurable by dint of careful search. One apartment which I entered probably served as a bath-room: as near as I can remember it was 10 feet by 15 feet. In the brushwood behind more bricks and flat tiles with inscriptions have been excavated. Part of the wall is built of small bricks laid diagonally in patterns, surrounded with rubble work, and supported at intervals by pillars of hewn stone. The plinth is also formed of the same material. Lieut. Pisani dug up many tiles with perfectly legible inscriptions. Some of these I transcribed.

Tracing back the leaden conduit, they found two bronze vessels and a tap, only a little rusty; they also came to ancient foundations, since built on, the superstructure now serving as a country seat. I here met a countryman who assured me that his father had, many years ago, discovered a large vase at this spot, which, on being broken open, was found to be full of antiquities; these he sold on his return home for two pair of trousers, with, perhaps, a little *buona mano;* the purchaser became suddenly rich and possessed of 40,000 francs (£1,600). The church of Sta. Catterina, below Rio, was built with the profits. Nenci, the perhaps too credulous historian of this island, says that in this ancient building a certain Queen Ilva held her court, after she had fled with her lover from the Etruscan mainland pursued by her father and brother. Rather than return, Ilva is fabled to have thrown herself from the cliff at the castle into the sea, and been drowned. The island of Ilva is stated by him to have acquired its name from this romantic lady. (Nenci, *History of Elba.*) *Suum cuique;* I do not vouch for the accuracy of this tale. My only object in bringing forward these remarks is believing that they may possibly serve as a guide to others in forming a judgment as to the age of the slags found close to the ruins, for I think the identity of these tiles from Capo Castello and the others from Rio, show that the mines of Rio were contemporaneous with the ancient fort. It would, indeed, be difficult, without the aid of fragments of antiquities, found buried with the slags scattered over the island, to form the least clue as to their age, but, reasoning from circumstantial evidence, I consider it probable they are exceedingly ancient, dating at least from the Roman kingdom or republic; for my part, I incline to the belief that they may be partly of Etruscan origin, for evidently the island was thickly wooded when the inhabitants smelted their ore so extensively in Elba, and the reason for the subsequent abandonment of these localities, and the shipment of ore to Populonia, as was practised in Strabo's time, was doubtless because wood and charcoal were there procurable at less cost.

Inscription on Roman tile from Capo Castello, **EUHEMER. QMANIP.S.**

Similar inscription on tile from Rio, to which are added the words **F. CARSIMARUS.**

On tile from Rio. **RVEVEI. EROTIS.**

Id. Id. **VARI.**

Inscription at the bottom of a vase brought by the writer from Capo Castello, **L·A·P·I·** (?), the stamp being in the form of a human right foot. Mr. Birch, of the British Museum, has been kind enough to inform me that these may be considered as potter's marks. EUHEMER signifying Ἐν ἡμέρα, *good day*; Εροτις, from ἔρως, *love*, signifying a freed slave. The dates may yet be made out by some one.

To bid adieu to the times of fable, more positive records are extant from the 6th century, when Elba with its iron mines pertained to the civil and ecclesiastical government of Populonia, a city only 20 miles distant. Other documents tell us that in the 11th century Elba belonged to the Pisan Republic, from whom it was taken in 1290 by the Genoese. For nearly 20 years the Pisans were very desirous of recovering so valuable a portion of their territory; at length, in 1309, while Count Federigo di Montefeltro was *Podestà* and Captain-General of the Pisans, the Genoese dictated a treaty by which the former should be reinstated in possession, on payment of 56,000 gold florins, *fiorini d'oro.* The merchants and citizens of Pisa were obliged to come forward and aid in raising so large a sum of money, for which they received in exchange part of the iron ore of Rio mine. Several items of these payments are recorded in the Arch. Dipl. Flor. (*Charte del Monastero di S. Michele in Borgo di Pisa*). Thus, a certain Luparello, innkeeper at Pisa, paid down 5,000 gold florins on the 11th August, 1311 (Pisan style). From another passage we glean two interesting facts; the antiquity of the present mode of weighing by *centenarj*, and the value of the ore in the 14th century; thus, Bartolo del fu Jacobo da Montemagno made a public declaration before the procurator-general of a commercial company entrusted with the sale of the Elban ores for the profit of the commune of Pisa, that he had received three *centenarj* of ore, each weighing 33.333⅓ lbs., for 180 gold florins, or at the rate of 60 gold florins per *centenaro* [5⅔ florins, per ton English], and thereby agreed to pay down the said sum within six months; (Arch. Dipl. Flor.), quoted by Repetti (*Dizionario Storico della Toscana*, tom. ii., p. 591).

Elba was governed by the Pisans down to 1399, when Gherardo di Appiano, their Captain-General, sold the Pisan territory to Giovanni Galeazzo Visconti, duke of Milan, for which he was very handsomely paid in cash and allowed to enjoy free power of governing the remoter parts of the Maremme, with Piombino, Elba, and Pianosa. I shall not say much more regarding Portoferrajo, which is

less connected with the iron mines, further than that it derived its name from Ferrara, by which it was known to the Romans. The etymology of Portoferrajo is *porto*, harbour, *ferrajo*, a smith (or probably better, a smithy). During my stay, many Etruscan and Roman antiquities were dug up at Portoferrajo, chiefly lamps and vases.

What was the condition of the Elban mines immediately previous to 1544 I cannot very positively say; at that time everything must have been brought to a sudden stand by an invasion of the island by the Turks. Charles V., having besieged and taken Tunis, brought back Sinam, son of the Commander-in-Chief of the Sultan's fleet, and a slave from Grassera, a town in Elba. Returning with him to Tuscany, young Sinam was baptised at Piombino. Barbarossa, King of Algiers, came to claim him, but was informed that the demand was useless, since he had been baptised in the Christian faith. Prince Appiani, however, assured the Mussulman that he should be treated like a son, and not as a slave. After long and fruitless deliberations, Barbarossa ordered his troops to land in Elba. They first devastated Capoliveri, the terror-stricken inhabitants flying to the mountains and woods, or hiding themselves in caves, from their pursuers, though most of them perished. The castle of Volterrajo was then attacked, but in vain, so they turned towards the castle of Lucceri, which they blew up. Appiani now thought of restoring Sinam to prevent the utter destruction of the island. Treating with Barbarossa he sent a galley to Piombino to fetch the youth. The two parties met off Capo della Vita, while Barbarossa, embracing the young man, took him into Portoferrajo, amid the wild demonstrations of joy of the barbarians. (See Nenci.) Capoliveri was so frequently a prey to the Mahometan pirates, that the village was walled in; on one occasion it stood a siege of three days. The inhabitants were continually thinned by such invasions, which must have materially influenced the working of the mines.

Portoferrajo subsequently fell into the hands of Cosmo I., who fortified it. However, the Spaniards, in 1602, built the fort of Longone, during the reign of Philip III. In all probability, they worked the mine of Terra Nera, which is within range of the guns of the fort; this could be ascertained by searching the Spanish chronicles. Longone sustained a desperate siege from the French, to whom it was given up in 1646. Four years afterwards, in 1650, the Spaniards attacked the fortress, and obliged the French to capitulate. Meanwhile, the princes Appiani were succeeded in the possession of the iron mines by the princes Ludovisi and Ludovisi-Boncompagni, of Piombino. Still it appears that Terra Nera belonged to the Bourbons down to the last century, because Ferdinand IV. transferred it to the prince of Piombino, on receipt of 12 gold *posati*. (Nenci.) On the 28th March, 1801, by the treaty of Florence, Ferdinand IV., King of the Two Sicilies, gave up Longone and the portion of Elba belonging to the prince of Piombino to the Emperor Napoleon I, while soon afterwards, in 1802, France received the remaining portion of Elba by the treaty of Amiens. Governed successively by the Republic and the Empire, in 1809, Elba, together with the rest of Tuscany, was given over to Eliza, the sister of the Emperor. (Repetti; *Diz. Storico*, tom. ii., p. 592.) For about ten months, (from May 3rd, 1814, to February 26th, 1815), Elba belonged to Napoleon, while exiled from the continent of Europe. In this little empire he strove to promote the good of the inhabitants, by making roads and working the white marbles near Longone, and doubtless the iron mine of Rio was not overlooked by that great man. In 1815, the island with its mines reverted to the Grand Duchy of Tuscany, and they only ceded the right of extracting ore in 1851. Such is a concise summary of the various political events by which the Elban iron mines have been more or less influenced.

Rio Iron Mine.—The ore at Rio is almost entirely specular iron (*Ferro Oligisto*). It occurs in enormous veins or dykes, the subjacent beds being hard Palæozoic metamorphosed rocks, generally known by Italians as *Verrucano;* the superincumbent strata, when present, are metamorphosed magnesian limestones. Associated with the Verrucano is another bed, of only local importance, provincially termed *Bianchetta;* it is a metamorphosed magnesian and talcose schist. The base of the veins at Vigneria, Capo Calamita, and Capo Pero equally rests on Palæozoic rocks. Many have hastily considered that the ore at Rio was a regularly stratified deposit, but Savi has clearly shown the fallacy of such a conclusion. Nor did I for a moment doubt the fact of the ore forming veins in the rock, though I had not then the advantage of reading Professor Savi's excellent memoir on the subject, for along the sea cliff, extending from Capo Pero to the Marina di Rio, an infinite number of tiny veins are seen in the Verrucano, some not more than a few inches in width, others several feet in breadth, generally much more prominent than the adjacent whitish quartzose conglomerate, here formed of fragments, compactly agglutinated together by the fusion of the more easily liquifiable portion. The method by which the ore is worked at Rio is apt to give us a false idea, and leave an impression that it occurs in vast *conche*, or basins, as the corporal (an overseer) seemed to think. This is owing to the system of discontinuing a working in a given spot when the ore becomes a little less productive, and commencing elsewhere. Such changes in the quality of the ore do not frequently occur at Rio, therefore these artificial basins are of enormous dimensions: little engineering skill has been expended to keep the mine in operation till within the last year or two; it needs but to follow where the ore is of good quality and most abundant.

The best bird's-eye view of this mine, which has for so many centuries furnished its successive owners with as much ore as they required, is obtained from the village of Rio, from whence we see the basins excavated at various levels on the side of the hill down to Val di Rio, through which a little brook flows towards the Marina, and forms the boundary; the greater part of the southern slope is covered with a prodigious vein or veins of specular iron, which traversing the rocks so as invariably to metamorphose them in contact with the ore, the term dyke, as Savi and Meneghini have described it, may, perhaps, be more properly employed than vein. That the dykes of iron ore at Rio were formed by igneous action I have no doubt, from the fact that specular iron is formed in volcanos at the present day, such as Vesuvius and Ascension. Hausmann describes specular iron artificially produced in an iron furnace at the works of Altenau, in the Hartz, which he considers to have crystallised out from the molten mass; the crystals being precisely similar to those of Rio, a most important fact, because in volcanos they are invariably very minute, and readily to be distinguished by mineralogists from specimens of Elban specular iron. (See Hausmann; *Beiträge zur metallurgischen Kristalkunde*, p. 18.) In parts the depths of the workings, as near as I could judge, cannot be less than 120 feet. Looking down towards the mine from Rio, imaginary lines can be drawn across the artificial cavities, and by following what was the original slope of the hill, we can appreciate to what an extent the ore has been extracted. When crystallised, the specular iron is excessively hard; and can only be excavated with gunpowder. One particular spot, now no longer worked, was pointed out to me, whence the most beautiful specimens have been obtained for many European cabinets; the size of the crystals is occasionally 1½ inches; between these the ore is very dense and massive, and has a strongly metallic lustre: the colour is a steel-grey, and frequently the edges of the crystals are sharp enough to produce severe cuts in the hand if taken up carelessly. This ore is called *Vena Ferrata;* sometimes quartz crystals are abundant along with the specular iron, in which case it is known as *Marmigno;* at places the ore is squamous and friable, whence it derives the name micaceous iron ore, *Vena Luccica*, which is soft enough to be dug out with pickaxes, as at the Polverino, where it occurs for the length of 600 feet, and a depth of

40 feet, resting immediately on yellow and dark ochres. The crumbling nature of the mineral at the Polverino renders it easy to remove, and be at once shovelled into the panniers and loaded on the donkeys. The specular iron or oligist—of which all these ores are but varieties—passes into rich hæmatite in a few places; this is chiefly powdery, being red ochre, apparently formed by a fresh arrangement of the particles of the mineral, for in chemical composition they are identical. The ochres are frequently seen between the interstices of oligist or the brown hæmatite, and form the variety called *Sanguinaccio.* I did not see much brown hæmatite at Rio; it is called *Vena Cieca,* but of the more earthy varieties, which constitute the abundant yellow ochres, or *Terra Gialla* of commerce, many shades are procurable, from which pigments might be made with considerable advantage, to compete with the celebrated Sienna earths. Some are already employed for fresco-painting. A kind, very closely resembling raw Sienna, is washed in a building near the top of the hill, and a portion being burnt forms red ochre. A whitish pigment, for the same purpose, is prepared from the decomposed *bianchetta.*

Accompanying the bianchetta in various parts of the mine are immense masses of iron pyrites, mostly decomposing and disintegrating: on taking a lump in the hand it falls to pieces, the agglomerated mass of crystals separating into its original members, so that it is easy to pick out little octohedral crystals of the size of a pea. I noticed that when they have become larger they usually assume hemihedral forms, such as the pentagonal dodecahedron, in a few rare instances with axes as much as an inch and a half in length. It is not an easy matter to find such perfect crystals, even after an entire day's search, they are most commonly grouped together in a very confused manner; this pyrites, known as *Marchesite,* is all thrown away up to this period, though I believe our recent improvements in the manufacture of sulphuric acid would fully repay the expense of extracting the Elban pyrites for economic purposes.

The ancient mode of smelting iron was such as to prevent the employment of small ore, which must naturally be removed, whether required or not; nor are the Tuscan and French furnaces, employing charcoal, adapted for this purpose to the present day; thus mounds or little hills of "rubbish," so to translate the word *Gettate,* have accumulated for ages, and been constantly increasing until very recently. The prodigious quantity of *gettate* at Rio and Rio Albano is the first thing which strikes the stranger visiting those mines. The ancients, and even the miners of later days, evidently chose out all the good lumps, rejecting whatever was of a smaller size than a pigeon's egg, together with the whole of the dust arising from the crumbling of the scaly or micaceous ore, in some cases a large per centage: in the course of their excavations they found it most convenient to place their rubbish as much as possible in one spot on the brow of the hill. The *gettate* forms a loose mass, which may be occasionally dug out with a pick-axe and shovel, though sometimes the rain-water, percolating to a small depth only, produces a hard superficial epigenic breccia, the angular dust and fragments of oxide of iron presenting themselves under the most favourable circumstances for forming a hard ferruginous cement. The English blast-furnaces have proved eminently useful for the employment of this material, and thus a secondary extraction on an extensive scale has been commenced, exhibiting for the first time any engineering skill. A *pozzo d'ornello,* or shaft, lately sunk to the depth of 150 feet through the *gettate,* is used to lower the ore in the immediate neighbourhood by means of waggons. From the bottom of the shaft an oval gallery, 412 feet in length, 6 feet high, and 5 feet wide, thus very capacious and airy, and rendered secure by good masonry, leads to the *Laveria,* or dressing-house, whence it is called *Galleria della laveria.* It is of great assistance in conveying any earthy hæmatite, as well as the gettate to the washing troughs. The waggons are lowered by means of an iron wire rope, now much coroded from the quantity of sulphuric acid in the mineral waters—a defect which might be easily rectified by having the wire galvanized. A second shaft is in progress, higher up the hill, for lowering the ore to the laveria; it is double, one half being intended for the gettate, the other for the lumps of ore. Most probably this shaft is already terminated; its depth will be 360 feet, the ground through which it has to pass being very pulverulent, and chiefly composed of gettate, the sides have been walled in. As the dressing-house requires a considerable body of water, and the torrent running by it through the Val di Rio is perfectly dry in summer, a large reservoir has been constructed at the upper part of the mine not far from the ochre sheds. It has the disadvantage of being a long distance off, and is at a much higher level. I must here, however, mention that the specular iron does not require any washing or other treatment preparatory to being thrown into the furnaces, so that the dressing-house is only employed for a comparatively small quantity of ore.

I fear I shall fail to convey to the reader who has not visited Elba a just idea of the truly wonderful mine of Rio. We have copper mines in Cornwall which attain the depth of 2,000 feet,* and the neighbourhood of Redruth presents leagues of "shafts," "levels," and "winzes," but we cannot take a general view of all those extensive workings otherwise than by a map, since those mines are little else than a series of horizontal and vertical tunnels through the rock; any one going down one of them can scarcely ever see a hundred yards before him. At Rio, on the other hand, where the whole of the ore is excavated at the surface, *cava all'aria aperta* as in an ordinary stone quarry, we can form a better conception of the quantity of material which has been extracted by human agency. The best comparison which occurs to me among English mines, is that of Carclaze, near St. Austle, whence tin is supposed to have been obtained since the days of the Roman sway in Britain. There is, however, this great difference, Carclaze is a single vast excavation: the immense quarries at Rio are in no way inferior in point of size, but instead of being one only, a considerable number are seen, which will, possibly, in the lapse of future ages be thrown into one vast quarry, the entire face of the hill being scooped away.

Since such irregularity and want of system in the workings is decidedly the worst plan that could have been adopted, causing as it does great waste, the various reasons which have led to its employment at different epochs may be briefly alluded to. The Etruscans, Tyrrhenians, and Romans no doubt found it to their advantage to extract only that quality of ore which they were able to smelt with most ease in their little charcoal furnaces. In those days the mines were doubtless ever and anon relinquished on account of wars, invasions, and piratical expeditions, so that the new comers chose fresh places which most pleased them. In the dark ages enterprise was at a low ebb: I should imagine that those who then obtained ore from Elba only excavated it on a small scale, at a time when companies were not common, many different individuals working in different parts. In the days of the Italian republics gunpowder was not used in mines: consequently, much of the ore must still have been unsuited for them, as proved by the discovery of rich portions of the vein of specular iron of the most compact variety, since laid bare by the removal of the "rubbish." Thus the same desultory system was carried on. Even within the reign of Leopold II., during the time that the Tuscan Government administered the mines for themselves, not the slightest trouble was taken to follow the more civilized arrangements adopted in every other country. They paid nothing for the monopoly of the mine, and consequently nearly everything was clear gain. Lastly; from the re-

* Tresavean mine is 2,100 feet deep; the United mines, in Gwennap, 1,800 feet; Fowey Consols, 1,680 feet.

verse reason, the present company are completely shackled, and almost driven to keep up much of the primitive method of mining, from the enormous tax which was levied on them by the Tuscan Government, in addition to the sum of £20,000 annually required to be paid for the rent of the mines.

The scene I am about to describe, without any embellishments or traveller's spectacles, is one of so primitive a character, that, thanks to the advance of civilisation, it is seldom to be matched in Europe. I mention it as the condition of things in 1859, persuaded that future visitors will find that Messrs. Bastogi and Co., on reading this account, will have already taken effectual steps towards improvement, as I am confident they earnestly desire.

About 130 *sommarj*, or beasts of burden, chiefly donkeys, are employed to convey the ore to the deposit, *scottiere*, on the beach at the Marino di Rio. Each carries about 333 Tuscan lbs. (250lbs. English). As the whole distance is downhill, with this load the unfortunate creatures are scarcely able to lift their feet off the ground, but totter along in the most pitiable manner. The scene can scarcely be called picturesque. Imagine some 30 or 40 of the most venerable donkeys, each bearing the honourable wounds he has acquired in the service, such as a raw knee, a blind eye, bleeding loins, or some similar distinction. He is loaded with as much as his wooden-frame panniers will carry, and these are prevented from falling over his head when he stumbles by a tight rope crupper, which, during the whole journey downhill, is kept in such an unnatural state of tension that the Elban asses must needs be provided with more than ordinarily strong caudal appendages, else they could scarcely resist such strains.* The little unshod urchin, son of their owner, runs along side, inflicting occasional blows on the head of his charge, unheeded, however, by the poor jaded animals, which need no guidance, as they are so accustomed to their duty that they sagaciously pursue their path, and only stop before the piles of ore at the beach. They are scarcely able to do more than clear the ground, so that their extensor muscles are kept invariably on the stretch. While I watched these trains of asses, now and then an unfortunate beast had to stop from sheer exhaustion, in order to gain a little strength. One fairly broke down under the weight of the panniers, which, resting on the ground on either side, pinned him down. For some time no one went to his assistance, and there he remained until finally unloaded. The donkey boys place a tally on a board for every load they take; these are checked by the man in charge. The price paid for bringing down the ore is 24 *quattrini*, 3¼d., for a *peso*, formed of two loads. Ten journeys are accomplished on an average daily.

Hitherto, only the washed ores are lowered to the laveria, from whence a tramway 400 or 500 yards in length conveys it to the common deposit, where it is tilted out from the waggons by the same men who roll it along. Each quality of ore is placed in a separate heap, to suit the various purchasers.

A wooden frame jetty is formed in front of the Marina di Rio, and when a vessel arrives a scene of animation ensues. The men abandon their ordinary occupation and crowd round a weighing machine supported on three poles. The invariable part of an Italian group, the *gendarmerie*, are to be seen among the three or four dozen men and boys, who assemble with baskets of all sizes, the load of each individual being proportionate to his strength, the boys only carrying a single lump on their heads. Starting off in a single file for the jetty, they successively drop their burden into the hold of the vessel, and return by parallel planks. Such is the amazing celerity of the operation, that a vessel of 100 tons burden can be loaded in a couple of hours, when the bustle is succeeded by the usual quiet. It will be scarcely credited that, not only was there *no wheel carriage* at the important village of Marina di Rio, during my visit in 1859, but *no road to Portoferrajo*, the capital of Elba, a distance of some nine miles. The bridle path which leads between these important places was so badly made, quite on the level of the mountain torrent through the Val di Rio, that it had been completely destroyed for some distance by the floods of the previous winter.

Vigneria Mine is very small, and at the sea level. Being formed on the slope of the hill facing the beach, a tramroad, about 200 yards in length, conveys the ore to large piles, whence it is taken in small boats to the common deposit at the Marina di Rio. The men who load these boats enter the water up to the middle and then upset their baskets. They are perfectly nude. The *capello*, or superficial covering over the ore, is about 10 feet thick at this place, and chiefly composed of ferriferous earth. In fact, in all the Elban mines where there is any *capello* at all, it does not exceed that depth, and is frequently reduced to much less. The ore is oligist, as at Rio, and is very soft and easily removed. In parts of the mine a large quantity of decomposing iron pyrites occurs in large veins, but not mixed with the ore.

The depth of the vein is considerable; it rests on hard Palæozoic quartzose rocks, as at Rio. In August, 1858, during the terrific inundation to which I have alluded, the strata separated by the lodgment of a large quantity of water above the more impermeable beds. A huge mass of rock became detached for a length of several hundred yards and a considerable width. At the time I saw it, a landslip had only just commenced, threatening to increase after the first heavy fall of rain. A house, placed on the very edge of this perpendicular precipice, narrowly escaped being swallowed up in the yawning gulf between. These landslips are likely to take place at this mine whenever there is an abundance of rain in the eastern part of Elba; the strata dipping towards the water, the superincumbent mass slides forward. Excellent medicinal mineral springs issue from the pyrites vein; they are strongly acidulated with sulphuric acid, have a nice refreshing taste, and are much prized by the Elbans, who resort to them when afflicted with numerous disorders. Other springs are ferruginous, and are esteemed very strengthening; these are met with more commonly, both here and at Rio. Were the sulphurous springs to occur in our own country, in so pretty and healthy a spot, I am persuaded that, instead of being allowed to flow uncared-for into the sea, they would soon be enclosed, and Rio become a *rendezvous* for invalids, who would have no reason to dread the malaria so prevalent at the nearest part of the opposite mainland, though only 15 miles distant.

(*To be continued.*)

* For the cause of humanity it is hoped some new system will soon be introduced, the work which the beast could accomplish being greater with common care.

EXAMINATION PAPERS, 1860.

(*Continued from page 711.*)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

LOGIC.

THREE HOURS ALLOWED.

Candidates for a first-class Certificate should answer half the questions in each of the two Sections. Other Candidates should answer six questions at least, taken chiefly from the former Section.

Section I.

1. What is the difference between an Art and a Science? To which of the two would Logic belong? Give reasons.

2. Explain the process of abstraction by which general notions are formed: with examples.

3. Explain univocal, equivocal, and analogous nouns. Under what condition may equivocal and analogous nouns be used in reasoning?

4. "A triangle is a figure with three equal sides and

angles." Show that this is a wrong definition. Correct it, and explain the principle.

5. Compare definition and division. Show the use of both in science.

6. Define the following words, mentioning in each case the kind of definition employed:—Philosopher, iron, politics, plant, aristocracy, freedom.

7. Draw out in proper form the following arguments, and examine their correctness:—

Slavery is degrading to a man, for it is a deprivation of free-will.

These invalids cannot be suffering from fever, for they are not hot.

This contains copper, from the peculiar blue tint which it gives on adding ammonia in excess.

Theft is a crime: theft was encouraged by the laws of Sparta: therefore the laws of Sparta encouraged crime.

Of two evils we prefer the less; occasional turbulence, therefore, being a less evil than rigid despotism, is to be preferred to it.

As we see by the example of Socrates, wisdom does not always protect from persecution.

Dew can have nothing to do with rain, for the dew is heaviest on a cloudless night.

8. Explain and give examples of dilemma, sorites, and hypothetical propositions.

9. Examine the following propositions, putting them into logical form where necessary, and giving the converse and the contradictory of each:—

Valleys are mostly fertile.
All that glitters is not gold.
The Venetians carried on war against the Turks.
He expects to succeed.
Sciences are either pure or inductive or mixed.
If virtue is voluntary, so is vice.

10. Give the general rules of syllogism, w th any explanations that seem necessary.

Section II.

11. What are the uses of language as an instrument of thought? Show particularly that names often contain a permanent record of theories.

12. What are the doctrines of nominalism and realism with respect to general notions?

13. "The more objects that a conception embraces, the less knowledge does this conception contain of those objects." Explain this, and apply it to the highest *genus* and the lowest *species* in any series.

14. Give briefly the rules of good definition, with examples of their violation.

15. What is the type of argument into which circumstantial evidence would fall? What is the logical error when the circumstances of suspicion are too few?

16. Upon what principle are we justified in arguing by induction from a small number of facts? Show that deduction helps induction. What part does experiment play in the inductive process? If possible illustrate your answer from the history of any discovery in science.

17. Describe the argument from analogy. What are the dangers arising from the use of it?

18. What are the figures of syllogism? How many are they?

19. "No human virtues are perfect." "All human virtues are imperfect." Are these propositions identical? If not, what is the relation between them, and on what does it depend?

20. Mention any of the attempts to establish a "*crite rion of truth*," and give your estimate of their value.

LATIN AND ROMAN HISTORY.

THREE HOURS ALLOWED.

Section I.

Translate—

Huc omnis turba ad ripas effusa ruebat
Matres, atque viri, defunctaque corpora vita
Magnanimum heroum, pueri, innuptæque puellæ,
Impositique rogis juvenes ante ora parentum.
Quam multa in silvis autumni frigore primo
Lapsa cadunt folia, aut ad terram gurgite ab alto
Quam multæ glomerantur aves, ubi frigidus annus
Trans Pontum fugat, et terris immittit apricis,
Stabant orantes, primi transmittere cursum,
Tendebantque manus ripæ ulterioris amore.

Œneid vi. 305—315.

(1.) Parse fully effusa, vita, innuptæ, rogis, parentum, frigore, immittit, transmittere, amore.

(2.) Conjugate the verbs to which belong ruebat, defuncta, lapsa, cadunt, immittit, stabant, tendebant.

(3.) Decline the nouns matres, corpora, ora, gurgite, cursum, ulterioris.

(4.) What is the force of the imperfect tense in this passage? Distinguish accurately between the meaning of the imperfect and perfect tenses.

Section II.

Translate—

Ille triumphata Capitolia ad alta Corintho
Victor aget currum, cœsis insignis Achivis.
Eruet ille Argos, Agamemnoniasque Mycenas,
Ipsumque Æaciden, genus armipotentis Achillei,
Ultus avos Trojæ, templa et temerata Minervæ.
Quis te magne Cato tacitum, aut te Cosse relinquat?
Quis Gracchi genus, aut geminos, duo fulmina belli,
Scipiadas, cladem Libyæ, parvoque potentem
Fabricium, vel te sulco Serrane serentem?
Quo fessum rapitis Fabii? tu Maximus ille es,
Unus qui nobis cunctando restituis rem.

Œneid vi. 837—847.

(1.) Explain the historical allusions in this passage.

(2.) Parse fully Corintho, Achivis, genus, avos, fulmina, parvo, cunctando.

(3.) Decline genus, cladem, unus, rem.

(4.) Conjugate the verbs to which belong agat, ultus, relinquat, serentem, fessum, rapitis.

(5.) Is this the usual meaning of the word tacitus? and if not, how is its meaning here to be accounted for?

Section III.

Translate—

"Obsidio erat nihilominus et frumenti cum summa caritate inopia; sedendoque expugnaturum se urbem spem Porsena habebat: quum C. Mucius, adolescens nobilis, cui indignum videbatur, populum Romanum servientem, quum sub regibus esset, nullo bello nec ab hostibus ullis obsessum esse; liberum eundem populum ab iisdem Etruscis obsideri, quorum saepe exercitus fuderit; itaque, magno audacique aliquo facinore eam indignitatem vindicandam ratus, primo sua sponte penetrare in hostium castra constituit. dein metuens, ne, si consulum iniussu et ignaris omnibus iret, forte deprehensus a custodibus Romanis retraheretur ut transfuga, fortuna tum urbis crimen affirmante, senatum adiit: Transire Tiberim, inquit, Patres, et intrare, si possim, castra hostium volo; non praedo, nec populationum in vicem ultor; maius, si Dii iuvant, in animo est facinus."

Livy II. c. 12.

(1.) Parse fully frumenti, sedendo, servientem, bello, exercitus, facinore, hostium, ignaris, deprehensus, fortuna, ultor, majus.

(2.) Conjugate the verbs to which belong habebat, fuderit, ratus, constituit, iret, retraheretur, possim.

(3.) Decline caritate, opem, cui, eundem, facinore, castra.

Section IV.

Translate—

"Aegre sedata ab Quinctio plebs, multo aegrius consul alter a Patribus. Dimisso tandem concilio plebis, senatum consules habent. ubi quum timor atque ira in vicem sententias variassent; quo magis, spatio interposito, ab impetu ad consultandum advocabantur, eo plus abhorrebant a

certatione animi, adeo ut Quinctio gratias agerent, quod eius opera mitigata discordia esset. Ab Appio petitur, Ut tantam consularem maiestatem esse vellet, quanta esse in concordi civitate posset. Dum tribuni consulesque ad se quisque omnia trahant, nihil relictum esse virium in medio; distractam laceratampue rempublicam magis, quorum in manu sit, quam ut incolumis sit, quaeri. Appius contra, testari Deos atque homines, rempublicam prodi per metum ac deseri, non consulem senatui, sed senatum consuli deesse. Graviores accipi leges, quam in Sacro monte acceptae sint." Livy II. c. 57.

(1.) Parse fully concilio, spatio, Quinctio, virium, quorum, sit, senatui, leges, monte.

(2.) Conjugate the verbs to which belong dimisso, interposito, agerent, petitur, trahant, relictum, quæri, deseri, accipi.

(3.) Decline plebs, alter, senatum, virium, rempublicam, consulem.

(4.) Why is variassent in the subjunctive mood? What is the general rule for the construction of quum?

(5.) Explain the construction of nihil relictum esse, rempublicam quæri, ut incolumis sit, accipi leges.

Section V.

(1.) Trace the chief steps by which the plebeians attained to supreme power, and give the dates.

(2.) Give an account of the first rise of the Tribunate, and of the modifications afterwards made in the office.

(3.) Give the chief steps by which Rome became mistress of Italy.

(4.) When did Rome first begin to form a navy? Mention some of her chief naval battles.

(5.) Under what circumstances did Rome get possession of Sicily?

(6.) Give a short account of the first Punic war?

Section VI.

(1.) Mention the changes in the Roman law respecting debt.

(2.) At what time did Greek literature begin to come into Rome, and what Roman authors introduced it?

(3.) What was the effect of the invasion of the Gauls on Roman progress to dominion?

(4.) Give a brief account of Camillus, Fabius Cunctator, Marcellus, Scipio Africanus, Œmilius, Fabricius, Sylla, Marius.

(5.) What powers had a consul, a censor, a prætor, an ædile?

(6.) Give an account of the Gracchi and their policy.

(*To be continued.*)

Correspondence.

PATENT STEEL PLATES.

River Zambesi, East Africa, 12 h January, 1860.

Sir,—The insertion of the following note in the *Journal of the Society of Arts* may prove of public service in preventing any other expedition trusting to a vessel built of the "patent steel plates," which have caused us so much toil, loss of time, and annoyance.

It is probable that there are purposes to which these patent steel plates might be applied with great advantage, but eighteen months' experience in a steam punt constructed of this material, has proved that the substance cannot be trusted in tropical waters. Whatever may be the process by which the plates are converted into steel, a very remarkable decomposition soon takes place when exposed to the heat and moisture of this climate, and a considerable portion of the plate becomes what possibly is the black oxide of iron. In our case the whole vessel was painted thoroughly, inside and outside, with Peacock's patent paint while on the deck of another vessel in the voyage out. But this proved no protection, for a process of decomposition began on both surfaces, altogether different from the common rust of iron. Scales of a jet black colour were formed, and when detached the plates were found to be as smooth and black as if they had left the rollers but an hour before. The scales are black in their substance, too, and strongly magnetic. The paint, firmly adherent on the outer surface, showed that it had failed to prevent the process, and curiously enough, the rivets, which are probably of common steel, neither rusted nor decomposed. For a considerable time the process of scaling off and leaving a smooth, black, and even shining surface, made us believe that the plates were suffering no harm by exposure to the weather. Friction had no effect in wearing them. But the decomposition was going on at the same rate inside; blisters, also, were formed, and at the bottom of each there was a minute hole right through, and at the end of twelve months the removal of the internal surface scale left us with plates as thin as wafers, and so full of small holes, our wretched craft might have been converted into a coffee strainer for the entire Society of Arts. The plates were only one-sixteenth of an inch in thickness at the beginning, and the internal scales are $\frac{1}{32}$ of an inch. The framework being of the flimsiest contract style, any attempt at mending involving hammering or wedging would have been putting a new piece into an old garment, so we had to resort to puddling her with stiff clay. This served for a while, but the holes becoming too large, we were obliged to run down to the sea, and with the assistance of the tides, get her out of the water. By digging the sand from beneath, we reached the worst places, and the engineers, Messrs. Rae and Hill, assisted, by men from H.M.S. Lynx, put planks outside and inside, with plies of canvass and white lead, sandwich fashion, and guaranteed her to float any time between three days and six weeks. New leaks, however, forced us to beach before the first period mentioned, and though rather annoyed at being kept tinkering, instead of doing good service to the cause of African civilisation, we must, as we have often done with disagreeables before, "put up with it."

No advantage whatever has been gained by the employment of these steel plates. The contractor intended that by their use the vessel should draw thirteen inches only, but when we tried her fairly out here in salt water, without fuel, gear, crew, or water in the boiler, she drew twenty-three inches, and her paddle floats are, of course, ten inches too deep. It was promised that she could carry from ten to twelve tons, but four tons bring her down to 2 feet 7 in., and within a few inches of the paddle wheel shaft, while six tons would sink her altogether.

Nor have we gained the least in speed, for, instead of "ten knots, at least," promised, we have to be content with a top speed of $3\frac{1}{4}$. This may in part be owing to the peculiar form adopted—an imitation of the Niger canoes, *i.e.*, long, narrow, and turned up at the ends. The negro reasons for this shape are sensible enough. They cannot make them broader than the trees, and make up in length what they cannot have in breadth, and they are turned up at the ends to avoid the shock which would be felt in coming to a bank, were they not made to slide up. These reasons are not so very recondite as to induce us to forsake the wave line of Mr. Scott Russell surely. Here we often see canoes made out of crooked trees, and as they are simply hollowed out, the canoe retains the bends of the stock. Some future contractor, if using other people's money, may infer that these crooked canoes are exactly suited for turning round corners, instead of inferring that the owners had no straight trees near the river.

I am, &c.,

DAVID LIVINGSTONE.

P. Le Neve Foster, Esq.

Proceedings of Institutions.

Much Wenlock Agricultural Reading Society.—The annual meeting of the Olympian Class of this In-

stitution took place on Tuesday and Wednesday, the 21st and 22nd instant. At the request of the mayor, magistrates, town councillors, and inhabitants of the borough, Lieut.-Colonel Sir Herbert Benjamin Edwardes delivered an Address to the class. On proceeding to address the members of the Olympian class, he said:—"Good friends of Wenlock and of Shropshire, it is a great pleasure to see such a gathering as this for making a holiday. There's a great deal too much work in the world—too much work for our profit, I mean—for of working for others—of self-sacrifice and self-devotion—there is never too much. Men are too much slaves to their occupations now-a-days. There is a perfect idolatry of labour, which leaves no margin for home, or holiday, or the inner life. I rejoice, therefore, to see this thorough determination of the good folks at Wenlock to have a regular game of play once a year at any rate. This Olympian Class is a great idea, and it does honour to your public-spirited townsman, Mr. Brookes. Long may you live to enjoy these games! And long may he live to have the satisfaction of seeing you enjoy them. I find that this Class is one branch only of a larger institution, the Wenlock Agricultural Reading Society, which has a lending library, a drawing class, a music class, a class for chemistry and botany; collects photographs, autographs of distinguished men, and fossils; and has a Working Men's branch besides. Looking through the Olympian Class for this year, I find prizes offered for no less than twelve manly sports, to which are added prizes for six different exercises of the mind; and lastly, two prizes for womanly industry in plain sewing and knitting. Now it is impossible to read this list of objects promoted by the Wenlock Agricultural Reading Society without at once according it our hearty approval, and saying "Here is a society really doing good. Here, in the heart of a midland county, out of reach of the great centres of learning, arts, politics, and fashion, in a quiet nook of Old England, here is a little knot of English men and women banded together to do good to themselves and others, and help as much as in them lies, not only to make Old England what she is, but better than she is." It improves the mind, strengthens the body, invigorates the race, affords innocent amusements, and so keeps men from bad ones, for amusements men must have; keeps men out of beer-shops, and from lounging about doing nothing, and drags them out into the fresh clear air of heaven to get health and fun together; it tends to make men sober, and adds to the general happiness and morality of the town and neighbourhood; and, lastly, it draws all classes, rich and poor, together in true English fashion. This is a thorough English society; and Wenlock may well be proud of it; and I rejoice to hear that the other leading towns of Shropshire are desiring to extend the circle of its influence. The annual expense of these games is very great. Let the cost and the enjoyment go round the county! I would venture, if you will allow me, to suggest the selection of another name for this particular class. The name "Olympian" is a good name in one respect, it classically expresses that union of mental and physical training, and mental and physical competition, which is your object, and which was the characteristic of the renowned games of Greece. But why should England adopt a heathen and a foreign name. Let me advise you then to call this thoroughly English class by a thoroughly English name, Call it the Shropshire Class of British Work and Play, or anything else you will; but let it tell of English men and women, English boys and girls, English labours and English holidays, English earnest and English fun. Again, I see among your sports the practice of the bow. Now let no Englishman speak slightingly of the "cloth-yard shaft," which ere now has measured the length of many an enemy on foreign soil. But there is a time for all things, and the time for archery as a martial exercise has gone by for ever. We live in days when the whole art of war has been revolutionised by the rifle. It is impossible then that the arrow can ever fly again in a foughten field. And if unfit for real war, does it not become unfit for athletic sport? Does it not lose its interest as an exercise for men? To them the very charm and life of any sport is its imagery of earnest; and the earnest has gone out of archery. For the future, then, I would say to the men of Wenlock, "resign your bow and quiver into gentler hands; trust these innocent weapons to the fair, who, when they aim at human hearts, mean them no harm!" For the stern men of England henceforward the national weapon is the rifle. And I am glad to see that this year you have for the first time introduced rifle shooting among your Wenlock games. This is giving it its true place. The volunteer movement will never be safe till rifle-shooting has become the national game of our day, as the popinjay and archery of yore. It is a more reasonable and intelligent weapon, less dependant on brute force, but not on that account less manly, for its practice requires great discipline of all the manly qualities. It develops individual intelligence, self-reliance, patience, thoughtfulness, and sobriety, for no drunkard will ever do anything with the rifle. The rifle is only *domesticated* in countries renowned for national liberty and individual independence. If, men of Wenlock, you wish to bring about this result in your own town, I would counsel you to apply to some one of your many tried and liberal friends among the landed gentry to rent you a piece of meadow land to be the playground of your town. It does not do to be always borrowing a field. Rent one, and be independent; so that any day of the week, except Sunday, you may be able to practise your rifles, or have a game of cricket or foot-ball. And now, my friends, I wish you a good day. May your Wenlock games long flourish. May they extend all over Shropshire, and make Shropshire men still better and stouter than they are."

The Sports commenced with Rifle shooting, but owing to the wetness of the weather the only other games that came off were the following:—A foot hurdle race, one mile, over 14 hurdles, open to all England. Winner, £5, the gift of the Right Hon. Lord Forester; second, £1. William Roberts, Wenlock, 1; J. Smith, London, 2; Levi Horner, Manchester, 3; Henry Heane, Salop; Samuel Hoare, Wenlock. This is the third year in succession that Roberts has carried off the above prize against "professionals" from all parts. A silver decoration has also been awarded him. A foot race, 400 yards; Winner £1, second 5s. Edward Evans, Salop, 1; William Owen, Ironbridge, 2; E. Shingler, Wenlock, 3; T. Roberts; M. Buddicombe; John Sledge, Wenlock; Hiram Hill.

The proceedings were brought to a close by a concert in the evening, which was successful.

The games, on account of the weather, were adjourned, and arranged to come off on the following Wednesday, the 29th ult.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 24th*, 1860.]

Dated 11th June, 1860.

1428. V. De Tivoli, 18, Stanley-place, Pimlico—Imp. in civil and military ambulances.

Dated 14th July, 1860.

1701. S. C. Lister, Manningham, Yorkshire—Imp. in machines for preparing silk, flax, and other fibrous materials.

Dated 23rd July, 1860.

1778. R. A. Brooman, 166, Fleet-street—A method of, and machinery for, goffering or impressing colouring and gilding, or otherwise covering with metal, leather or fabrics, and substances in a sheet state. (A com.)

Dated 2nd August, 1860.

1870. A. V. Morel, Paris—An improved apparatus for printing in colours, textile fabrics and other surfaces.

Dated 3rd August, 1860.

1838. E. U. Thompson, Bristol, U.S.—Imp. in machinery or apparatus to be applied to a shroud, stay, or other portion of the rigging of a navigable vessel in order to enable the setting or tightening thereof to be effected and maintained.

Dated 4th August, 1860.

1894. J. Lancelott, Rose-terrace, Buxton-road, Essex—Imp. in machinery or apparatus for the manufacture of small metallic chains, and also in the manufacture of such chains.

Dated 6th August, 1860.

1898. A. J. Seitz, Newcastle-upon-Tyne—An improved manufacture of artificial sulphate of baryta. (A com.)

Dated 7th August, 1860.

1902. R. Coxon, Beeston, near Leeds, Yorkshire—Imp. in hoops or apparatus for giving shape or distension to female attire.

1908. R. A. Brooman, 166, Fleet-street—Imp. in mills for grinding corn and other grain. (A com.)

Dated 8th August, 1860.

1909. D. Moseley, Chapel Field Works, Ardwick, Manchester—Imp. in the manufacture of hats, caps, bonnets, and other coverings for the head, and in machinery connected therewith.

1910. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved plant protector. (A com.)

1911. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved mode of binding up brooms, together with the machine used for that purpose. (A com.)

1913. J. Webster, Birmingham—Imp. in the manufacture of prussiate of potash and Prussian blue.

1914. R. A. Brooman, 166, Fleet-street—An improved excavating machine for boring tunnels and performing other excavating operations. (A com.)

1915. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for burning gas in carriages, ships, and other moving structures. (A com.)

1916. J. B. Crétal, Saint Malo, France—A new smoking pipe.

1917. F. Davidson, Liverpool—Certain imp. in marine steam engines.

1918. J. S. Gisborne, Birkenhead—Imp. in apparatus for supporting or carrying electrical conductors for telegraphic communication.

1919. J. Fielding, D. Whittaker, and B. Croasdale, Blackburn—Imp. in looms for weaving.

1920. G. Hall, jun., Montrose—Imp. in the form and construction of reaping machines.

1921. J. Barlow, Lauder-street, Saltley, Birmingham—Imp. in railway signals, for communicating with the engine driver, guards, and other parties while the train is in motion.

1922. C. F. Flounders, Liverpool—An imp. or imps. in duplicating photographic expressions, and also for certain machinery for the same.

1923. M. Dodds, Hamsterley, Durham—Imp. in machinery for moulding, forming, or shaping articles of iron and other malleable metals, and for shearing or cutting iron and other metals.

1924. E. Smith, Keighley, Yorkshire—Imp. in machinery for preparing wool, cotton, flax, and other fibrous materials for spinning.

1925. A. V. Newton, 66, Chancery-lane—Imp. in the mode of and apparatus for superheating steam. (A com.)

1926. G. H. Newton and A. Wild, Oldham, Lancashire—Imp. in mules for spinning and doubling.

Dated 9th August, 1860.

1927. Dr. F. Grimaldi, 26, Great Prescot-street, London—Imp. in the instantaneous generation of steam.

1928. H. Earle and W. Earle, Hereford—An imp. in connecting skins or sheets of parchment, vellum or paper together, and in attaching seals to deeds and other instruments.

1929. H. Cockey and F. C. Cockey, Frome Iron Foundry, Somersetshire—Imp. in driving chaff and root cutters, and other agricultural machines.

1930. A. Neumann, 4, Pancras-lane, London—Imp. in the treatment of food for cattle, and in machinery or apparatus employed therein. (A com.)

1931. A. Neumann, 4, Pancras-lane, London—Imp. in the hanging and fastening of doors, lids, and other hinged covers. (A com.)

1932. P. Mauvillin, Paris—An improved sewing and embroidering machine.

1933. A. Eddington, Chelmsford, Essex—Imp. in draining ploughs.

1934. F. Parker, Wood-street, Northampton—Improved coverings for the feet or part thereof, suitable more especially as footwarmers for railway and other travellers.

1935. A. V. Newton, 66, Chancery-lane—An imp. in ventilating buildings, vessels, and mines. (A com.)

Dated August 10th, 1860.

1936. J. Underwood, Birmingham—An imp. or imps. in dressing cases and writing cases.

1937. C. Stevens, 1B, Welbeck-street, Cavendish-square—Imp. in boilers. (A com.)

1939. J. Summerscales, Coney-lane Mills, Keighley, Yorkshire—Imp. applicable to churns, washing and mangling machines, dough-kneading machines, and mixing machines.

1940. F. A. Enklaar, Hattem, Holland—Imp. in implements for cultivating the soil.

1941. T. W. Plum, Blaenavon Iron Works, Monmouth—Imp. in fixing tyres upon wheels and chairs upon sleepers, part of which is applicable to rivetting generally.

1942. S. Middleton, 15, Whitefriars-street—Imp. in combing and preparing surfaces of paper and other materials for the purpose of preventing forgery or fraud in the manufacture of bank notes, cheques, bills of exchange, or other valuable documents.

1943. J. Giles, 8, Cannon-street—Imp. in steam engines and in steam generators.

Dated 11th August, 1860.

1245. R. Smith, 114, West street, Glasgow—Imp. in the manufacture of colouring matters for dyeing and printing fabrics.

1947. R. Phillips, Wavertree, near Liverpool—Imp. in harvesting machines. (A com.)

1948. H. Holland, Birmingham—An imp. or imps. in the manufacture of umbrellas and parasols.

1949. H. Cotterell, Balsall Heath, King's Norton, Worcestershire—Imp. in the manufacture of umbrellas and parasols.

1950. T. Hart, Northampton—An improved brick-making machine.

Dated 13th August, 1860.

1951. C. P. E. Poussier, Paris—Imp. in the manufacture of alcaline or other bichromates.

1953. J. Stodart, Walworth, Surrey, and J. T. Benett, Dalston, Middlesex—Imp. in ships' propellers.

1954. S. Norris, Great Peter-street, Westminster, and R. Rogers, King-street, Covent Garden—Imp. in the manufacture of boots particularly adapted to military purposes.

1955. H. Hewetson, Blackheath, Kent—Imp. in rockets and in apparatus for discharging the same.

1956. J. Stuart, Vulcan-place, Castor-street, Poplar—Imp. in treating hydro-carbon oils.

1957. A. V. Newton, 66, Chancery-lane—An improved mode of treating waste vulcanized india rubber. (A com.)

1958. T. Greenwood, Leeds—Imp. in the construction of projectiles.

1959. A. V. Newton, 66, Chancery-lane—Imp. in the mode of, and machinery for, manufacting hose pipe. (A com.)

1961. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of driving bands, and in the machinery to be employed in such manufacture. (A com.)

1963. J. Billing, Abingdon-street, Westminster—Imp. in chimney tops.

1965. N. Wehnert, 3, King-street, Cheapside—Imp. in the consumption of fuel, in superheating steam, and in the apparatus employed therefor. (A com.)

Patents Sealed.

[*From Gazette, August 24th*, 1860.]

August 24th.

526. J. Lang and C. Chevalier.
537. P. H. Desvignes.
538. S. F. Shore.
540. W. Munslow and H. Wallwork.
544. Z. Wright.
546. G. Weir.
556. J. M. Bryden and W. C. Bryden.
557. W. Williams.
558. G. Ranken.
570. I. Bonnet and J. D. Heid.
580. G. Edwards.
584. J. W. Lewis.
610. W. E. Gedge.
611. W. E. Gedge.
612. W. E. Gedge.
620. J. Arnot.
650. J. H. Young.
653. T. Morris.
656. M. J. E. Jullienne.
675. M. Henry.
687. M. Henry.
696. R. B. Sayer.
697. W. Hudson and C. Catlow.
710. P. Brotherhood.
760. W. S. Lewis.
878. M. Henry.
911. E. Westmoreland and W. Westmoreland.
1236. A. V. Newton.
1362. W. W. H. Smith.
1442. A. V. Newton.
1451. A. V. Newton.
1492. G. Hinton.
1521. W. Macfarlane.
1557. W. Macnab.
1585. H. F. Cohade.
1616. J. T. P. Newbon & T. Smith

[*From Gazette, August 28th*, 1860.]

28th August, 1860.

564. R. H. Collyer.
565. P. C. D. Destas.
566. W. Krutzsch.
571. J. Milnes.
572. J. Driver and J. Jessop.
573. D. Chadwick and H. Frost.
576. W. H. Nash.
578. H. Bessemer.
585. R. A. Brooman.
587. J. Eccles.
591. W. S. Hale.
601. W. N. Wilson and J. Pitt.
623. C. A. Chapuis.
925. J. Imray and J. Copeland.
677. J. Sim.
705. J. Reynolds, jun.
729. J. Newhouse.
1129. W. E. Newton.
1645. J. I. Taylor and G. Butler.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, August 24th*, 1860.]

August 21st.

2233. L. Levison.
2253. H. Lawford.

August 22nd.

2237. W. Harling, J. M. Todd, and T. Harling.

[*From Gazette, August 28th*, 1860.]

23rd August, 1860.

2236. G. D. Davis.
2255. P. Hill, and J. Moore.

24th August, 1860.

2250. J. Penn.
2251. J. J. Tucker and G. Blaxland.
2260. A. V. Newton.
2269. A. V. Newton.
2274. J. D. Brady.

25th August, 1860.

2249. J. Ronald.
2270. J. H. C. Lobnitz and J. McLintoch Henderson.
2299. E. Leigh.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, August 24th*, 1860.]

August 2nd.

1963. J. Whiteley.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 7, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week (corrected)	£362,300	
Richard Headly, Stapleford, Cambridge	100	Commerce.
Granville Harcourt Vernon, Grove, Retford	100	Arts.
Total	£362,500	

By Order, P. LE NEVE FOSTER, *Secretary.*

BRITISH ASSOCIATION, OXFORD, 1860.

On the Mechanical Effect of Combining Girders and Suspension Chains, and the Application of the System to Practical Purposes. By Peter W. Barlow, F.R.S.

At the meeting of 1857, a paper was read by me on this subject, my attention having been directed to it from being required to investigate, as Engineer-in-Chief to the Londonderry and Enniskillen and Coleraine Railways, the best mode of connecting the railways across the River Foyle, in connection with a road bridge. The depth and bad bottom of the river led me to recommend a suspension bridge combined with a girder; and in order to investigate the strain, and the amount of girder power required to cure the oscillation and wave, the model was made which I now submit to the meeting.

The design, when submitted to the Commissioners of the Road Bridge, was approved by Sir William Cubitt, then their consulting engineer; but some doubt having been suggested as to the fitness of suspension bridges for railway traffic, the question was submitted to Mr. Hawkshaw, who recommended the girder bridge now in course of erection by the Road Commissioners, at their cost.

It is no doubt the safest course for an engineer to recommend what has been done before, and to avoid experiments, but this, it is contended, does not render it less desirable that the subject now before you should be understood as a mechanical question, as it is admitted by the strongest opponents of suspension bridges that they are practicable and advantageous when large spans cannot be avoided; and we have as a fact the Niagara Bridge, of 822 feet span, constructed principally of timber, in a situation exposed to severe hurricanes, which has carried over for six years the heavy goods and passenger railway traffic of the New York Central and Great Western of Canada Railways.

It is not, however, in cases where large spans are indispensable that this principle of construction is alone desirable. In the case of the Londonderry Bridge it is not impracticable to construct piers in the river, but they are attended with serious risk and cost of interruption to the navigation, which, in the opinion of Sir William Cubitt, might have been avoided, and a superior engineering work made at less cost.

The same occurs in London. The Hungerford Suspension Bridge has become the site of a railway extension, and it is at once assumed that for railway purposes suspension is inadmissible, and this bridge, so ornamental to the river, is to be superseded by a girder bridge with numerous piers, I believe for no other reason than because the mechanical effect of the combination of chains and girders is not sufficiently understood, and for this reason I desire to press the investigation of the subject. But referring again to the Niagara Bridge, which is 822 feet in span, and of which the girder portion is of timber; if this bridge will stand heavy railway traffic, can it be doubted that a bridge entirely of iron of the best quality, or the improved material, puddled steel, can with safety be constructed of much larger spans?

But it is not only to avoid the difficulties of rivers that a successful suspension girder bridge would be useful, but in many cases valuable property may be saved, and even the difficulties of dealing with the crowded traffic of the streets of London very much diminished.

A suspension girder bridge of spans of 2,000 feet is perfectly practicable, constructed with superior metal, but 1,000 feet is sufficient to meet the difficulties of the case, and lines of railway can thus be easily carried across a crowded city at less cost and with less destruction of property than underground railways or any other means that have hitherto been suggested.

I shall speak subsequently more in detail of the cost and practicability of such lines of communication, but it is necessary now to say a few words to justify my claiming the attention of the meeting to the subject.

The principal cost of a structure consisting of a series of openings will be the suspension wires or chains and the towers. The amount of girder power to cure the wave and oscillation will not be found, as my experiments will show, to be a serious addition to the cost and the item in ordinary suspension bridges which forms the largest proportion, viz., the anchorage, will here be divided over numerous openings.

With reference to the chains or wires, the most ready estimates will be deduced by reference to any existing structure, and I select the Niagara Bridge as the only one tested by railway traffic.

Here we have a section of 242 inches of wire with a weight of 350 tons, a span of 822 feet and a deflection of 59 feet.

In a series of spans the suspension chains, irrespective of the towers, would form fully half the weight of metal in the structure, and assuming a price of £40 per ton, we have £12,400 for each opening as the cost, assuming that for the purposes of omnibus traffic we require an amount of strength which has been found *sufficient* in a locomotive railway of heavy traffic, combined at the same time with a separate carriage road communication.

The rule for ascertaining the sufficiency of railway bridges adopted by the officers of the Board of Trade is to estimate the strain produced by the greatest weight which by possibility could come on the bridge throughout every part of the structure, which should not exceed one-fifth of the ultimate strength of the metal.

The strength necessary, therefore, depends in a great measure on the mode of traction adopted, and it is therefore a very important question in this case to consider whether locomotive steam engines are the best mode of traction where the traffic will be entirely of an omnibus character, requiring trains as frequently as every four or five minutes to give efficient accommodation and relief, but of the lightest character.

Parsey's Air Engine may be well adapted to the purposes of such traffic. Although it may be justly condemned as applicable to the ordinary railway traffic, it has advantages where the tractive power required is not such as to exhaust the reservoir of power, and require high pressure too rapidly, which will not be the case in the present application, partly because the trains will be very light, and partly because at every pier or tower small stationary engines will be used for the purpose of raising the passengers from the surface of the ground to the platform of the railway, which would furnish a supply of compressed air for the renewal of the reservoir of the air locomotive. Without entering further at present into the question of the practicability of this suggestion, or whether atmospheric or any stationary system may be, as it is assumed that such a system of traction is adopted, or that a locomotive of one-half the weight only of ordinary locomotives, such as I am now employing on our railway is required, and therefore the ultimate weight which might arise on such a bridge would not exceed one-half of what might occur on a railway bridge, assuming the extreme case that it be loaded from end to end with locomotives.

It is generally considered that a bridge for ordinary road traffic does not require to be made of the same strength as an ordinary railway bridge, but this I believe to be an error. A railway bridge covered from end to end with locomotives is a possible strain to which it may be subjected, but in a large span it is a less possible or probable contingency than that of a road bridge being densely packed with passengers or soldiers, by which a greater actual weight would arise with a greater amount of vibration, while bridges with a motive power like Parsey's engine, or stationary power of any kind, would not be liable to an ultimate strain of one-half that of a bridge for ordinary road traffic.

It is true that many failures have occurred in suspension bridges, which fact has much shaken public confidence in them, but it is only necessary to examine the causes of their failure to see that they were the certain results of the defects of construction, and when these cases are examined they become evidence of the advantage of the principle, not of its defects. If road, like railway bridges, had been constructed under the supervision of the Board of Trade, not a single failure would have occurred, and when it is stated that these bridges have been constructed with from $\frac{1}{4}$th to $\frac{1}{6}$th the section of iron that the Board of Trade would require, and without any means of correcting the wave and vibration, it is not surprising that they have failed, but rather that they have existed so long, and that some of them now exist.

The public may rest satisfied that any bridge which has passed the approval of the Board of Trade is not only sufficiently strong, but much in excess of the necessary strength, and they can as safely reside under such a bridge as under the roof of a house, and it is in accordance with these rules that my estimate is formed.

The section of metal in the suspension chains or wires required for a double line of railway, with a span and depth equal to the Niagara Bridge, with girders constructed of good iron to comply with the Board of Trade rule, would not be more than 240 inches, and I propose to adopt this section, that is to say, to give the same strength to my structure for light railway passenger traffic as has been given to the Niagara Bridge, which has a road communication, in addition to a heavy railway traffic, in a situation exposed to most severe hurricanes.

We thus arrive approximately at the main cost of the structure, viz.: the supporting chains which will contain 2000 tons per mile, which at £40 per ton will be £80,000.

We have next to consider the cost of the towers or piers, which I propose to construct of wrought or cast iron, and we have the Crystal Palace Water Towers as an example of a similar structure from which the cost may be deduced. These towers are 220 ft. in height, and support 1800 tons of water at the top. The towers required for such a bridge as I have described will not have so much weight to support, and the height will not exceed 150ft., and allowing the same section of metal and strength, the cost will not exceed £10,000 each tower.

The next large item is the cost of the girders and the platform necessary to prevent the undulation or wave, a necessary addition to every suspension bridge, but one which has hitherto been generally neglected, and thus has arisen the want of confidence in a mode of structure which admits of numerous applications of great public importance.

The investigation of this part of the subject is the immediate object of this paper, as the strains and necessary weight of metal in the main suspenders have been long calculated and fully established: but for the purposes of the approximate estimates I shall only here state that a weight of metal equal to the chains will be found to be sufficient at a cost of £60,000, and thus a total cost, allowing for land and other contingencies, of £300,000 per mile would carry such a structure through the densest part of London; a sum small compared with the object to be obtained, and which will probably be much reduced on further investigation, as it accomplishes the object of railway communication without any interference with the sewers, water pipes, &c., and with less destruction of property than a tunnel, which will be unavoidably most unpleasant for passengers, and more objectionable for the application of steam and locomotive power, than a viaduct, where, if Parsey's system or stationary power does not

admit of a practicable adaptation, light locomotives may without difficulty be used.

I am, however, dwelling more on this part of the subject than the title of my paper justifies, my object being merely to show that if a system of larger spans can with safety be established for railway purposes, there are many instances of useful application to the public.

General Remarks upon the Construction of Bridges of Large Span.

Bridges may be divided into three classes:—

1st. The arch—a structure in which the supporting material is subjected to compression alone, but which contains no rigidity in itself.

2nd. The suspension bridge—in which the supporting material is subjected to extension alone, which also contains no rigidity in itself. And,

3rd. The girder—in which the material is subjected to both extension and compression.

Of these three systems, the girder necessarily requires, from combining compressive and extensive resistances, a much larger amount of metal than either of the other systems.

In an ordinary arch, the compressive force is resisted by the abutments, which in no way add weight or strain to the metal; but if the arch is converted into a girder, it can only be done by adding a tie-bar, the arch having then to support its own tie, or substitute for an abutment, in addition to its own weight.

In a suspension bridge the tensile force is resisted by the anchorage, and if these are taken away to make it a girder, a compression tube or bar has to be used as a substitute for them (as in the Chepstow bridge), which tube becomes in large spans, with its supports, by far the largest portion of the structure, and destroys the bridge by its own weight, besides doubling the deflection.

It is thus evident that if you convert a girder into an arch or suspension chain of the same depth, half the supporting material is at once dispensed with, from the duty being transferred to the abutments or anchorage, and the deflection decreased one-half.

Thus, theoretically, an arch will produce the same saving as a suspension chain, but it is not so in practice, because there is much greater difficulty in dealing with compression strains than with extension. In the latter case the strength is correctly measured by the section of the metal, but where you have compression strains to deal with, wrought iron is liable to buckling, and you thus cease to have any true measure of its strength and power of resistance—a difficulty which arises not only in larger iron arches, but occurs also in deep girders, and thus limits their extent of application.

Mr. E. Clarke, who published an account of the Britannia Tube, concludes his investigation of the subject by arriving at a similar conclusion, in which he no doubt also expresses the views of Mr. Robert Stephenson. In speaking of the limits to which tubes similar to the Britannia would be carried out, he says:—

"If the dimensions of the section remained constant, and the length only were increased, the tube would break with its own weight when it became about 850 ft. long.

"But if the dimensions of the section were also increased so that the tube retained the same proportions, becoming then a similar tube to what it is at present, it would break with its own weight when it became about 1570 ft. long. The depth of the tube would in this case be 100 ft.; the breadth, 48 ft.; and the weight 62,000 tons.

Other curious properties of similar tubes may be determined from the preceding reasoning, but in practice these theoretical limits cannot be approached. The impossibility of construction—the rapid increase in the weight of the requisite pillars for any great extension of depth—the necessary additions for preserving the general form of a large structure, considered merely as an edifice, independent of its action as a beam, and the great crushing strain to which the bearings would be subjected, are all elements increasing in a high ratio with the dimensions, and rendering impossible, on similar principles, any structure of much greater magnitude than the Britannia Bridge. This will be evident if we call to mind that in that tube 21 per cent. of the whole weight of the sides is already consumed in stiffening them; and not only would the weight of a larger structure increase as the cube of its length, but it would also require a much larger per centage of stiffening plates in the sides, for as the pillars increase in height, the weight increases as the cube of the length, while the strength is only as the square.

In this respect the ordinary suspension bridge possesses considerable advantages over other structures, for the strain being wholly tensile, the laws of pillars do not come into operation, and such bridges may be safely constructed of magnificent dimensions with little material.

These advantages, however, at once disappear when the horizontal strain is resisted by a pillar forming a portion of the structure itself, as in the case of the Chepstow Bridge; and the limits of such a system are nearly similar to those of a tube, the weight per foot run increasing nearly as the square of the length, and therefore the weight of the whole structure as the cube.

The magnitude of the arch is limited, like that of the beam, by the danger of distortion, its stability being dependent on the laws of pillars. The thrust on the abutments becomes, moreover, a formidable difficulty in arches of great magnitude."

These observations, which are, however, much at variance with the arguments which decided that the suspension bridge of Telford should be superseded, I fully concur in, and they are very important. It must be admitted, on all hands, that a structure whose direct strength depends on the resistance to the extension of iron, is safer and of greater strength than one which depends upon its compressive resistance. Firstly,—because the extensibility obeys known laws, and metal is superior in tensile strength; secondly,—for the reason previously described, that you avoid the necessity of loading your bridge with material to produce compressive resistance; and thirdly,—because the deflection varies nearly as the square of the depth, and you can have increased depth in a suspension bridge with little additional material and cost.

A comparison of existing structures will at once prove this, and as an example I will mention that the two tubes of the Britannia Bridge contain 2,500 tons of supporting material in a span of 460 feet., while the Niagara Bridge, of equal strength and of 822ft. span, contains only 350 tons.

In the face of such undeniable facts, it is suprising that a system of parallel girders for large spans has been adopted, the safety of which, as regards direct strength, is not so certain because you depend on compressive resistance, which may suddenly fail from buckling, as you cannot estimate where it will occur from experiments on a model, and you are therefore only certain of the strength of your structure as far as you actually test it, and have not that margin of the excess of certain strength to allow for deterioration, which it is desirable to obtain.

As these advantages of suspension structures must be obvious, the question at once suggests itself, why have they been abandoned for railway purposes, where safety is so important?—the only answer to which is the supposed impracticability of curing the oscillation and the wave produced by a passing load; and it is to the investigation of this important subject that my experiments and observations are directed. The first objection of the oscillation or swinging produced by a hurricane is not a serious one, as the force of the wind will only occasion mischief in combination with its action on the timber platform of the bridge, producing undulation and waves, and has been cured by Mr. Rendel by the addition of a girder parapet of wood. It could not occur in bridges with an iron platform, and stiffened by a girder of good iron, presenting comparatively little resistance to the wind; and I have, therefore, directed my experiments alone to the cure of the wave.

For the purpose of my experiments I had the model

made which I now lay before the meeting, which represents one opening of the intended Londonderry bridge $\frac{1}{33}$ of the intended size, the length between the towers being 13 ft. 5 in., which it is submitted is of sufficient dimensions to deduce accurate results when large compression strains are not the subject of investigation.

To illustrate the object of my experiments, I will again explain that a suspension chain, *per se*, has no rigidity in itself; a weight placed on any part will instantly distort the figure, and the platform will take the form of the wave, and thus the numerous bridges erected on this principle, without a means of correcting the distortion, are unfit for the purposes of traffic of any kind.

The obvious correction for this undulation, which has been adopted by Mr. Rendel and Mr. Rouhlin with success, is a girder attached to the platform of the bridge, so that the weight is distributed and the wave is diminished to such a degree as to be unobjectionable in practice; and the mechanical question for consideration is the amount of wave which will arise with a girder of a given depth and section of iron.

Previous calculation and experiments on girders enable an estimate to be made of the deflection of the girder of a given length with a given weight, and therefore the deflection of any girder intended to be attached to a chain can be calculated.

It therefore occurred to me, that if the relation between the deflection of a wave attached to the chain, and that of the same girder unattached, could be obtained, that we should be able to ascertain precisely what girder to allow to a chain, so that a given load would produce a given amount of deflection.

For this purpose I made a series of experiments upon girders of different kinds, attached and unattached to the chain, and the following are the results arrived at:—

Experiments.

The first experiments were made with a model girder to correct scale, but it was found that, when attached to the chain, the deflection was too small to be observed, and it was found necessary, in order to magnify the wave and make its amount more distinct, to have a girder of a quarter of the depth of the model girder, which was made of angle iron one-eighth of an inch thick.

The deflection of this girder, without the chains, with a load of 42 lbs. placed in the centre, was 1·2 in.

The deflections of the wave with the chain attached, and 227 lbs. distributed over the girder when the weights were placed at $\frac{1}{4}$ from the high tower were, with

lbs.	$\frac{1}{4}$ from high tower. in.	Centre. in.	$\frac{1}{4}$ from lower tower. in.
66	− ·10	− ·01	+ ·05
112	− ·20	− ·04	+ ·12
168	− ·28	− ·06	+ ·16

Experiment 2.—In this case the weights were placed $\frac{1}{4}$ from the low tower.

56	+ ·06	− ·01	− ·12
112	+ ·15	− ·05	− ·25
168	+ ·18	− ·07	− ·36

The deflections here averaged ·32 in. with 168 lbs., equal to ·08 in. with 42 lbs., or $\frac{1}{15}$ the deflection of the girder without the chain.

It was still obvious, from the deflection at the centre, and little rise exhibited in the wave, that the stretching of the chain to bring the metal surfaces to bear, still sensibly influenced the result; and I had another wooden girder made, consisting of a plank $7\frac{1}{2}$ in. in width, and three-quarters of an inch thick, in order still more to magnify the wave, and to diminish the error from the stretching of the chain.

The deflection without the chain attached was 1·48 in. with 10 lbs.

Experiments with the Chain attached.—With 56lbs. placed at $\frac{1}{4}$ from the high tower on the girder, which was previously quite unloaded, the deflections were, at

$\frac{1}{8}$ from H.T.	$\frac{1}{4}$ from H.T.	$\frac{2}{3}$ from H.T.	$\frac{1}{2}$ from H.T.	$\frac{5}{8}$ from H.T.	$\frac{3}{4}$ from H.T.	$\frac{7}{8}$ from H.T.
− ·31	− ·48	− ·32	− ·02	+ ·22	+ ·29	+ ·15

Experiment 2.—70lbs. being equally distributed over the girder, and 56lbs. at $\frac{1}{4}$ from high tower.

− ·28	− ·42	− ·25	+ ·04	+ ·23	+ ·28	+ ·20

Experiment 3.—150lbs. all over weight in same place.

− ·20	− ·35	− ·20	+ ·02	+ ·20	+ ·23	+ ·14

Experiment 4.—193lbs. equally distributed; 56lbs. as before.

− ·18	− ·31	+ ·17	+ ·05	+ ·18	+ ·20	+ ·14

The deflection here indicated with the model loaded with a weight representing 96 tons on the bridge (which experiment was several times repeated), was ·31 with 56lbs. = ·055 with 10 lbs., or $\frac{1}{26}$ of the deflection of the girder without the chain.

This result being so much at variance with the general view of the subject, although very nearly in accordance with my calculations, I determined to verify it by a smaller girder, 6in. by $\frac{3}{4}$ of an inch thick, which would render the wave still more visible, the observations being made with great nicety.

The deflection at the centre, when not attached to the chain, was 2·375 inches with 8lbs.

Girder attached to the chains, 193lbs., being equally distributed over it. The deflection, with the weight placed $\frac{1}{4}$ from the high tower, was:—

lbs.	$\frac{1}{4}$ from H.T.	Centre.	$\frac{1}{4}$ from L.T.
56	− ·64	+ ·13	+ ·53

Experiment 2.—With 56lbs. at the centre of bridge the deflection was ·30.

The deflection of the wave here exhibited at $\frac{1}{4}$ of the length with the bridge loaded to a weight equivalent to 100 tons on the actual bridge, which experiment was repeated several times with the same result, was 0·64in. with 56lbs., the deflection without the chains being 2·375 with 8lbs., or 25 times the amount, thus confirming the previous experiment,—a result so at variance with the preconceived notions of many engineers, that it is to be expected, in some instances, it will be received with incredulity; but an investigation will show that the result is in accordance with the law

$$\frac{l\,3\,w}{b\,d^3\,x} = \text{a constant quantity.}$$

If the girder were supported only in the middle, the deflection of the half girder would be one-eighth, but as one half of the girder cannot deflect without the other half rising from the action of the chain, it is reduced to $\frac{1}{16}$; but the girder is not supported at one point only, but at various points, which will still further reduce the deflection.

Assuming ·27 to be the true average result, I have calculated the necessary dimensions of a girder as follows:—It being determined by the Board of Trade what amount of weight should be the test to produce a given deflection on half the girder, we may derive from existing girders the weight which must be given to such a span as the Niagara Bridge to reduce the wave to a given amount. Let us assume, for example, that 200 tons on one-half the span shall not produce a wave exceeding 2 in. To deduce the result from the Boyne Viaduct we have the ascertained fact that in a girder of 264ft. span, the deflection with 540 tons all over was 1ft. 9in.

The deflection, if of the length of the Niagara Bridge, would have been 264^3 to 283^3 : 1·9 : 57in. $\frac{57}{27}$ = 2·11in. is therefore the deflection, which would have been produced by a weight of 540 tons, and therefore 200 tons would produce ·79 in. deflection.

The weight of a girder of the same section as the Boyne Viaduct would be 932 tons, 264 : 820 : 300 : 932 tons, and to produce 2in. deflection, 368 tons, if made of ordi-

nary iron; but if made of superior metal, the reduction of weight will be in proportion to the increased strength.

To obtain the result from the Britannia Tube, we have as an ascertained fact that its weight is 1600 tons, and that its deflection with 200 tons all over, 1·25in. $240^3 : 820^3 : 1{\cdot}25 : 7{\cdot}04$.

The weight of the tube of 820ft. long would have been 2852 tons.

The deflection, if attached to a chain, $\frac{7{\cdot}04}{27}$·36in.

The weight therefore, to produce 2in. deflection, with 200 tons, will be 370 tons, which nearly agrees with the calculations from the Boyne Lattice Bridge. To compare the Britannia Bridge with a suspension end of the same span, and to produce the deflection, we have $\frac{w}{27}$ weight of the chains equal 500 tons.

Concluding Remarks.

By the above calculation we arrive at the result that spans much above 820ft. may be constructed even without improved metal where girders are not practicable, and that in large spans, where they are practicable, a suspension girder, tested with the same load, and to the same deflection, will only require $\frac{1}{5}$ or $\frac{1}{6}$ of the metal, and will be a safer structure from depending on the extension of the material.

This result is the more important because the advocates of parallel girders have acted on this assumption—that the construction of a platform 450ft. long, sufficiently rigid for railway traffic, almost amounts to the construction of a girder itself.

When my paper was read at the Dublin meeting, there were several girder engineers present, but there was no observation made during the discussion upon the especial object of my experiments, except by Professor Rankine, who investigated the subject on the spot, and arrived at nearly the same result.

The only observation made by other engineers was to the effect that there would be some oscillation or motion which could not be arrived at by investigation, but without any denial of the truth of the deductions of my experiments.

Now I venture to contend that the amount of deflection of a given girder with a given weight can as clearly be arrived at by investigation when it is attached, as when it is unattached to a chain.

There may be practical points more in favour of one construction than another, which I am prepared, as a practical man, to discuss; but these are questions rather for the Institution of Civil Engineers. But whatever these practical failures may be, there must be a certain deflection which arises with a given force or weight applied, and it is this—the first and most important inquiry in every mechanical structure, which is alone the subject that I am now desirous should be investigated and understood.

With reference to any supposed practical objection to suspension structures, when applied to railways, even when the wave is cured, I will only observe, having had great experience in railway construction, I am unable to form an opinion, without further explanation, of what is referred to, although some railway engineers adhere to the idea that no weight of girder will make a chain rigid, yet this was the original proposition for the boiler, but some of the most eminent men have expressed a contrary opinion. Telford, with whom I had the honour to serve for a time as pupil, and Sir W. Cubitt, whom I also served several years as engineer on the London and Dover Railway, and who has had great experience in railways, are both fully satisfied that the suspension construction might be adapted to every description of bridges.

Mr. Rendel, who constructed the Inverness Bridge, and Mr. Vignoles, who constructed the Kiev Bridge, in Russia, have expressed a similar opinion. Both of these bridges had stiffening girders, of small depth, and the effect from observations made on passing loads (the Inverness Bridge having had a locomotive over it on a truck) fully bears out my calculation of the ratio of the deflection with or without a chain.

I may add, that in America, suspension bridges have been used for aqueducts with success, as well as for a railway bridge, and that the wave of the Niagara Bridge, which has a girder of wood, is less than my calculation would give; in fact, I should have doubted whether any wooden girder construction could have reduced the wave of a span of 820ft. sufficiently for heavy traffic either for road or a railway.

It may be true that public feeling is against suspension bridges, from the repeated failures arising from want of metal, and from no means of curing the wave which arises, as my model has shown, by the smallest weight applied at any one point; but this is only a reason why men of science should look at the question and correct an error which is a check upon useful enterprise and upon the progress of public improvement.

When alluding to the adoption of a system of large spans for the relief of London traffic, it was not intended to express a decided opinion that this is the best mode of removing the difficulty, although I believe, on mature consideration, it will be found to be so, as the objections to the other modes suggested are very great.

Tramways in the streets will be more beneficial than is probably expected, but as London streets are generally so narrow, little can be done by this system, unless stopping at shops or residences is prohibited, except at appointed places.

The construction of a viaduct consisting of a series of shops, with a railing on the top and a street on each side, as suggested by Sir Joseph Paxton, would be the most perfect arrangement, but the cost would be serious; and the railway must follow the surface of the ground, or nearly so, which would render the gradient unfavourable.

The scheme, however, which contends with the greatest variety of difficulties, although actually in course of construction, is the tunnel under London. It is expensive, not only from destroying property on the surface, but from interfering and disarranging the sewer, gas, and water pipes, &c., under the surface. The passengers will be inconvenienced by travelling in the dark, and in a tunnel in which the atmosphere (being immediately under the surface of a crowded city), must be necessarily very impure.

An underground system has also the objection that the application is limited to the elevated parts of London, as, if below the level of high-water, it would be liable to inundation.

The use of steam power is also prohibited by Act of Parliament; and Parsey's air engine, not being applicable, the girder system has, in this respect as well as others, the advantage, as steam power may be employed if necessary.

In conclusion, I will, however, observe that whether suspension girders are applicable or not to the particular purpose of London traffic, there are many cases where the benefit of railways may be extended by a safe and economical system of large spans, where they would otherwise be prohibited by the cost of execution, and I therefore trust not to have been in error, as far as relates to the mechanical points, in bringing this important subject before the British Association.

In the Mechanical Section, the following paper was read by Mr. G. F. Train, of Boston, U.S.:—

On Street Railways.*

The age of omnibuses in crowded cities has passed; the age of horse railways has commenced. America has introduced the new invention of relieving crowded streets by giving additional facilities for travel; and Europe

* This subject was very fully treated by Mr. W. Bridges Adams, in a paper read before the Society of Arts in February, 1857.—See *Journal*, Vol. V., p. 187.

must sooner or later adopt a similar system. While on a recent visit to the United States, I was surprised to find the progress that had been made in what the Americans call horse-railways. In the cities of Boston, New York, Philadelphia, Baltimore, St. Louis, and Cincinnati, the railway cars were displacing omnibuses in all the large streets. Like all practical, labour-saving inventions, the people first oppose, then advocate them. They have already become a public utility; and Americans would miss their railway cars as much as the English would their penny-postage system. The horse-railway is a fixed fact. It has had a fair trial, and has met with striking success. The horse-railway is creating, and will continue to create, the same revolution in large cities that the telegraph on land and the electric cable under the ocean have done in commerce. As the locomotive supersedes the stage-coach on the shore, and the steamboat displaces the sailing-vessels on the sea, so will horse-railways make omnibuses give way to the force of progress.

The railway from Liverpool to Manchester, in your recollection, astonished the world; now there are 70,000 miles! Brunel's genius progressed from the Great Western of 2,000 tons to the Great Eastern of 20,000 tons in twenty years. Now a thousand steam vessels connect the mother land with her colonial children, as the arteries carry life from the heart.

England, first in iron railing the country with steam, is last in iron railing the city with horse-power. But the enterprise that stimulated the Thames Tunnel, the Tubular Bridge, the Crystal Palace, and Great Eastern, will not long submit to the miserable steam-packets from England to France, ferry-boats from Liverpool to Birkenhead, or to omnibuses blockading the leading thoroughfares. The latter enterprises, I am confident, on the improved system, would prove as great financial successes as the former have financial failures. Although the Americans have seized the idea, and are practically demonstrating it by introducing horse-railways into all their large cities, as if it was a modern invention, I find that there is nothing new after all in the system, except its application for passengers. A century ago tramways were used in England.

Cæsar's military roads from hill to hill still mark the Romans' track. First pack-horses transported the products of the land from place to place. Even a hundred years ago this was the custom in Scotland; in fact, in some places in the highlands, and some of the hilly parts of Wales, it is the practice of to-day. Wooden sledges drawn by horses succeeded; then wheel carriages—afterwards wooden tramways—and last came what the Egyptians used in the age of the pyramids, and the Chinese during the Christian era—canals; the first in England was made in 1756. The Asiatic practice of laying down timber in bad roads most likely introduced the wooden rail. Down to the Elizabethan age coals from Newcastle were taken in carts or in panniers to the sea. Wooden railways were introduced previous to 1649. Two tons were a good load for one horse on the wooden rail; this is now about the weight of the passenger car. In 1738 cast iron rails succeeded wood. In 1752 iron wheels were made, but the carriages were not linked together till 1763. Six tons of rails were made by the Colebrookdale Company for their tramway on the 13th November of that year; and the Ebbw Vale Company, nearly a century after, are rolling their first 300 tons of street rails for the Birkenhead Street Railway. In 1805 malleable rails were made at Wall-bottle Colliery, Newcastle-upon-Tyne.

After horse-power came steam. Savery reduced to practice, in 1663, the Marquis of Worcester's suggestion in the "Century of Inventions." Newcomen made improvements in 1707. The cylinder and piston high-pressure engine came in 1720. These engines were used to pump water, but Dr. Robertson suggested to Watt, in 1759, the idea of making steam move wheel carriages. The Surrey Iron Railway Company, in 1801, was the first railway act passed in the kingdom. In the year that Wellington and Napoleon were born, 1769, Hornblower introduced his patent. In 1782 Murdock made his model-engine. Trevithick and Vivian, in 1802, reduced theory to practice, and obtained a patent for propelling by steam. The first trial was on common roads. Thousands saw the experiment where the Euston-square Station now stands. Wolf made improvements in 1804; but George Stephenson, just before the battle of Waterloo, invented the steam-blast, which was the life-blood of the steam-engine. Five hundred pounds premium was offered in April, 1829, by the directors of the London and Manchester Railroad, for the best locomotive engine, to draw three times its own weight over a level plain 10 miles an hour, weight not to exceed 6 tons, to cost not over £550. October, 6, 1829, was the first trial day, and imagine the sensation produced by the engine running 28 miles an hour! The last day in that year the first railway in England was opened for passengers. On the 4th of December, 1830, Stephenson's engine, the Planet, took 135 bales of cotton to Manchester. Thirty years later there were 10,000 miles in England; and in America 5,000 miles more of railway in active operation than is necessary to circumnavigate the globe! This rapid glance from Roman days to our time gives each stepping-stone from pack-horses to locomotives.

Sir Benjamin Hall, if the short-hand notes taken at the interview between the Chief Commisioner and the representatives of the London Tramway Company, two years ago, are reliable, seems to have thrown cold water upon the deputation. He did not meet the arguments of Messrs. Coates and Samuel, except by prejudice. Arguing against facts is difficult, and over-riding stubborn truths impossible; and in September next sceptics will have an ocular demonstration of what I have undertaken to explain to this meeting.

The following are the advantages of the street railways:—

1. Each railway car displaces two omnibuses and four horses, thus relieving streets of one of the main causes of the oft-recurring lock-ups.

2. The wear and tear from these omnibuses being transferred to the rail, as that of many other vehicles that prefer the smooth surface of the iron to the uneven stone pavement, the ratepayers save a large per-centage in taxes.

3. The gas and water commissioners are not inconvenienced when making repairs, as the rails are laid on longitudinal sleepers, which can be diverted in case of need; and as these cars, as well as the carts and carriages that take the rail, move on a direct line, it is a self-constituted police system, saving confusion without expense to the public.

4. The cars move one-third faster than the omnibus; and so gentle is the motion that the passenger can read his journal without difficulty.

5. The rails are so constructed that no inconvenience arises at crossings from wrenching off carriage wheels; and as the improved rail is nearly flat, even with the surface, and some 5 in. wide, no grooves impede the general traffic, and the gauge admits all vehicles that prefer the track to the pavement.

6. The facility of getting in and out at each end of the car and on each side, giving the passengers the choice of four places, together with the almost instantaneous stoppage by means of this patent brake, permits travellers to step in and out when in motion without danger, instanced by the fact that nearly 70,000,000 of passengers passed over the New York, Boston, and Philadelphia roads last year, with only twelve accidents.

7. In case of necessity troops can be transported from one part of the city to the other at 10 miles an hour.

8. It is a special boon to the working man to buy a ticket from his work in the city to his cottage in the suburbs.

In short, the horse railway is as much a necessity as gas, sewerage, the steam rail, or the electric telegraph.

Once introduced, you would miss the passenger car as much as any great public benefit.

The advantages of this system are, that you ride in less time, less confusion, less noise, less fear of accident, less mud and dust, and with the additional luxury of more regularity, more attention, more comfort, more room, better light, better ventilation, and a greater facility of ingress and egress.

Birkenhead will have the credit of introducing the first street railway on this side of the Atlantic. The Ebbw Vale Company have agreed to deliver the iron in July; Messrs. Crowe and Williams are preparing the timber; Mr. R. Main is at work on the carriages, to be ready in August; Mr. Chas. Burn, the contractor, will break ground the moment the material is at hand, under the engineership of Mr. Samuel, of London, and Mr. Palles, of Philadelphia, the resident engineer; and in September, Mr. R. Peniston, the secretary of the "Birkenhead Street Railway Company (Limited)," will issue excursion tickets from Liverpool to Birkenhead-park and back for sixpence.

Street railways in England will soon become a great fact. Birkenhead opens the ball; Liverpool follows; then Manchester, Birmingham, Glasgow, and Dublin; and London cannot well hold back after building the Metropolitan Subterranean Railway. A street railway can be constructed directly over it in as many months as that will require years. The former costs £3,000 per mile; the latter £300,000. In the one you travel in the dark; in the other in broad daylight! (Who crosses in the Thames-Tunnel?) The former stops before every man's door; the latter has stations only at intervals. One starts every five minutes; the other every half-minute, if required. The metropolitan blocks up the thoroughfares for months; the street railway for hours only.

Are not the streets of London too narrow? By no means. London streets are wider than those in American cities. Ludgate-hill and Cheapside are of course in your mind. But when we remember that there are some five hundred miles of street in and about London adapted to this system, why select the narrowest to commence with. First construct a line from Bayswater, through Oxford-terrace and the New-road to the Bank; then another line over Westminster Bridge, down those wide solitary streets on the Surrey side of London Bridge, with a branch over Waterloo Bridge to the Strand. This would relieve Fleet-street of a thousand omnibuses, and thus make way for a single line down the centre of the city, to return by another route.

Mr. Train stated that his car would accommodate, inside and out, sixty passengers; that the weight of the car was 2 tons. Two horses would be equal to a gradient of 1 in 30, but that for a gradient exceeding that an additional horse might be employed. On the street rail two horses would be five times more than two on the ordinary road.

Mr. Train has commenced his system at Birkenhead, and on Thursday, the 30th ult., a line was opened, five months only having elapsed since Mr. Train first laid his proposals before the Commissioners of Birkenhead. Two months later, the proposals were accepted and permission given to lay down the lines and run the carriages.

The line extends from the Woodside Ferry, the landing place at Birkenhead, just opposite the centre of Liverpool, by the Shore-road, through Angle and Conway streets, and so on to the entrance to Birkenhead-park. The whole distance is little more than a mile and a quarter; it is, however, quite sufficient to enable those who take an interest in the subject to form a good idea of the merits of Mr. Train's experiment. A junction in Conway-street enables the carriages to return from the park by Hamilton-street, to the point from which they originally started.

Nothing can well be less complicated than the machinery which is employed for the accomplishment of this double journey. The tramway itself consists simply of two iron plates, each being raised about an inch on the outer side, and running parallel to one another, as in the case of the rails on an ordinary railroad. They are fixed upon longitudinal bearers, which rest upon tranverse sleepers, and are so let into the street as to run completely on a level with its surface. They do not, therefore interfere in the slightest degree with the ordinary traffic. To ply on these iron plates, carriages capable each of affording abundant accommodation to from 50 to 60 passengers have been built by Mr. Main, of Birkenhead. They are more than double the size of an ordinary omnibus, are somewhat similar in shape, and are provided underneath with wheels like those of a railway carriage, but somewhat smaller in size. The plan upon which they are constructed would appear to be exceedingly well-adapted to street traffic. Each carriage is 24 feet long by 7 feet wide; 7 feet being also the height of the interior from floor to roof. It furnishes sitting room for 24 persons inside and for as many more outside, for whose protection a hand rail runs round the top. A space of two or three feet intervenes between the passengers on each side of the interior, and this it is proposed to turn to account by allowing passengers to stand there in the event of all the seats being occupied; hand-rails, with guiding straps attached, being run beneath the roof for their convenience. A small platform at the end of each carriage, raised about a foot and a half from the ground, and separated from the horses—which may be yoked to either end—by a contrivance somewhat resembling the splash-board of a hansom cab, affords the means of ready ingress or egress to the new conveyances. The carriages are roomy and convenient, affording that pleasant sense of freedom from squeezing and crushing in which our present system of street conveyance will so rarely permit us to indulge. In the construction of the new carriages, ventilation has not been neglected. Each has its sliding windows, with "louvres" to prevent a draught. Each is provided also with a driver and conductor, both of whom have it in their power to control, by means of a patent break, the machinery by which the progress of the carriages is stopped or retarded.

Such is the system of street conveyance which has begun its career at Birkenhead. As a mere spectacle its inauguration possessed no particular attraction. Shortly before 10 o'clock two of the new carriages were drawn out from the depot in Canning-street and placed upon the line. At 11 two horses were yoked to each, and they proceeded on their way well freighted with passengers, gliding along the rails at the rate of about four miles an hour—a rate of speed which might without difficulty be increased to six or seven miles an hour—smoothly and uninterruptedly, turning one or two extremely sharp curves with the utmost facility, and landing their passengers at their several destinations in security. They continued throughout the day to ply for hire with a success which must have gladdened the hearts of the proprietors, and their progress was, at different points along the route, watched by some hundreds of spectators.

Many of the objections which have been hitherto urged against the introduction of street railways into this country the trial at Birkenhead can scarcely fail to do something to obviate. With the result of that trial made known, it can scarcely be contended that they operate as impediments to ordinary traffic, inasmuch as the tramway itself does not monopolise the space on which it is laid down, the "track," on the contrary, being used by vehicles of all descriptions—which are under the necessity of diverging from it only when one of those passenger carriages is seen to approach—as affording greater facilities for their easy and rapid progress than the general surface of our roads.

WEAR AND TEAR OF GOLD AND SILVER COINS.

The following table and correspondence contain the results of experiments by Mr. William Miller, First Assistant-Cashier in the Bank of England, with observa-

tions by Mr. John Miller, of the Gold Weighing Office at the same establishment:—

Bank of England, 8th October, 1859.

Results of some careful examinations made in 1858, of light Gold and Silver Coin, of the early years of the present system of coinage, 1817 to 1825, taking 1822 as the mean of those years.

	Mint Weight of each Coin.	Mint Weight of £100 worth.	Weight of £100 worth of Old Coin.	Loss in 36 years, 1822 as the mean.
	oz.	oz.	oz.	oz.
Sovereign	·25682	25·682	25·360	·322
Half-Sovereign.	·12841	25·682	25·070	·612
Half-Crown ...	·4545	363·636	345·850	17·786
Shilling	·1818	same.	315·575	48·061
Sixpence	·0909	same.	296·950	66·686

The above data, applied to 100 years, give the following results:—

	Mint Weight of £100 worth.	Loss of Weight of £100 worth in a century.	Loss of Value in a century.	Loss of Weight of each piece in a century.	Loss of Volume per 1,000 parts in a century.
	oz.	oz.	£ m.	oz.	
Sovereigns	25·682	·895	3·485	·00895	35·
Half-Sovereigns.	same.	1·700	6·620	·00850	66·
Half-Crowns ...	363·636	49·406	13·587	·06176	136·
Shillings	same.	133·503	36·713	·06675	367·
Sixpences	same.	185·239	50·941	·04631	509·

(Signed) W. MILLER.

(Copy.)

Gold Weighing Room, 29th August, 1859.

Sir,—According to your wish, I collected one hundred sovereigns of the date of one thousand eight hundred and twenty, which, on weighing, I find have lost, in value, one pound six shillings and seven pence.

As these sovereigns were taken from parcels sent in from different places, and at different times, during a long period, I think the experiment is as likely to give a correct estimate of the loss which the coin undergoes by wear, as any that could be tried.

I have the honour to be, Sir,
Your very obedient servant,
(Signed) J. MILLER.

A. Latham, Esq., Deputy-Governor.

Gold Weighing Room, 2nd September, 1859.

Sir,—I hasten to offer you the following surmises relative to the wear of Gold Coin.

In the first place, it may be noticed that sovereigns issued from the Mint in different reigns, or at different times, do not wear equally well. They wear more or less, according to the difference in the alloy, in the impression, or in the temper of the metal.

The sovereigns of George III. were much better than those of subsequent reigns, from their being alloyed with silver.

When the impression is simple, without many minute prominences, which soon rub off, the coin wears much better. The milling, too, round the rim, loses much by wear A plain rim, with letters round it, would wear better.

If the metal of a coinage should happen to be more soft or brittle than usual, the coins would not wear so well.

The first coinage of a new reign will, after a long period, be found in better condition than one of two or three years subsequent; from the fact of many coins of the former being hoarded as curiosities.

The wear of the coin depends on the manner in which it is used in circulating it. A sovereign passed at the West end of London meets with better usage in such shops as jewellers or milliners, than it does when rung with a strong arm on the counter of a potato salesman, where it would be rubbed by the sand.

In commercial towns the coin becomes light sooner than in other places; not only from its greater circulation, but in consequence of the rough usage it undergoes in being so often thrown into bankers' scales and drawers.

During the time of great commercial activity, as the coin would be used more, of course its wear would be greater than at other times. It is probable that the coin issued during the last ten years has become light more quickly than that issued in the preceding ten years, and it might be found that our coin becomes light more rapidly than the coin of other countries.

I do not know if the old process of sweating the coin, by shaking it in a bag, be ever practised now, but we have constant evidence of the sovereigns being reduced by acid, and also by being filed in many ingenious ways.

From these considerations, I believe it difficult to arrive at any exact conclusions as to the loss of the coin by wear, but, from the experiment of which I gave you the result, it seems hitherto to have been at the rate of a little more than 3 per cent. in a century.

I have the honour to be, Sir,
Your very obedient humble servant,
(Signed) J. MILLER.

A. Latham, Esq., Deputy Governor.

Home Correspondence.

PATENT STEEL PLATES.

Sir,—In your last week's number is a letter from Dr Livingstone, relative to the "patent steel plates" of which his little vessel was constructed, and of which he very justly complains.

Now the cause of the failure of these plates is apparent. They were made of puddled steel, by which operation the mass of metal from which they were made became by rolling divided into numerous thin layers or flakes, much like the crust of a tart or puff. Now, even with iron, the process of puddling has this tendency, but not to so great an extent as with steel, iron being much easier to weld than steel; and in proportion to the thinness of the plates so made will the difficulty increase.

The doctor states that the paint with which the plates were coated adhered to the scales which peeled off, and that after their removal the under-surface was "smooth, black, and even shining," thus showing that the adhesion of the numerous layers of which the plates are composed is less than that of a purely extraneous matter. Now I think no stronger argument could be employed to prove the inefficiency of puddled steel plates, either for ships, boilers, or other purposes where great strength and durability are required. And it is to be regretted that these facts were not considered before employing them for a vessel having so important a work to perform as that on which Dr. Livingstone was engaged.

But at the same time the failure of these puddled steel plates is no argument against the employment of steel plates, if properly made. On the contrary, the facts mentioned by Dr. Livingstone, that the paint adhered firmly

to the steel, even after the scales were separated, and that friction had no effect in wearing them, are strong evidences of their value and utility when properly made. The whole question, therefore, hinges on this point,—Is it possible to make steel-plates free from these defects, and at a price which would permit of their employment? It is. By the Bessemer process perfectly homogeneous steel plates may be cheaply made of any substance varying from that of tissue paper to three or four inches in thickness, and perhaps more. Homogeneous steel plates are also made by another firm in Sheffield, but whether by the Bessemer process or not I cannot say.

Dr. Livingstone further states that the destruction of the plates was not confined to the outside of the vessel, but on the inside also "blisters were formed, and at the bottom of each there was a minute hole right through; and at the end of twelve months the removal of the internal surface scales left them with plates as thin as wafers and full of holes." Indeed, however carefully puddled steel plates be made, if thin, such must be the result. The several thin layers of which they are composed are, for the most part, united only by compression, and in thin plates it is next to impossible to get the several layers to interlace or amalgamate with each other. As soon, therefore, as the least vibration is imparted to them they must separate, and as soon as the least crack or crevice is opened, the water or air with which they are in contact rushes in and forces the several parts asunder, until—as in Dr. Livingstone's vessel—the plates are entirely destroyed. Had the homogeneous steel plates been employed, I have no doubt they would have answered well enough. I trust, therefore, for the sake of English science, the cause for the effect will be duly weighed, and care taken to avoid such mishaps in future.

I am, &c.,
WILLIAM GREEN.

Victoria-road, Limehouse, September 4th, 1860.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. Numb.

Delivered on 2nd August, 1860.

383. (A 2.) Poor Rates and Pauperism—Return (A).
493. Gas (Metropolis Bill)—Report from Committee.
483. Miscellaneous Expenditure—Report.
288. Bills—Companies (1860) (as amended in Committee and on Re-commitment).
303. „ Attorneys, Solicitors, Proctors, and Certificated Conveyancers (amended).

Delivered on 3rd August, 1860.

448. Piers and Harbours Bill—Report from Committee.
470. County Rates—Return.
490. Constabulary (Ireland)—Paper.
492(1). New Zealand)—Map.
500. Emigration (New Zealand)—Return.
504. South Kensington Museum—Report from Committee.
304. Bill—Stamp Duties (No. 2).

Delivered on 4th and 6th August, 1860.

497. Navy (Steam Ferry and Tug Boats)—Return.
498. East India (Revenue and Charges)—Paper.
505. Ecclesiastical Estates, &c. (Purchase of Estates)—Return.
506. Ecclesiastical Estates, &c. (Sales of Estates)—Return.
474. Cambridge University (Eton College)—Report of Comissioners.
481. East India (Financial Measures, &c.)—Further Return.
511. Falmouth and Gibraltar Cable—Papers
305. Bills—Titles to Land (Scotland) Act (1858) Amendment.
306. Bills—Party Emblems (Ireland).
308. Bills—Fortifications (Provision for Expenses).

First Session, 1859.

208(B1). Poor Rates and Pauperism—Return (B).

Delivered on 7th August, 1860.

441. Military Organisation—Report and Evidence.
494. Thames Embankment—Report from Committee.
510. Vaccination—Return.
513. Isle of Man Harbours Bill—Return.
514. Galway Packet Contract Transfer—Return.
515. Holyhead Packet Harbour—Returns.
516. East India (Religious Endowments)—Return.

Delivered on 8th August, 1860.

495. Lunatics—Report from Committee.
499. Steam-ships, "Pacific," &c.—Return.
310. Bills—Felony and Misdemeanour (Lords' Amendments).
311. Bills—Court of Chancery (as amended by the Select Committee).
312. Bills—Roman Catholic Charities (as amended in Committee, on Re-commitment, and on second Re-commitment).
Nicaragua (Communication by Post)—Convention.
Nicaragua (Mosquito Indians and Rights and Claims of British Subjects)—Treaty.
Nicaragua—Treaty of Friendship, Commerce, and Navigation.

Delivered on 9th March, 1860.

464. Bed of the Sea, &c.—Return.
466. Vaccination—Return.
501. Income and Property Tax—Return.
509. Constabulary Force (Ireland)—Returns.
524. Revenue (Ireland)—Accounts.
529. Hainault Forest (Allotment of Commons) Act (1858)—Return.
313. Bills—County Coroners (Lords' Amendments).
314. Bills—Mines Regulation and Inspection (Lords' Amendments).
315. Bills—Maynooth College (Lords' Amendments).
Syria—Further Papers relating to the Disturbances.

Delivered on 10th August, 1860.

253. Joint Stock Winding-up Acts—Returns.
517. Customs Duties—Account.
518. Poor Law (Metropolis)—Return.
523. Municipal Boroughs (Ireland)—Paper.
307. Bills—Weeds Destruction (Ireland).
316. Bills—Conjugal Rights (Scotland).
317. Bills—New Zealand.

Delivered on 11th August, 1860.

505. Schools—Return.
449. Steam Vessels—Return.
521. Isle of Man—Return.
527. Galle Harbour (Ceylon)—Return.
309. Bills—Defence of the Realm.
318. Bills—Customs (No. 2).
319. Bills—Metropolitan Police Force (Dockyards) (No. 2).
320. Bills—Naval Discipline.
Public General Acts—Cap. 54 to 86.

Delivered on 14th August, 1860.

440. Civil Service Appointments—Report from Committee.
526. Registry of Deeds (Ireland)—Return.
531. Felt and Scaleboard—Return.
Syria—Further Papers relating to the Disturbances.
British Columbia—Further Papers (Part 3).

Delivered on 15th August, 1860.

486. Savings Banks—Return.
507. East India (Prize Property)—Return.
533. Greenwich Hospital—Return.
543. Military Savings Banks—Account.
321. Bill—East India Loan.

Delivered on 16th August, 1860.

519. Cambridge University—Paper.
530. Merchant Shipping—Report from Committee.
537. Ecclesiastical Commission—Return.
542. Refreshment Houses Licenses—Return.
549. Civil Services—Supplementary Estimates (Caledonian and Crinan Canals, and South Kensington Museum).
550. Army Estimates—Detail of Vote No. 12 (Fortifications).
325. Bill—Debtors and Creditors Act Amendment.

Delivered on 17th August, 1860.

522. Cambridge University—Paper.
528. Army (General Officers)—Report from Committee.
538. York Deanery Endowment—Return.
551. Militia Estimates—Report from Committee.
322. Bills—Tenure and Improvement of Land (Ireland)—Lords' Amendments.
324. Bills—Local Government Act (1858) Amendment (No. 2).

Delivered on 18th August, 1860.

456. Salmon Fisheries (Scotland)—Lords' Report.
534. Durham Diocese—Returns.
535. Chapters—Return.
536. Cathedral and Collegiate Churches—Return.
539. Episcopal Residences, &c.—Return.
547. Sale of Gas Act—Return.
552. New Zealand—Return.

Delivered on 20th August, 1860.

502. Exchequer, &c.—Returns.
520. Irremovable Poor—Report from Committee.
532. European and Australian Mail Company—Return.
558. Metropolitan Boroughs—Return.
559. Houses (Compounding for Rates)—Return.
325. Bills—Chancery Evidence Commission.
326. „ Coast of Africa, &c., Act Amendment.
327. „ Offences within Her Majesty's Possessions Abroad.
British North America (Exploration)—Further Papers.
France—Convention relative to the Emigration of Labourers from India to the Colony of Réunion.

Delivered on 21st August, 1860.

496. East India (Civil Service Furloughs, &c.)—Return.
548. East India (Lord Clive's Fund)—Return.
328. Bill—Ecclesiastical Commission, &c.—Lords Amendments.

Delivered on 22nd August, 1860.

563. Civil Service Commission, &c.—Return.
329. Bills—Exchequer Bonds or Bills (£2,000,000).

330. „ Poor Law Officers Superannuation.
331. „ Endowed Charities (as amended in Committee and on Re-commitment.)

Delivered on 23rd August, 1860.

561. Reverend L. C. P. Fox—Return.
332. Bill—Union of Benefices (as amended in Committee and on Re-commitment).
Public General Acts—Cap. 87 to 97.

Delivered on 24th August, 1860.

540. British Museum—Report from Committee.
Syria—Despatches (1858 to 1860) respecting Past or Apprehended Disturbances.

Delivered on 25th August, 1860.

557. East India (Malt Liquor)—Return.

Delivered on 27th August, 1860.

503. East India (Madras)—Return.
567. Paper, &c.—Returns.
571. National Gallery—Return.
Public General Acts—Cap. 84 (a Corrected Copy).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 24th*, 1860.]

1967. W. Field and E. Jeffreys, Shrewsbury—Imp. in the permanent way of railways.
1969. R. D. McKibbin, Earl-street, Blackfriars—An improved waterproof and non-inflammable material applicable to roofing and to other purposes, for which felt, tarpauling, oil cloth, and such like materials are now used.

[*From Gazette, August 31st*, 1860.]

Dated 2nd May, 1860.

1103. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the manufacture of bolts. (A com.)

Dated 18th July, 1860.

1742. R. A. Brooman, 166, Fleet-street—The treatment of gluten, in order to manufacture a substance to be employed in printing fabrics and other industrial uses, in substitution for albumen. (A com.)

Dated 21st July, 1860.

1770. W. Turner and J. W. Gibson, Dublin—Imp. in bridges.

Dated 25th July, 1860.

1798. Lieut. J. Kingsley, 52, Great Coram-street—Imp. in railways, and in carriages to be used thereon.

Dated 28th July, 1860.

1834. G. C. A. Marquis d'Auxy, 57, Rue Lafayette, Paris—An improved apparatus for the preservation of corn.

Dated 30th July, 1860.

1844. F. W. Searle, Coleman-street—An improved apparatus for giving information at doors and places of business.

Dated 2nd August, 1860.

1866. A. F. Haas, Jewin-street—Imp. in dolls. (A com.)

Dated 3rd August, 1860.

1880. Dr. S. S. Skipton, 78th Highland Regiment of Foot—An improved splint for gunshot and other compound fractures of the limbs.

Dated 7th August, 1860.

1904. J. Bonne, Clus Indre, France—Imp. in furnaces intended to work iron ore.

Dated 10th August, 1860.

1938. J. Crawford, Manchester—A certain imp. in machinery or apparatus for spinning cotton and other fibrous substances.

Dated 11th August, 1860.

1944. C. de Bergue, 9, Dowgate-hill—Imp. in the permanent way of railways.

Dated 13th August, 1860.

1952. E. B. Orange, Barentin, France—An improved method of and apparatus for unloosening horses instantly from a carriage when frightened or running away.

Dated 14th August, 1860.

1964. J. Reed, Limehouse—Imp. in pianofortes.
1968. E. Wroughton and T. Holmes, Nottingham—Imp. in machinery for ornamenting or embossing lace or other fabrics.

Dated 15th August, 1860.

1970. P. Faure, Avignon, France—A centrifugal hydraulic pump.
1971. H. Courtot, Reims, Marne, France—An improved machine, with a drawer and moveable knife, used to part and break sugar.
1972. W. Jenkinson, Bentley, near Doncaster, and A. Solbé, Leadenhall-street, London—Imp. in the connections or joints of the posts and frames of bedsteads and iron houses.
1973. H. B. Barlow, Manchester—Imp. in the manufacture or preparation of indigo. (A com.)
1974. A. Lely, Redditch, Worcestershire—New or improved machinery for grooving sewing-machine needles.
1975. G. Doidi, 131, High-street, Borough, Southwark—Imp. in the preservation of meats.
1976. W. Holms and J. Oldfield, Glasgow—Imp. in machinery or apparatus for weaving.
1977. G. Gage, Luton, Bedfordshire—Imp. in the colouring and manufacture of straw plaits.
1978. P. A. Godefroy, 3, King's-mead-cottages, New North-road, Middlesex—Imp. in the mode of insulating and laying down inland telegraphic wire.
1979. W. Walton, Houghton Dale, Denton, near Manchester—Imp. in the manufacture of wire cards and in machinery used therein.
1980. C. Green and W. Asbury, Birmingham—Imp. in machinery for manufacturing tubes for tubular steam boilers.
1981. A. Fryer, Manchester—Imp. in centrifugal machines.
1982. J. Samuel, Great George-street, Westminster, and G. F. Train, Liverpool—Imp. in rails for streets and roads, and in wheels and axles to be used thereon.
1983. J. Bluzat, M. Rivière, C. Bluzat, and F. Maigron, Marseille, France—Improved machinery or apparatus for obtaining and applying motive power.

Dated 16th August, 1860.

1984. J. Bentley, Liverpool, and D. Bentley, Birmingham—Imp. in breech-loading fire-arms.
1985. W. Petrie, Woolwich—Imp. in the manufacture of sulphuric acid, and in apparatus employed therein, parts of which imps. are applicable to the obtaining of draught, to the condensing of gases, and to the construction of flues.
1986. H. Grundt, St. Louis, U.S.—Imp. in pontoons.
1937. T. Mellodew, Oldham, and C. W. Kesselmeyer, Manchester—Imp. in the manufacture of velvets and velveteens.
1988. J. J. Coleman, Holly Royd, Halifax—Imp. in the manufacture of colouring matters for dyeing and printing.

Dated 17th August, 1860.

1989. C. F. Atkinson, Sheffield—The application of steel or iron to the manufacture of collars and wristbands to be worn as articles of clothing.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2019. H. M. Clarke, Boston, U.S.—An improved machine for grinding or reducing paper stuff to pulp, and sizing the same. (A com.)—22nd August, 1860.
2021. E. A. Dana, Massachusetts, U.S.—Relating to ordnance as well as fire-arms. (A com.)—22nd August, 1860.
2049. F. G. M. de Baran, Paris—An improved method of stopping bottles or other vessels for containing gaseous liquids.—25th August, 1860.

PATENTS SEALED.

[*From Gazette, September 4th*, 1860.]

September 3rd.
588. X. Mousty.
592. W. E. Gedge.
594. C. Schiele.
595. E. Humphrys.
596. J. Broel.
598. C. Price.
602. T. W. Ashby & J. Coulson.
604. W. Bridges.
614. J. Walsh.
615. P. Hugon.
616. W. Buxton.
635. G. Shearman.
636. G. Spiller.
640. C. Sheldon.
641. C. F. Bielefeld.
649. J. S. Ottley.
651. J. Rae.
652. W. Ullmer.
654. F. A. Pope, E. F. Cook, and R. F. Woodward.
657. W. Tuxford and G. W. Hills.
661. J. Langman.
663. T. W. Ashby and T. Yorke
726. A. Shand.
734. W. Spence.
864. G. Mallinson.
880. W. Clark.
906. J. Kershaw.
1314. W. Tasker, jun.
1466. M. Myers, M. Myers, and W. Hill.
1548. G. J. Firmin.
1628. W. Hood.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, August 31st*, 1860.]

August 16th.
2191. C. Nightingale.

August 18th.
2204. F. Potts.
2212. R. A. Brooman.
2217. T. Ingram.
2230. F. A. Gatty.
2234. P. G. Gardiner.
2277. R. Whittam.

August 27th.
2285. H. Brinsmead.
2294. T. Gray and G. J. Gladstone.
2391. G. J. Bensen.

August 28th.
2314. C. W. Ramie.

[*From Gazette, September 4th*, 1860.]

August 30th.
2298. R. Stock.
2308. P. G. Gardiner.

August 31st.
2290. T. Bradford.
2335. C. J. Duméry.

September 1st.
2341. B. Sharpe.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, August 31st*, 1860.]

August 27th.
2100. J. Ward and E. Cawley.

August 28th.
2000. J. Cundy.
2009. C. Goodyear.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 14, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following addition has been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£362,500	
Thomas E. Harrison, C.E., 45, Westbourne-terrace, W.	100	Arts.
Total	£362,600	

By Order, P. LE NEVE FOSTER, *Secretary*.

MINERAL RESOURCES OF TUSCANY.—No. V.

By William Paget Jervis, F.G.S.

(*Continued from page* 728.)

Metalliferous Minerals; including the History of the Mines of the Tuscan Archipelago, from the earliest period down to the close of the Lorraine Dynasty, in 1859: with Statistics of the Manufacture of Elban Iron.

Rio Albano mine is situated in a much more convenient place, at Capo Pero, for a portion of the vein or dyke actually runs out into the sea, into deep water, for 20 or 30 feet, and forms a natural pier, at which large vessels can load directly—an inestimable convenience. The iron ore, which may be thirty feet deep opposite the pier, rests on Verrucano strata, and dips towards the sea at an angle of twenty or thirty degrees. This Verrucano is distinguished as *Anagenite*, a whitish quartzose crystalline conglomerate, often traversed by minute veins of specular iron. The loose material forming the *capello* is ferruginous, and constitutes a kind of soil. The ore is chiefly specular iron, but a large quantity of brown hæmatite is extracted in places; this goes by the name of *Vena Cieca*. In some parts of the mine I procured stalactitical specimens, evidently formed recently, round pieces of stick, &c.; they occasionally assume very beautiful iridescent colours and the most elegant forms. The ancients observed this phenomenon of recently-produced stalactitical hæmatite, but not knowing that it was simply the result of the deposits of ferruginous springs, had a notion that the mine was constantly being replenished as soon as the ore was dug out; Strabo, apparently, gave credence to this argument, as is recorded in the brief description he has left us of the Elban mines. The *vena cieca* is stated to produce very excellent soft iron for castings: *Vena Luccica* also occurs in smaller quantities. The company has been already working at Capo Pero for about seven years. An ancient quarry is seen above the present one, on the sea cliff, and a line of similar quarries is reached on ascending the hill. We must stand at a short distance, on some eminence, and look down, in order more easily to see how the surface has been scooped out in numerous places. I entered a vineyard and fruit-garden, formed in one of these hollows; on two sides is a cliff, and in the centre rises an isolated column-like rock—all belong to the iron vein. It is, in fact, an ancient mine; the central portion was, doubtless, left because it consisted of poorer or harder ore than the surrounding parts. The soil under the ore could not certainly have accumulated sufficiently to have fitted the place for a fruit-garden, in which large trees are thriving, in less than many centuries. The ancients picked out many such favourable spots for a long distance along the edge of the hill. Within 100 yards of the place where the miners are now working, I observed a line of cliff ten to twenty feet high, and one hundred feet above the sea-level. Being entirely overgrown with brushwood and vegetation, without close inspection it might be passed over. When examined, by chipping off pieces with a hammer, it is seen to be likewise composed of specular iron, and in many parts bears evidence of having been artificially dug out; besides which, the abundance of *gettate* all around prove the agency of man.

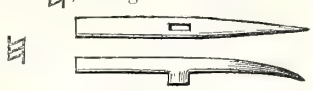
It would repay the trouble of the walk, to stroll along the beach in returning to the Marina di Rio, in order to observe the small veins of specular iron in the cliff. At other times, we meet with large boulders of oligist of a cubic yard or more on the beach; these are sold under the name of *Ferrino*, (literally little iron, in contradistinction to the ore found *in situ*).

Where the current sets in, the fine sands are covered with a layer of minute scales of micaceous iron ore, *Puletta*, thrown up during storms. These Mediterranean-washed ores are of the greatest purity, and are eagerly sought after by the Neapolitan founders. I scarcely know which is the prettiest sight, the minute spangles of oligist which cover the paths from Rio to the water's-edge, shining with intense brilliancy in the blaze of the sun, and successively presenting their tiny faces to one in passing onwards, or their more silvery appearance seen through the blue Mediterranean, unruffled by waves, but gently rippled by the balmy summer's zephyrs, just sufficiently to keep the little crystalline surfaces in never ceasing motion, which might

inspire a poet with the idea that the sea was resting her bosom on a bed of gems.

Terra Nera.—Pursuing the foot-path from the Marina di Rio inland, and over Monte Arco, the outcrops of the iron veins are frequently seen. At the bottom of a water-course, half a mile before arriving at the Gulf of Longone, one may be distinctly traced for some distance; it then enters into a vineyard, and is very conspicuous, standing up boldly as much as 6 feet above the ground, though it has grown rusty and brown at the surface. There can be little doubt that even here there must be inestimable mineral wealth laying not far below the surface.

On reaching Terra Nera we find a steep declivity before us. The mine extends from an elevation of 200 or 300 feet down to the water's edge. The ore is excavated in *conche*, within a few feet of the surface. The vein is much more irregular than at Rio, for in the midst of some splendid mass, giving every prospect of success, the ore suddenly disappears, and it needs much skill to find it again. Though scientific and practical men have endeavoured to study this question, it has hitherto baffled their ingenuity. Doubtless, the vein was originally continuous, similar to that at Rio, but has become distorted and convulsed during the eruption of serpentine rocks, portions being upheaved producing faults. As far as I could judge, the specular iron, partly well crystallised, as at Rio, is mostly a more dense variety of *vena ferrata*, with minute cellular structure, and is very hard and difficult to break. There are several excavations, each continued down to the rock below, partly a hard, compact white sandstone, and partly strata belonging to the *Scisti variolorj*, as described by Savi. Vessels, as at Capo Pero, load at once from a portion of the dyke which runs out into the sea, where it may be clearly traced into many fathoms of water. A large quantity of *gettate* may be noticed on the slope of the hill below some of the quarries. Scarcely any soil is found on the back of the exposed vein, not even sufficient for grass; therefore the ferriferous district can be generally recognised with ease from a distance by its dark sterile appearance. I observed little or no *puletta* on the beach near Terra Nera, attributable to the absence of micaceous ores.

Up to the present time there is no proper road from Terra Nera to Longone, about a mile distant. In walking in that direction, we pass a large quantity of slag in deep beds, and a most interesting group of ruined houses built of iron ore instead of stone. I do not conceive these houses can be more than 200 years old, nor is there any evidence of Terra Nera having been worked before the foundation of the fort of Longone, in the 17th century, otherwise we should have some ancient village in the neighbourhood, which is not the case. I have figured an old rusty pickaxe found at Terra Nera  ; though I do not think it very instructive as to date; in form it certainly differs from such as are now employed in Elban mines. The slags were probably made from Riese ore. I may mention that, though Terra Nera is alluded to by Pini, in 1777, it had been stopped for some years before his visit, nor does he say why only Rio mine was then open. (*Osservazioni mineralogici sulla Miniera di Ferro di Rio.*)*

Capo Calamita Mine.—This ferriferous district, like the preceding ones, is situated on the coast. It is 13 miles from Portoferrajo, 5 from Longone, commencing 2 miles beyond Capoliveri, to which the road extends: in the latter village, containing a population of 1,200 inhabitants, the miners and agent live.

The territory is bounded by the little torrent Serchio; it stretches for a mile along the coast to another, called the Romajola, and is confined to the southern slope of Monte Calamita, in places extending down to the water's edge. The average breadth of this strip is half-a-mile. The highest excavation is on Monte Calamita, half-a-mile from the sea. Numerous small quarries have here been made, but to no depth. The ore presents several qualities, all more or less magnetic. A characteristic form in which it occurs is in coarse lenticular grains or globules, dark black, with a reddish cement, dense, and difficult to quarry. This is splendid ore, and easily smelted by the Catalan process, by which wrought-iron is obtained directly. It is not used in Tuscany, but exported to France. Another variety is steel-grey, and compact. A succession of gentle blows with a hammer produces a kind of dust, which remains attached in long needles of great beauty, branching out in various directions for a quarter of an inch in length. All these are called generically *Ferro Magnetico*, but the name loadstone, *Calamita*, is restricted to the more granular lenticular variety, possessing a crystalline structure. Oblong fragments of such ore present decided polarity, as I proved by taking up successively a number of pieces, and bringing them within a short distance of my compass. On entering one of the quarries where the loadstone is worked, within a few yards the needle is deflected, but on taking up a fragment in the hand it makes the compass swerve round, so that it may be made to revolve as rapidly as desired. I cannot help thinking that the stories about vessels having been inconvenienced by the quantity of magnetic iron at Monte Calamita, are but tales to amuse the listener, for on particular inquiry of the sailors I could not find this substantiated, and I ascertained for myself that at a short distance the needle was little affected, though probably close

* Not the least gratifying reminiscence I preserve of my visit to Terra Nera mine is the conversation I had with an octogenarian Frenchman, still a hale miner, who entered with considerable *naïveté* into the history of his career, and proceeded to describe, with a vividness of recollection for which I was little prepared, his being in Paris in 1793, and witnessing from the crowd the execution of Louis XVI. He detailed the costume the unhappy king wore on that sad occasion, spoke of his silk stockings and garters as though the lifeless head had but just fallen on the block; described the dress and demeanour of poor Marie Antoinette, and related many highly interesting particulars, which I am sorry to say have faded from my memory. Fortunately for me, long practice in speaking French enabled me to conceal from him the fact of my being an Englishman, and I was recommended by the Corporal by no means to allude to the circumstance, unless I coveted his patriarchal benediction, since his hatred to the very word *l'Angleterre*, like the spark he applied to his own train of powder, would rouse all his youthful virulence and hate, still as rife and fresh in his mind as the events of the closing day of the first French monarchy, and the first day of civilisation and progress in France and the Continent of Europe. This was an opportunity of diving into the past, seldom, if ever, to recur, and thus, brought up in another school, I kept my counsel, nor thought it derogatory to fraternise with sincere pleasure with the aged Napoleonist; and I think it would be a great mistake were any one to visit Terra Nera and omit to have a few minutes chat with the venerable old French miner. Perhaps 60 years hence the young man to whom I spoke close by, may, on this very spot, recount to a future and more advanced geologist, who will smile at our infantile ignorance, how he witnessed the flight of the last of the Lorraine Grand Dukes of Tuscany; record to the incredulous and astounded traveller from the New World how the enslaved, down-trodden, priest-ridden Italian heptarchy, (to do justice to the Grand Duke of Tuscany,) possessed five tyrants; make both his ears tingle as, pointing with his trembling finger towards the south, with quivering lips, he relates how, by decree of one little less than an ambassador from the arch-fiend, human flesh and blood rotted in damp dungeons for the utterance of a speech; without any shadow of an examination or trial was loaded with chains for the possession of a thought in contradiction to the royal pleasure; how age and sex, virtue and integrity, rank and rectitude, law and justice, were among the words in the unpublished volume of the Regal dictionary, and the Word of God was a sealed book fitted only to teach infidelity and scepticism; and finally how from north to south of fair Italy the adamantine chain of Rome hung rivetted with chilling grasp and more fatal consequences to the soul of every man, woman, and child.

under the rocks there might be a very trifling deviation; but who would dream of bringing a vessel under sharp rocks, exposing her to be dashed to pieces?

Descending the hill the back of the dyke is seen at every step, and loose blocks of ore, more or less rolled, lie among the few stunted heaths and other rock-plants which have succeeded in taking root here. We soon come to a quarry of greater dimensions, whence compact and somewhat lamellar specular iron is obtained. It can be readily distinguished from the ores of which I have spoken, and does not crumble under the hand. The crystals when present are small; it is sufficiently spongy and porous to be easy of fusion, and is well adapted for the Tuscan charcoal-fed furnaces. In a few minutes we arrive at an extensive quarry in the face of the rock. It is fully 50 feet deep, and about 100 feet above the level of the sea, which is within a stone's-throw. One portion yields very dense and superior *oligisto*, but on the sides of the mass the ore is poorer, much intermixed with ochre and earthy matters, and iron pyrites, *marchesite*, not to be procured higher up. On the surfaces of some of the lumps of specular iron I found coatings of crysocolla, a silicate of copper, but none of the miners had any knowledge of the existence of any copper ore. Little, if any, quartz is found in these mines. From hence, advancing towards the cape, and walking parallel to the sea, we observe a large prominent mass of ore, 12 feet high, and as many broad and long, probably containing 1500 cubic feet, though in a great measure consisting of comparatively poor brown hæmatite.

Cape Calamita is a low prominence, consisting of three points: that in the middle is called the black point, Punta nera, from the dark colour of the ore; it juts out several hundred feet farther than the others, being formed of the hard metalliferous vein which has been better able to resist the action of the sea than the surrounding limestones. A few hundred feet to the west is the Punta bianca, or white point, so called from the white metamorphic limestone of which it is composed, while to the east is the Punta rossa, formed of the red hydrated oxide of iron. A large quantity of amphibole or pyroxene is seen at the Punta nera; it passes insensibly into yenite; the crystals of these two minerals intimately blending, are only to be distinguished by their colour, the former being greenish or straw-yellow, the latter blackish. The variety of amphibole here met with is known to Italian geologists as *Pyrosseno fibroso;* having been much acted on by weather and water, it crumbles to pieces at the surface, and is easily washed away by the waves. Savi says that the pyroxene is due to the metamorphic action of the iron dyke in the process of eruption on the superincumbent altered limestones.

To the east of the Punta nera are veins of titaniferous iron, formed of porous masses, in which the minute brilliant crystals endowed with strong metallic lustre are dispersed. It is useless. Covering the surfaces of fissures in the rock in the same places are found groups of ferriferous garnets, often as large as a pea, but seldom in detached crystals in which the faces can be clearly made out.

Taking a boat with Sig. Melini—the hospitable agent of the company at Capoliveri—and sailing to the westward, I was able to see the general disposition of the strata; the limestones in contact with the iron veins or dykes have been much upheaved and metamorphosed; farther off the original structure is apparent. About three or four hundred yards from the coast two rocks rise up boldly from deep water; being of nearly similar size, they have obtained the name of the twins—Isole de' Gemini; though only separated by a space of a few fathoms from each other, the structure of these two islets is entirely dissimilar: the inner and smaller one is formed of limestone, like that which rests on the iron, and the beds are much upturned; the outer rock is serpentine, and rises to the height of fifty feet.

Palæozoic strata are discovered in places under the limestone; they are very hard crystalline rocks, as are all the representatives of the *Verrucano* in Elba. I have alluded to the serpentine and the iron dykes as having contributed to raise these hills, as they doubtless did, but that is not sufficient to account for their present relief. Savi, Meneghini, Cocchi, and others, having fully established the fact that the whole of the iron veins in Elba are of Eocene age, and the serpentine was *nowhere erupted* after the close of the Miocene period; on the other hand, Pleiocene *Panchina* is seen high up the hill in several places between this and Capoliveri. This occasionally consists of coarse sand, such as is produced at the level of the tides, and contains *Pecten* and one or two other genera of littoral shells—the only fossils found in Elba; the whole is strongly agglutinated by calcareous cement. I observed a deep bed of *panchina* at the Spiaggia (beach) della Madonna delle Grazie, three miles N.W. of Capo Calamita, where it forms a hard little cliff on either side of a rivulet. Patches of the same rock are seen in various places near Capoliveri, at considerable elevations.

The depth of the iron ore at Capo Calamita is not known, it has been worked for so short a period—only a few years; it is, however, stated by some to improve in going downwards. Throughout the whole mine no water is obtainable in summer, but the brooks on either side might be turned to advantage in dressing the hæmatite. Hitherto the ore is conveyed on *sommari* (asses), to a wooden jetty half-way to the Spiaggia della Madonna, but I consider that, *with a little expenditure*, it might be put on board, in fine weather, with far greater advantage, at Capo Calamita itself, where the water is deep close under the rocks.

There is yet one locality which I must mention, although the interest attached to it is rather geological than economic; it is at the little coast-guard station at the Torre della Marina di Rio. A dyke of yenite and amphibole of extreme hardness is there seen in the cliff overhanging the sea, in an almost inaccessible position. I was scarcely able to splinter off the least fragment. Some of the crystals of yenite are $2\frac{1}{2}$ inches in length, prisms with perfect terminations, but these cannot now be any longer procured. I was unable to obtain any yenite with metallic lustre, but only more earthy specimens verging into brown hæmatite.

The importance of the Elban iron mines will be best appreciated by a few thoroughly reliable statistics. With regard to the produce of the five mines, Mons. Ulrich informed me that it was sent to various countries, in the following quantities, per annum:—

Destination.	*Tonnelate.* (Tuscan Tons.)	Variety Used:—and Method of Manufacture.
Tuscany: — Cecina, Follonica, Valpiana . .	20,000 to 25,000	*Vena ferrata;* porous *Oligisto.* For making cast iron, part of which is subsequently manufactured into malleable iron.
Naples and Genoa.	1,500 to 2,000	*Pulleta* and *Ferrino* to Naples, for their Catalan furnaces, also hardest *Vena ferrata*, from Terra Nera. For making iron directly. Naples and Genoa take $\frac{2}{3}$ of large ore and $\frac{3}{5}$ of dust or fine ore. I understood that they paid 357 *lire* per *cento*, or £1 1s.4d. per ton.
France:—Corsica, Catalan forges.	10,000 to 20,000	Magnetic oxide, best for Catalan forges; from Calamita mine. For the direct manufacture of wrought-iron.
South of France, blast furnaces.	15,000 to 20,000	*Ferro magnetico, Calamita.* For making cast iron, and subsequently malleable iron.
Wales, (Newport).	2,000 to 2,500	*Marmigno; Gettate*, containing 52 per cent. of iron, from Rio and Rio Albano. The price of the Gettate, is 140 to 150 Tuscan *lire* per *cento*, or 8s. 3d. to 9s. per ton. Employed for the manufacture of steel.
Hitherto unused .	... ...	Titaniferous iron.
,, ,, . .	... ...	Lievrite, or *Yenite.*
,, ,, . .	... ...	Iron pyrites, *Marchesite.*

In 1777, Ermenegildo Pini wrote his *Osservazioni sulla Miniera di Ferro di Rio*, from p. 66, from which I extract the following particulars. 110 workmen were employed under the direction of a *Caporale* and *sotto Caporale*, superintended by the *Ministro della Miniera*, whose duty it also was to see to the shipment and sale of the ore. Lastly, the Prince of Piombino, to whom this part of Elba belonged, appointed an *Ispettore Generale* to control the whole of the other officials. The quantity then obtained from Rio only was 1,250 *centi*, or 13,888¾ tons, which cost from 50 to 52 *scudi* per *cento*, according to circumstances; only the richest was then taken out. The Corsicans were allowed to choose their ore, but the Grand Duke of Tuscany paid higher, and an agreement was made that he should only be given the best specular iron (*vena ferrata*). Those who bought picked ore, were obliged to take one-fifth small, the rest, on the other hand, being only compelled to buy one-tenth small ore. Pini then enters into a disquisition on the probable amount of ore obtained from these mines, in which he goes minutely into the various calculations. The following are the most useful:—

He estimates the weight of ore extracted from Rio mine before 1777 at	18,030,290 Tuscan tons.
Capacity of the workings in 1777, at	397,727,000 cubic Tuscan feet.
Presuming that only ⅓ of the above was good ore, its capacity would be	132,575,666 ,, ,,
Weight of rich ore per cubic Tuscan foot	408 Tuscan pounds.
Which would allow, at the rate of 13,888·75 tons of good ore per annum	1,298 years.
But since in very ancient times Populonia alone is spoken of, while in 1777 there were 17 furnaces in Corsica, and 3 belonging to the Prince of Piombino at Follonica, not to speak of others in the Grand Duchy of Tuscany, the Romagna, Naples, and the Genovesato, he thinks we may reasonably suppose they only obtained one-third of the quantity then raised, which would give, at the rate of 4,629·6 tons per annum . .	3,894 years.
Otherwise, for the last 2,596 years (Circum temp. Prophet Samuel) an uniform annual yield of good ore, of	6,944 tons.

He then says that it might last for the supply of Italy for other thousands of years, though he incidentally informs us of how much waste there must have been (fully 20 per cent.) in his time, when metallurgy was in its infancy, for the hard oligist was supposed to yield rather more than half its weight of iron, whereas, chemically, it is composed of 70 per cent, of iron and 30 of oxygen, and is always nearly pure. (Pini; *op. cit.* p. 73.)

Savi thinks that the hills of slag at the Punton' di Scarlino (Val di Pecore), and at the Torre Nuova, at Populonia, indicate that the Elban iron mines not only supplied the whole of Italy in ancient times, but also the rest of Europe.

Produce of the Elban Iron Mines.*

1777.—Under the Prince of Piombino: average annual yield for several years, Rio then only worked, according to Pini, 13,888 tons; value 4½ to 4⅝ *scudi* per ton.

While under the Tuscan Grand Ducal direct control (official documents):—

1840-1849.—Average yield, Rio alone, 26,400 tons; value per ton, 4s. 7d.

Under the joint administration of the new Company (official documents):—

Years.	Tons of ore extracted.	Tons of "rubbish," *Gettate*, sold to England.	Mean Cost Price, per ton.	Quantity of ore exported, or smelted in Tuscany, exclusive of *gettate*.	Consumption in Tuscany during seven years, and countries to which ore was exported. Mean Annual Sale.
			s. d.	tons.	tons.
July 1, 1851 to June 30, 1852	21,500	...	4 2¼	22,250	Tuscany, by the Company itself. 21,431
1852-3	38,344	...	2 11	25,480	France 18,520
1853-4	61,816	...	2 8	47,381	England 3,902
1854-5	63,423	...	3 2	59,437	Sardinia (Genoa) 2,149
1855-6	58,679	...	3 7	60,297	
1856-7	59,148	...	3 7	72,442	
1857-8	55,406	6,363	3 3	49,356	
1858-9	...	5,370	...	...	Naples 2,090
Mean per ann.	51,188	5,853	3 4	48,092	48,092

In 1859 about 15,000 tons of *gettate* were ordered to be sent to Newport in Wales, otherwise little was done; the French vessels were taken up by the war with Austria, and the Tuscans were thinking almost exclusively of freeing themselves from a heavy yoke, so that the mines were in a sad state of depression. They were all temporarily suspended the week after I visited them, with the exception of that of Rio.*

* To form a more accurate idea of the value of the Elban mines, I append the statistics of the produce of the principal British iron mines in 1859. (Official.)

Parkside iron mines, Whitehaven; red hæmatite, giving 70·0 of iron	96,107
Eston mines in Cleveland, giving only 20·0 of iron,	500,000
Greatest amount from Cornish iron mines, giving about 30·0 of iron:—	
Restormel	6,915
Gt. Retallack	6,609
Indian Queens	3,027

* I will endeavour to complete the calculations of Pini up to 1859: of course they are only hypothetical.

Supposing that the quantity of ore extracted from the Elban mines did not increase during the whole of the last century, that is to say, down to 1801, when Elba came under French rule, we should have an annual yield, up to that time, of 13,888·75 tons. For the next 39 years, up to 1840, when reliable statistics again come in, we may fairly assume the increase to have been uniform, *i.e.*, 320 tons per annum. From these data we may establish the following:—

	Tuscan Tons.
Weight of ore extracted up to 1777 (Pini).....	18,030,290
From 1777 to 1801; 24 years, at the uniform rate of 3,888·75 tons per annum, as above ...	93,330
From 1801 to 1840; 39 years, with progressive increase of 320 tons per annum	590,616
From 1840 to 1850; 10 years (official)	264,000
From 1851 to 1858; 7 years (official).....	358,316
From 1858 to 1859; 1 year at same rate (probably)	50,000
Estimated yield of the mines of Elba, from the remotest period down to 1859	19,386,552
This reduced to English tons would be equal to	19,438,409

As to the future produce of the mines to which I have paid a little attention, I may subjoin the following calculations as very moderate, the ore being really inexhaustible; the amount now raised must rapidly increase after the kingdom of Italy has become a little consolidated, to which period, say to 1864, there will be less prospect of improvement:—

	Tons.
1859-64; 5 years, at 90,000 tons per annum...	450,000
1864-81; 17 years, end of lease of Messrs. Bastogi and Co., at 150,000 tons	2,550,000
1881-91; 10 years, at 200,000 tons per annum.	2,000,000
1891-1951; 60 years, with progressive increase of 5,000 tons per annum, and final yield of 500,000 tons in the last year	21,000,000
Total in 90 years (considerably above the amount the mines have furnished up to this time)...	26,000,000

Beyond our grand children, we have little occasion to trouble ourselves; that the 26,000,000 tons can be raised in Elba, allowing for improvements in the art of mining, in so short a time, and from these mines alone, I have little doubt.

To convey the ore from Elba the following vessels have been employed (official since 1851) :—

Years.	Under Tuscan Flag.	Under Foreign Flag.	Total.	Number of Men employed in the Elban mines.
	Vessels.	Vessels.	Vessels.	Men.
1777	...	...	...	(Pini) Rio alone ... 110
Before 1850	...	...	...	(Occasionally). ... 210
1851–2	444	32	476	225
1852–3	453	104	557	240
1853–4	803	134	937	550
1854–5	742	145	887	880
1855–6	678	244	922	800
1856–7	648	136	784	630
1857–8	444	141	585	530

The wages of the men vary from one to five *lire*—8d. to 3s. 4d. per diem; they work saints' days, *feste*, excluded, about six hours a day, and are divided into several categories :—

CAPORALI, overseers, equivalent to Cornish "captains."

SCAVATORI, to remove the earth, and superficial cover with pickaxes and shovels.

ROMPITORI, to break up the ore with pickaxes and crowbars, so as to be ready to be thrown to the

MARTELLATORI, those who hammer up the larger masses of ore detached from the vein, ready to be laden on asses.

SEPARATORI, whose business it is to separate any *cattivanza* or "bad" parts, such as quartz and gangue, when present.

SOMMARAJ, donkey boys.

Up to 1851 the men were obliged to relinquish five per cent. of their wages to supply the benevolent fund, *fondo di soccorso*, and when they were old were pensioned like any other Government servants. I saw some of these, who informed me that that system was not any longer in force.

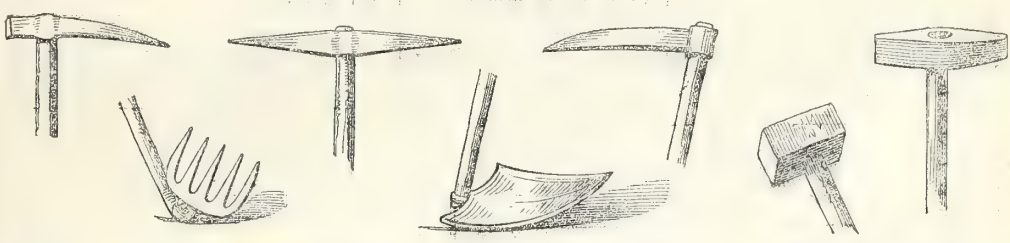
The ore is still weighed in *Centinari*, or *Centi*:—*Libbre toscane*.

		Tuscan lbs.
1 Donkey-load calculated at	.....	$333\frac{1}{3}$
2 Donkey-loads form 1 *Peso*	.....	$666\frac{2}{3}$
50 *Pesi* equal ..... 1 *Cento*	.....	$33,333\frac{1}{3}$
30 *Centi* ,, ... 1 *Millione de Libbre*		1,000,000

3,000lbs. equal 1 *Tonnelata* (Tuscan ton).

2,992lbs. Tuscan being equal to one English ton, I have not, in the present instance, altered the calculations, as the value of the iron is so inconsiderable.

TOOLS EMPLOYED IN THE ELBAN IRON MINES.



Picchio. Rastrello. Piccone. Marra. Zappone. Mazzetta. Mazza.

W. P. JERVIS, Ad. Nat. Delt.

PRODUCTION OF IRON IN TUSCANY FROM THE MINES OF ELBA.

1835. Annual produce at Follonica alone estimated by Repetti at 8,000,000 lbs. or 2,666 tons; sold uniformly at 41 *lire* per 1,000 lbs., £4 2s. per ton :—

	YEARS.	*Ferraccio*, or Cast Iron.	*Getti*, or Castings.	Bar Iron.	PRICES OF Dense Charcoal per *soma*.	Light Chestnut Charcoal per *soma*.	Cast iron Per Ton.	Castings Per Ton.	Bar Iron Per Ton.
		Tons.	Tons.	Tons.	s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.
Under the direct Government administration.	1849	6,212	221	234	4 $5\frac{5}{6}$	3 $4\frac{2}{3}$	3 2 2	10 4 6	10 13 7
	1850	5,175	196	241	4 $5\frac{1}{3}$	3 4	3 6 2	10 17 3	10 8 10
	1851	6,483	123	217	4 $5\frac{1}{2}$	3 $3\frac{2}{3}$	3 0 5	10 17 5	10 0 2
	Mean ...	$5,956\frac{1}{3}$	180	231	4 $5\frac{1}{2}$	3 $4\frac{1}{6}$	3 2 11	10 13 6	10 7 6
Under Messrs. Bastogi and Co.	July 1, to June 30 } 1851								
	1852–3	6,398	106	228	4 $6\frac{1}{2}$	3 $2\frac{1}{6}$	2 18 0	11 11 0	10 0 2
	1853–4	6,744	466	210	4 8	3 2	2 17 5	5 9 0	9 18 8
	1854–5	8,349	81	256	4 $6\frac{1}{2}$	3 $1\frac{1}{2}$	2 17 0	9 19 0	10 5 2
	1855–6	10,356	194	305	4 $6\frac{5}{6}$	3 $2\frac{1}{2}$	2 19 10	6 0 10	10 0 0
	1856–7	10,476	127	285	5 $0\frac{2}{3}$	3 $2\frac{1}{2}$	3 3 10	9 8 0	10 5 0
	1857–8	10,625	214	287	5 4	3 $4\frac{1}{6}$	3 4 2	8 16 8	10 5 0
	1858–9	10,705	889	303	5 $5\frac{1}{3}$	3 $8\frac{1}{2}$	3 5 2	6 18 10	10 1 8
	Mean ...	9,093	296	268	4 9	3 $3\frac{1}{3}$	3 0 9	8 6 2	10 4 8

Five Annual Balance Sheets of the Joint Administration of the Tuscan Iron Mines and Smelting Works, from July 1st, 1853, to June 30th, 1858.

DEBTORS.

Financial Year (July 1st to June 30th).	STOCK. Iron ore.	Cast iron.	Iron castings.	Large and small bar iron. (*Ferri sodi e sottili.*)	Charcoal.	*Generi di approvvisionamento.*	Planting trees.	Scrap iron (*Rottura di ferro*), *puletta*, nails, spades, English pig-iron, manufactured iron, &c.	Platforms, ventilators, *macchine trebbatrici*, etc.	Total Stock.	Cash Account.	Various Debtors.	New Works at Follonica and Rio, plant, machinery, implements, furniture at the several establishments, keep of oxen, ox sheds, etc.	Bonds and bills in hand. (*Recapiti in portafogli.*)	ANNUAL TOTAL.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1853–4	10,265 18 6	3,586 11 1	2,521 8 8	1,987 11 8	3,053 3 10	2,163 10 6	134 14 10	915 10 11	none.	24,628 10 0	4,813 11 10	35,531 6 5	15,486 17 9	8,234 15 6	88,695 1 6
1854–5	10,941 2 2	3,297 5 4	2,441 14 0	2,482 11 0	2,613 19 4	2,646 15 6	134 15 2	558 2 10	none.	25,116 5 4	151 3 8	64,822 18 8	18,193 15 4	7,276 15 0	115,560 18 0
1855–6	11,460 12 4	3,358 10 8	3,078 18 9	2,241 12 8	3,045 11 4	3,755 4 9	129 7 6	486 3 10	none.	27,553 1 10	3,016 2 4	87,799 15 2	17,016 17 6	6,867 12 8	142,256 9 6
1856–7	9,801 8 8	3,599 12 0	none.	2,129 18 7	3,743 11 6	3,886 18 10	130 11 6	477 18 9	3,160 5 6	26,930 5 4	8,420 4 4	105,805 11 6	15,785 18 10	9,632 6 8	166,574 6 8
1857–8	10,796 1 10	5,418 13 4	none.	2,179 19 6	5,219 6 10	3,469 0 0	130 11 6	£1,120 2s. 2d.		28,333 15 2	8,960 5 6	49,356 11 4	16,720 12 4	10,558 3 2	113,929 7 6

CREDITORS.

Financial Year (July 1st to June 30th).	PERMANENT CAPITAL. Household goods and stores. (*Masserizie fisse, e Mannati.*)	Machinery and Implements.	Furniture.	Total Permanent Capital.	Floating Capital in Stock.	Floating Capital in Cash.	Various Creditors.	EMPLOYMENT OF DIVIDENDS. Expenses attendant on payment of coupons, including salaries, losses by Exchange, etc.	Reserve Fund, in accordance with contract with the late Government.	Stipulated annual amount paid to the Tuscan Government.	Stipend of the Director-General, Sig. Bastogi.	Apportionment of the residual amount, in accordance with Statutes of the Company. Government moiety.	Director-General's share of 5 per cent.	Dividends to be divided among the 24,000 Shareholders, 45 per cent.	TOTAL DIVIDENDS.	GRAND TOTAL.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.		£ s. d.	£ s. d.	£ s. d.	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1853–4	4,562 1 0	5,800 18 7	1,433 11 7	11,796 11 2	27,911 4 2	10,000	13,471 0 8	594 12 6	266 13 4	20,000	333 6 8	2,160 16 6	108 0 10	2,052 15 8	25,516 5 6	88,695 1 6
1854–5	4,562 1 0	5,800 18 7	1,433 11 7	11,796 11 2	27,911 4 2	10,000	39,899 0 2	563 15 6	266 13 4	20,000	333 6 8	2,395 3 6	119 15 2	2,275 8 4	25,954 2 6	115,560 18 0
1855–6	4,562 1 0	5,800 18 7	1,433 11 7	11,796 11 2	27,911 4 2	10,000	68,125 16 6	246 2 0	266 13 4	20,000	333 6 8	1,788 7 10	89 8 4	1,698 19 6	24,422 17 8	142,256 9 6
1856–7	4,562 0	5,800 18 7	1,433 11 7	11,796 11 2	27,911 4 2	10,000	90,890 5 8	193 4 8	266 13 4	20,000	333 6 8	2,591 10 6	129 11 6	2,461 19 0	25,976 5 8	166,574 6 8
1857–8	4,562 1 0	5,800 18 7	1,433 11 7	11,796 11 2	27,911 4 2	10,000	38,628 17 6	243 6 8	266 13 4	20,000	333 6 8	2,374 14 0	118 14 8	2,255 19 4	25,592 14 8	113,929 7 6

Financial Year (July, 1st to June 30th).	RECEIPTS. By Discount from various parties.	By iron ore.	By micaceous-iron sands.	By cast iron.	By castings.	By sundry products and difference in various accounts.	By large and small bar iron.	Annual Total.	EXPENDITURE. Expenses of General Administration. Pay of employés.	Sig. Collarini, Solicitor, as Agent at Florence.	Rent of premises.	Stationery, stamps, etc.	Total Expenses of General Administration.	To divers parties as discount, loss by Exchange.	Expenses of Churches at Cecina and Valpiana.	Difference in sundry accounts, and various losses.	Dividends.	Annual Total.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1853–4	66 3 6	12,973 8 0	357 13 4	10,639 3 4	210 5 4	2,259 17 10	824 18 8	27,331 10 0	242 6 8	40	44 0 0	47 10 4	373 17 0	53 14 8	52 2 10	1,135 10 0	25,516 5 6	27,331 10 0
1854–5	58 3 0	13,463 9 6	208 6 1	11,730 4 8	742 18 8	2,087 10 0	1,102 12 5	29,398 4 4	252 6 8	40	44 0 0	51 1 0	387 7 8	282 0 6	62 8 10	2,712 4 10	25,954 2 6	29,398 4 4
1855–6	56 13 8	13,357 12 6	490 10 6	10,365 10 2	224 14 4	3,596 15 4	1,140 10 6	29,232 7 0	257 6 8	40	37 17 10	37 19 8	373 4 2	446 6 8	39 3 6	3,950 15 0	24,422 17 8	29,232 7 0
1856–7	219 10 10	13,762 4 10	354 9 8	10,635 16 0	631 2 8	6,088 6 2	1,209 18 8	32,931 8 10	271 16 8	40	36 13 4	60 13 1	409 3 1	411 4 0	46 2 0	6,088 14 1	25,976 5 8	32,931 8 10
1857–8	334 16 4	15,229 3 0	173 11 6	10,467 9 6	805 7 0	8,574 0 4	1,297 11 6	36,831 19 2	329 6 8	40	55 15 6	45 6 10	470 9 0	219 7 0	62 1 6	10,537 7 0	25,592 14 8	36,831 19 2

The castings made during the last seven years* have been entirely sold in Tuscany; the pig-iron, however, has been largely exported.

Exportation of Cast-Iron, made from Elban Ores, by Messrs. Bastogi and Co.

	Tons.
France	15,907
Piedmont	12,270
States of the Church	9,120
Modena	761
Austria (Trieste)	93
Spain	31
England	20
	38,202

Neither the cast nor the malleable iron pay export duty.

We must now cross to the main land, to follow the smelting operation in the Maremme.†

Three furnaces have been established at Follonica, a bustling little village on the coast, exactly facing Rio, from whence it is fifteen miles distant, and ten from Massa Marittima. Pini already alludes to these furnaces as the property of the Princes of Piombino, ninety years ago, though I cannot tell if they were on the same principle as the present ones, which are blast furnaces. They are each capable of containing 18,000 Tuscan pounds—about six tons of ore; the charge is

350 lbs. of specular iron.
200 lbs. of dense charcoal.

A hot blast is employed, but no flux of any kind is required, the ore being very easy of fusion. Ninety charges are added daily. They produce 20,000 lbs. to 25,000 lbs. of iron daily (6 tons 14 cwt. to 8 tons 7 cwt).

The furnaces are tapped every four hours.

Objects are cast directly from the iron as it flows from the furnace, constituting *Ferro di prima fusione*, otherwise it is made into pig iron, *Ferraccio*. To the foundry is attached a nice little fitting-shop, with the necessary machinery for turning, boring, &c.: the iron is said to be particularly well adapted to filing and turning. I understood, however, that rails were not yet made of it—perhaps simply because they were not required in Tuscany, Among the objects hitherto manufactured of wrought-iron. may be mentioned ploughs, threshing and reaping machines, &c. The malleable iron is entirely made with soft charcoal. Mons. Ponsard purposes shortly to make use of Monte Bamboli lignite.

Abundance of water is supplied even during summer, by a powerful mill-stream; there is sufficient to give blast and turn wheels, &c. A pier has been made at the beach for better unshipping the ores, which are already conveyed to the foundry by a new tramroad. From the conversation I had with Mons. Ponsard, I feel persuaded that he is determined to give an impetus to the entire establishment; till the time of the present company there was no such a thing as an ordinary plan of the premises.

One other furnace is situated on the road to Massa, at Valpiana; a fifth at Cecina, at the mouth of the river of that name, south of Leghorn.

All these places are in the most unhealthy localities:

* For comparison, the total quantity of iron manufactured in England and Wales has rapidly increased within the last hundred years, from an amount which was *actually less* than that now made from Elban mines alone:—

Years.	Tons of Pig Iron.
1740	17,000
1750	22,000
1788	68,000
1840	1,000,000
1859 (Great Britain,) from 8,500,000 tons of ore, about	3,500,000

† The word *Maremme* simply signifies a district bordering on the sea, *mare* the sea; *maremmano* means belonging to the Maremme. The name is, however, applied to a particular geographical tract in Tuscany.

Follonica is notoriously the focus of the intermittent fever district. The men can only work from December to June.

The tables, pages 748 and 749, form a condensed and methodical statement of the expenses and proceeds of the mines of Elba and the smelting works on the Continent. The data are official, and may be implicitly relied on, as coming from the Ministry of Finances and Public Works. I have arranged it in a very much simpler manner than the voluminous original papers, through which few would have time or inclination to wade, could they even have access to them. The amounts also are expressed in pounds sterling, reckoning, as I have everywhere done, 45 *paoli* = £1 sterling.

From the foregoing Tables it will be seen that the net dividends are at present almost nil; they were, per share of 1,000 *lire*:—

	Lire.	Soldi.
In 1853–4	2	11
In 1854–5	2	17
In 1855–6	2	2
In 1856–7	3	2
In 1857–8	2	16

The reasons for all this have been sufficiently alluded to in the course of my paper, for the most casual observer could not attribute it to want of sufficient ore at a very cheap rate.

Some of the heaviest items of expense from 1851 to to 1858 may as well be recorded:—

	£	£
Organising the works at the new mines, restoring and building bridges, making donkey roads, and one mile one furlong of tram-roads	8,240	
Establishments in the Maremma	1,733*	
		9,973
Engineering works at Rio mine	10,542	
Building two vessels for conveying the ore regularly to the smelting works	1,300	
Laid out on the establishments in the Maremma [forming part of the permanent capital of the Administration]	3,531	
		15,373
		£25,346

(*To be continued.*)

* Of this sum £8,340 has been already paid off with the gross proceeds of the mine, the remaining £1,633 has yet to be liquidated.

EXAMINATION PAPERS, 1860.

(*Concluded from page 730.*)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

FRENCH.

THREE HOURS ALLOWED.

PART I.

Candidates for a *third-class* Certificate (Competency) are requested to translate into English the following extract, and to answer *any ten* of the twelve grammatical questions thereto annexed (in the order in which they are placed). This first Part is all that will be expected of them.

Translate into English:—

Le peuple réformé de France avait plus souffert, et plus long-temps, que nul autre au monde. Il avait, de 1660 à 1787, été privé de tous les emplois, entravé dans toutes les carrières libérales, chassé des corporations d'arts et métiers, violemment refoulé dans l'agriculture et le commerce. A la Révocation il avait perdu ses hommes d'élite les plus opulents, les plus industrieux, les plus actifs; et le reste, accablé de logements militaires, écrasé de taxes et d'amendes, traqué dans les bois et les montagnes, sans écoles, sans famille légitime, sans héritage assuré, sans droits civils, avait été traité comme une race de parias; et pourtant, chose étonnante! chose admirable! il se trouva, en 1787, que le peuple réformé de France n'avait rien perdu, ni de son ressort intellectuel et moral, ni de sa force industrielle. Loin de s'être abaissé, abandonné lui-même, comme on l'a vu chez les Irlandais sous un régime incomparablement moins oppressif, non seulement il s'était maintenu au niveau de la population catholique, mais en moyenne il était plus élevé sur l'échelle sociale, plus riche, et mieux instruit. Ce fait, que personne ne saurait contester sérieusement, nous offre l'un des plus grands spectacles de l'histoire de l'humanité.

De Félice: "*Histoire des Protestants de France.*"

1. Being given an English compound noun, how, as a general rule, will you translate it into French? Give examples of several kinds, and state also how the plural of compound nouns is formed in French.

2. When is *de* used instead of the article *du* or *des?*

3. When are *vingt* and *cent* to be written with an *s?*

4. State, with examples, the principal cases when an English *ordinal* number (*fifth*, *tenth*, etc.) is changed in French into the corresponding *cardinal* number (*cinq*, *dix*, etc., and not *cinquième*, *dixième*, etc.)

5. *Tout*, placed immediately before a qualificative adjective or a participle past, means *tout-à-fait*, and ought therefore to be invariable. What exception is there to this rule?

6. When is *quelque* spelt in two words, i. e., *quel que?* and what difference is there between *quoique* and *quoi que;*

7. When is the verb *to be* idiomatically translated by *avoir*, and when by *faire?*

8. When is the verb *to have* idiomatically translated by *être?*

9. The *preterit* is very little used now in common phraseology in French. By what other tense do you translate the English preterit (*I came*, *I saw*, etc.)? Explain your answer, with examples.

10. State briefly the different cases when a verb in the *Indicative Mood* in English should be translated into a corresponding tense of the *Subjunctive Mood* in French. Give a few short sentences as examples.

11. Give the reason why the same participle past should be spelt differently in the following sentences:—

Pauvres innocentes, je les ai *vu* jeter en prison et je les ai *vues* mourir sur l'échafaud.

La pauvre enfant, je ne l'ai pas *vue* tomber, mais je l'ai *vu* relever, toute pâle et tremblante; heureusement elle ne s'est pas *blessée* à la tête, elle ne s'est *blessé* que les bras et les genoux.

Le peu d'attention que vous avez *apportée* à l'étude de ces règles a suffi pour vous les faire comprendre, mais le peu d'attention qu'il y a *apporté* explique naturellement les difficultés qu'il y éprouve.

12. This sentence: *Je crains qu'elle ne se soit foulé le poignet*, suggests several remarks as compared with the English: *I fear she sprained her wrist.* What are those remarks, each of which bears upon an important point of French syntax?

PART II.

Candidates for a *second class* certificate (Proficiency) are expected to answer *any two* of the last four grammatical questions (Nos. 9, 10, 11, and 12) at the end of Part I., and to translate the following extract and idiomatic expressions.

Translate into French:

The "Thoughts" of Pascal are to be ranked as a monument of his genius above the "Provincial Letters," though some have asserted the contrary. They burn with an intense light; condensed in expression, sublime, energetic, rapid. They hurry away the reader till he is scarcely able or willing to distinguish the sophisms from the truth they contain. For that many of them are incapable of

bearing a calm scrutiny, is very manifest to those who apply such a test. The notes of Voltaire, though always intended to detract, are sometimes unanswerable; but the splendour of Pascal's eloquence absolutely annihilates, in effect on the general reader, even this antagonist.

Pascal had probably not read very largely, which has given an ampler sweep to his genius. Except the Bible and the writings of Augustine, the book that seems most to have attracted him was the "Essays of Montaigne." Yet no men could be more unlike in personal dispositions and in the cast of their intellect. But Pascal, though abhorring the religious and moral carelessness of Montaigne, found much that fell in with his own reflections, in the contempt of human opinion, the perpetual humbling of human reason, which runs through the bold and original work of his predecessor. * * * *

But the leading principle of Pascal's theology, that from which he deduces the necessary truth of revelation, is the fallen nature of mankind, dwelling less upon scriptural proofs, which he takes for granted, than on the evidence which he supposes man himself to supply.

Hallam, "*History of Literature, &c.*"

Translate the following idiomatic expressions:

1. Let the worst come to the worst.
2. Your credit is at stake.
3. I cannot put up with that.
4. Have nothing to do with it.
5. What is the matter?
6. I cannot afford it, so I must go without.
7. It will never answer.
8. Much ado about nothing.
9. Well, I can't help that.
10. That lies heavy upon his heart.
11. Never mind, do not give it up yet.
12. I will leave no stone unturned.
13. That's right; where there is a will there is a way.
14. He always behaved like a gentleman.
15. Some odd pence; an odd glove; an odd volume.

And also:

1. Où voulez-vous en venir?
2. Passe pour cette fois, mais que je ne vous y reprenne plus.
3. Je me le tiendrai pour dit.
4. A quoi bon vous tourmenter?
5. Vous voilà bien avancé avec tous vos beaux projets.
6. Non, non, je ne veux pas m'y frotter; je sais de quel bois il se chauffe.
7. Je n'y vois goutte.
8. Qui se ressemble s'assemble.
9. J'y suis maintenant.
10. Cela me va, j'en suis.
11. Il y tient—Il en tient.
12. A la guerre comme à la guerre.
13. Il a mangé son blé en herbe.
14. Oh! il est homme à se tirer d'affaire.
15. Fais ce que dois, advienne que pourra.

N.B. The Candidates, in translating the above sentences, are requested to retain the order in which they stand, and to affix the number.

Part III.

Candidates aiming at a *first-class* certificate (Excellence) are expected to do justice to the five following subjects:—

I. *Grammar.*—Answer the last *two* grammatical questions at the end of Part I. (Nos. 11 and 12.)

II. *Idioms.*—Translate the above idiomatic expressions (in Part II.)

III. *Weights and Measures.*—Explain *in French* the meaning of the words *kilomètre, litre, hectare, kilogramme,* and *franc.*

IV. *Cotemporary Literature.*—State what is meant by the name of *Romantiques* given to a school of French writers under the reign of Louis-Philippe (1830–1848); name the leading representatives of that school.

Or, instead of that question:

Give the titles of as many standard works as you may remember by the following authors:—

Augustin Thierry.	Casimir Delavigne.
Lamartine.	Villemain.
Amédée Thierry.	De Tocqueville.

V. *History.*—Show, according to Michelet, how the personal character of Francis I. influenced the course of the Reformation in France.

Or, if you prefer it, sketch briefly the character of Margaret of Valois, sister of Francis I.

GERMAN.

THREE HOURS ALLOWED.

Section 1.

Translate from German into English.

Each candidate is expected to translate one of the following passages, and to answer a few of the grammatical questions appended to the first.

(1.) Der Anblick dieser entzetzlichen Ausschweifungen, welche sie aus Mangel an Ansehn und aus Geldnoth geschehen lassen mussten, erweckte selbst den Unwillen der kaiserlichen Generale, und ihr oberster Chef, Graf von Schaumburg, wollte schamroth das Commando niederlegen. Zu arm an Soldaten, um sein Land zu vertheidigen, und ohne Hülfe gelassen von dem Kaiser, der zu den beweglichsten Vorstellungen schwieg, befahl endlich der Churfürst von Brandenburg seinen Unterthanen in einem Edikte, Gewalt mit Gewalt zu vertreiben, und jeden kaiserlichen Soldaten, der über der Plünderung ergriffen würde, ohne Schonung zu ermorden. Zu einem solchen Grade war der Greuel der Misshandlung und das Elend der Regierung gestiegen, dass dem Landesherrn nur das verzweifelte Mittel übrig blieb, die Selbstrache zu befehlen.

Grammatical and Etymological Questions.

(*a.*) State the gender and the manner of forming the plural of substantives ending in *thum, heit, schaft, ung, niss,* and *ent.*

(*b.*) How do neuter substantives form the genitive singular?

(*c.*) Which case is, in the plural, distinguished from the other cases, and how is it done?

(*d.*) In what is the declension of the words *Soldat, Churfürst, Philosoph, Jesuit, Graf,* distinguished from that of the great majority of other masculine nouns?

(*e.*) How do German articles, adjectives, and adjective pronouns indicate the gender, number, and cases of the substantives to which they are joined?

(*f.*) Conjugate the verb *geschehen* in all its moods and tenses.

(*g.*) Give the singular of the present; the first person of the imperfect, indicative and subjunctive; the second perperson singular of the imperative; and the past participle of the verb *lassen, niederlegen, vertreiben.*

(*h.*) Give the infinitive and past participle of *mussten, schwieg, befahl,* and *blieb,* and the imperfect of *ergriffen* and *gestiegen.*

(*i.*) Mention the relative pronouns, and state which might be substituted for *der,* in the sentence—"der über der Plünderung ergriffen würde."

(*j.*) Give the rule by which the verb in the same sentence is moved to the end.

(*k.*) When must the English personal pronoun be rendered by a demonstrative? Give two examples.

(*l.*) When must the personal pronoun be repeated after the relative, and why?—Give two examples.

(2.) Auf die Unschuld schielt der Verrath mit verschlingendem Blicke,
Mit vergiftendem Biss tödtet des Lästerers Zahn,
Feil ist in der geschändeten Brust der Gedanke, die Liebe
Wirft des freien Gefühls göttlichen Adel hinweg,

Deiner heiligen Zeichen, o Wahrheit, hat der Betrug sich
Angemasst, der Natur köstlichste Stimmen entweiht,
Die das bedürftige Herz sich in der Freude Drang erfindet;
Kaum giebt wahres Gefühl noch durch Verstummen sich kund.
Auf der Tribüne prahlet das Recht, in der Hütte die Eintracht,
Der Gesetze Gespenst steht an der Könige Thron.
Jahre lang mag, Jahrhunderte lang die Mumie dauern,
Mag das trügende Bild lebender Fülle bestehn,
Bis die Natur erwacht, und mit schweren ehernen Händen
An das hohle Gebäu rührt die Noth und die Zeit,
Einer Tigerin gleich, die das eiserne Gitter durchbrochen,
Und des numidischen Walds plötzlich und schrecklich gedenkt;
Aufsteht mit des Verbrechens Wuth and des Elends die Menschheit,
Und in der Asche der Stadt sucht die verlor'ne Natur.

(3.) O Spatzenkopf! Wo nichts heraus zu verhören ist, da verhört man hinein. Ehrlichkeit macht unbesonnen, auch wohl trotzig. Da fragt man erst recht sachte weg, und der Gefangene ist stolz auf seine Unschuld, wie sie's heissen, und sagt alles gradezu, was ein Verständiger verbärge. Dann macht der Inquisitor aus den Antworten wieder Fragen, und passt ja auf, wo irgend ein Widersprüchelchen erscheinen will, da knüpft er seinen Strick an, and lässt sich der dumme Teufel betreten, dass er da etwas zu viel, dort etwas zu wenig gesagt, oder gar aus Gott weiss was für einer Grille einen Umstand verschwiegen hat, auch wohl an irgend einem Ende sich hat schrecken lassen; dann sind wir auf dem rechten Wege.

(4.) Die verbündeten Heere hätten die Verwirrung noch sehr vergrössern, die abziehenden Haufen in noch verzweifeltere Flucht, die Widerstand-Leistenden zu schnellerer Ergebung bringen können, wenn sie die Stadt selbst hätten beschiessen lassen. Aber ein so grausames Mittel, welches Tausende von unschuldigen Einwohnern mit verdorben hätte, war ihren menschenfreundlichen Herzen zuwider: sie wollten nur die Thore und Eingänge erstürmen lassen, and das vollbrachten ihre unerschrockenen Krieger auch sehr bald. Der Prinz von Hessen-Homburg —wiederum einer aus diesem tapfern Geschlecht—stürmte mit Preussen gegen das Grimmaische Thor, Bennigsen gegen das Petersthor, Langeron gegen das Hallische Thor.

Section II.

(1.) Every animal likes to live where it finds its food; and every man where he finds enough for his maintenance.

(2.) Did your friend see where my brother had laid the books?

(3.) While we fix our attention upon time, part of it has already disappeared.

(4.) While many people are living in luxury, many more are dying from want.

(5.) You had better wait here, till your father returns from the continent.

(6.) By playing high, he lost all his money.

(7.) Assuming the fact, I wrote to him as follows:

(8.) If the battle is won, we may expect a speedy and honourable peace.

(9.) If the battle had been won, we might have expected a speedy and honourable peace.

(10.) The battle not having been won, a speedy and honourable peace could not be expected.

(11.) We have a right to expect such a peace, because all the battles during the whole campaign have been won by our brave soldiers.

(12.) Being now again at home, we shall invite your youngest sister to spend a week with us at our country house.

(13.) Is it possible that he thinks what he speaks?

(14.) Fair as virtue is, so hateful (ugly) is vice.

(15.) Old as your uncle is, he is stronger than your eldest brother, who is by thirty years younger than he.

(16.) I infer his country from his accent.

(17.) From his not answering me, when I asked him, I inferred that he was ashamed of what he had done.

(18.) I was interrupted by one visit after another.

(19.) At last I received a letter from my friend, in which he told me he was very sorry, but he was unwell, and could not come.

(20.) If I had known that he could not come, I should not have stayed at home.

(21.) She said, she could not help despising such advice.

(22.) If you think that the more learned a man, is the wiser he must be, you are mistaken.

(23.) This room is square.

(24.) That tower is round.

(25.) This bridge is longer than the one which leads over the Thames near Richmond.

(26.) Who, do you think, is the richest man in this country?

(27.) That is as difficult to say as to say who is the best man.

(28.) One of the brothers is as rich as the other, but the oldest of all is exceedingly rich.

(29.) He is getting richer every year.

Subject of a short and concise German Essay, for a first class certificate:—

Welches waren die politischen und sittlichen Folgen des Dreissigjährigen Krieges für Deutschland?

MUSIC.

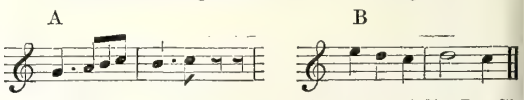
THREE HOURS ALLOWED.

Rudiments of Musical Grammar.

1. What is the minor third above *Do* (C)?
   ,, perfect fourth above *Fa* (F)?
   ,, major second above *Mi* sharp (E sharp)?
   ,, imperfect fifth above *La* (A)?

2. Give the time signatures of the following:—

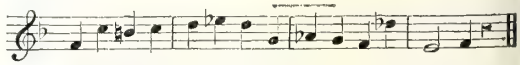
A B



3. Write (on music paper) the signatures of *Fa, La, Si,* and *Mi* flat (F, A, B, and E flat) *major*, and of *Do, Si, Sol,* and *Mi* (C, B, G, and E) *minor*.

4. Write the following (at the same pitch) on the *Alto* stave:—

5. Transpose the following a tone higher and a semitone lower:—



6. Write any melody with which you are acquainted, from memory?

7. What are the names (*Do, Re;* A, B, or other) of the notes below?

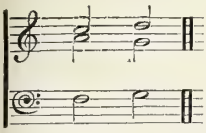
8. In what centuries did the following composers write:—Palestrina, Purcell, Mozart? State anything that you know about them.

Harmony and Counterpoint.

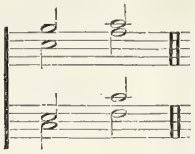
1. Give an example of the discord of the dominant seventh and its resolution; also of each of the *inversions* of the same discord, with their several resolutions.

2. Point out, and correct, the errors in the following:—

A

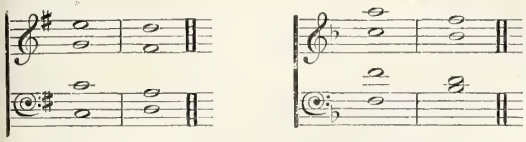


B

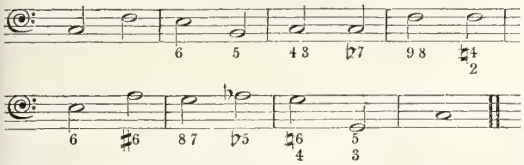


3. What is similar motion? and what are the objections to, and difficulties connected with, the frequent use of it?

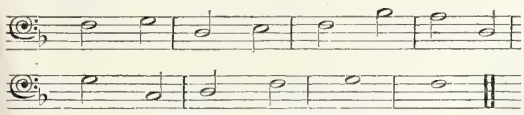
4. Connect each of the following combinations by suspensions:—



5. Add three parts to the following figured bass:—



6. Add a part, in any species of counterpoint, above or below the following:



Home Correspondence.

PATENT STEEL PLATES.

SIR,—A letter from Dr. Livingstone in your *Journal* for the 31st August, has been the means (accidentally no doubt) of propagating a very erroneous report respecting puddled, or, as it is called, patent steel. I shall be greatly obliged if you will give as much publicity as possible to the fact that the vessel in question was not only not built by me or the Mersey Steel and Iron Company, but that we had nothing whatever to do, in any shape or way, with the manufacture of the material of which she was constructed, and I know for a fact that the launch was not made of puddled steel at all.

I am, &c.,
WILLIAM CLAY.

Mersey Steel and Iron Works, Sefton-street, Liverpool, September 12, 1860.

Proceedings of Institutions.

WEST HARTLEPOOL LITERARY AND MECHANICS' INSTITUTION.—The report read at the annual meeting held in the Athenæum, on Wednesday, 6th June last, states that the Committee, being anxious to promote the welfare of the Institution, by consulting the wishes and convenience of its Members, in October last determined to establish a second-class subscription, at the reduced rate of 2s. 6d. per quarter, entitling the subscribers in this class to all the benefits of the news room and library, with a view to place these benefits within the means of the humblest member. And in order to provide still further accommodation, the news-room, at a considerable expense, was enlarged to double its former size, forming a first-class reading-room. The attendance and increase of members show that the alterations have been duly appreciated, and the expense warranted. The number of members fluctuate during the year, rather decreasing during the summer, and increasing during the winter season. At present there are nearly 300 upon the books of the Institution, divided into classes as follows:—

	Per Quar.	No.
1st Class for News Room, Library and Institute at	4s. 0d. ...	94
2nd ditto ,, ,, ,,	,, 2s. 6d. ...	144
3rd ditto for Library and Institute only	,, 2s. 0d. ...	23
4th ditto ,, ,, (Ladies)	,, 1s. 6d. ...	11
5th ditto ,, (Youths and Apprentices)	,, 1s. 0d. ...	18
Total . .		290

The Committee have been for same time past engaged in re-arranging and classifying the volumes in the library, and have also completed a new catalogue. Upwards of 150 volumes of the best works, by the most popular and eminent authors, have been added to the library during the year, also some of the newest periodicals. The library now contains near 1,800 volumes. The number of issues during the year has been of books about 7,000; of periodicals about 2,000. The evening classes for the instruction of male and female youths and adults, who may be otherwise prevented from obtaining instruction, were in operation during the winter season. The attendance was about the same as in former seasons, there being about 100 males and 30 females, varying in age from 12 to 28 years; they were taught by a competent master and mistress, and assistant teachers. The average weekly attendance during the season was about 50. The Committee are of opinion that it would be of great importance if a series of classes of a higher grade, embracing the several branches of science, could be more fully established, as a preliminary to the course of instruction for candidates intending to compete in the Examination of the Society of Arts. The number of lectures given during the year has been but small, but of a very interesting and instructive character; and, although delivered by eminent lecturers, it is to be regretted that the members and their friends, by their attendance, have not afforded sufficient encouragement to make them remunerative. The Committee have again to thank the proprietors of collieries for their liberal donation of coals for the use of the Institution. Also, those patrons and friends who contribute annual subscriptions as honorary members.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August* 31*st*, 1860.]

Dated 17*th August*, 1860.

1990. R. Smith, 114, West-street, Glasgow—Imp. in the preparation and production of colouring matter.
1991. R. Mole and F. M. Mole, Birmingham—An imp. or imps. in the manufacture of matchets and cutlasses.
1992. J. Wardle, Bury, Lancashire—Certain improved arrangements of the flues of steam boilers.
1993. W. Middleton and D. Fox, Glossop, Derbyshire—Imp. in machinery or apparatus for making paper.
1995. G. Nimmo, Glasgow—Imp. in the manufacture of steel.
1996. R. Read, jun., Havelock-street, Leicester—Imp. in the manufacture of waterproof fabrics permeable to air.
1997. A. Pirotte, Liege, Belgium—Imp. in the construction of condensers.
1998. J. Garnett, Windermere, Westmorland—Imp. in writing desks, and in apparatus connected therewith.

Dated 18*th August*, 1860.

1999. R. Tempest and J. Tomlinson, Roach Iron Works, Rochdale—Imp. in certain machines for preparing cotton and other fibrous materials.
2000. D. Foxwell, Manchester—Imp. in sewing machines.
2001. W. H. Crispin, Marsh Gate Lane, Stratford, Essex—An improved propeller.
2002. G. Tidcombe, Watford Iron Works, Hertfordshire—Imp. in hydrostatic presses.
2003. R. Romaine, Devizes—Improved machinery applicable to steam cultivation.
2004. F. B. Houghton, 12, Eldon-road, Kensington—Imp. in the manufacture of paper when the straw of wheat, barley, oats, rye, or rice is employed.

2005. T. Grahame, Leamington, Warwickshire—Imp. in projectiles and cannons, or barrels for discharging the same.

Dated 20th August, 1860.

2006. J. Boott, Lille Town, France—Imp. in the manufacture of various weavings in bobbin-net, and in machinery for the same.

2007. A. V. Newton, 66, Chancery-lane—An improved guard for boots, shoes, and clogs. (A com.)

2008. A. V. Newton, 66, Chancery-lane—An improved mode of coupling the rails of railways. (A com.)

2009. E. Bridgman, Tarragona, Spain—Imp. in the construction of wet gas meters.

Dated 21st August, 1860.

2011. J. Neal, Birmingham—A new or improved mixture or composition for fumigating plants, and thereby destroying insects infesting the said plants.

2013. J. Campbell, 44, Adelaide-road, Haverstock-hill—Imp. in apparatus for removing sand or mud from the bottom of the sea, and of rivers, docks, and harbours.

2017. A. M. Perkins, Francis-street, Regent-square, Gray's-inn-road—Imp. in apparatus for distilling sea and other water.

Dated 22nd August, 1860.

2023. W. Clark, 53, Chancery-lane—Imp. in the preparation or manufacture of manure. (A com.)

[*From Gazette, September 7th*, 1860.]

Dated 3rd July, 1860.

1602. J. Johnson, Ashton-under-Lyne, Lancashire—Certain imp. in jacquard machines.

1610. T. L. Braynard, New York—Imp. in apparatus for working, training, and levelling cannon on board of vessels, and in fortifications, redoubts, and other places. (A com.)

Dated 24th July, 1860.

1786. E. Harrison, W. Bradbury, and J. Buckley, Oldham—A certain improved compound or compounds to be used as a substitute for gunpowder.

Dated 7th August, 1860.

1906. W. Clark, 53, Chancery-lane—Imp. in pattens or clogs, and coverings for the feet. (A com.)

Dated 8th August, 1860.

1912. E. M. Thornton, Brooke street, Holborn—An improved rein holder.

Dated 11th August, 1860.

1946. J. Wilkins, 18, Essex-street, St. Peter's, Islington—An improved inkstand.

Dated 13th August, 1860.

1960. A. V. Newton, 66, Chancery-lane—Imp. in the mode of and apparatus for manufacturing packing for pistons and other parts of machinery. (A com.)

Dated 14th August, 1860.

1962. G. Leslie, The Mall, Hammersmith, Middlesex—Imp. in preserving casks and apparatus connected therewith.

1966. J. Lark, Strood, Kent—Imp. in grinding cement and other substances, and in the machinery or apparatus connected therewith.

Dated 21st August, 1860.

2010. H. Greaves, 7, Beaborough gardens, Pimlico, Middlesex—Imp. in the construction of railways, tramways, or tracks for carriages, and in the appliances for the conveyance of passengers, parcels, and letters thereby.

2012. W. E. Gedge, 11, Wellington-street, Strand—Imp. in apparatus for obtaining motive power based upon the hydrostatic paradox. (A com.)

2014. C. E. Wilson and H. G. Hacker, Monkwell-street, London—Imp. in machinery for the manufacture of chenille.

2015. E. Hall, Dartford, Kent—Imp. in machinery for grinding and smoothing glass.

2016. M. Jacoby, Nottingham—Imp. in the manufacture of twist lace in twist lace or bobbin net machinery.

Dated 22nd August, 1860.

2018. R. West, Walsall, Staffordshire—Imp. in the construction of wet gas meters.

2020. J. Jobin and A. Boll, Robert-street, Chelsea—Imp. in cigarettes and mouthpieces, and in apparatus used in manufacturing cigarettes.

Dated 23rd August, 1860.

2025. J. Newhouse, Farnworth, near Bolton-le-Moors, Lancashire—Imp. in or applicable to certain machines for spinning and doubling cotton and other fibrous materials.

2027. E. O. W. Whitehouse, Brighton, Sussex—Imp. in testing insulated conductors.

2029. W. W. Cannon and R. Jackson, Bolton, Lancashire—Certain imp. in machinery or apparatus for spinning cotton and other fibrous substances.

2030. Sir J. S. Lillie, 105, Pall-mall—Imp. in blocks for building purposes.

2031. C. Weiss, Huddersfield—Imp. in the manufacture of cloth, and in preparing and manufacturing woollen flock. (A com.)

2032. W. Spence, 50, Chancery-lane—Imp. in padlocks and keys for the same. (A com.)

2033. J. H. C. Lacroisade, Paris—An improved apparatus for heating tailor's irons and other irons, also for cooking and other heating purposes, with irons adapted to be used therewith.

Dated 24th August, 1860.

2034. R. R. Bealey, Manchester—Imp. in shirt fronts.

2036. W. Keen, Horton, near Slough, Buckinghamshire—Imp. in castors.

2037. H. Pritty, 6, Victoria-grove West, Brompton, Middlesex—Imp. in apparatus used to damp paper for copying letters and other documents.

2038. A. Halter and F. D. W. Douard, 91, Rue de Malte, Paris—Imp. in the manufacture of flexible tubes for the conveyance of water, illuminating gas, or other fluids.

2039. S. Greenwood, Butterfield-place, Cropper-lane, Bradford—Certain imp. in looms for figure weaving.

2040. F. Lambe, Cushion-court, Old Broad-street, London—Imp. in the construction of certain parts of oil lamps and other lamps. (A com.)

2041. A. Barclay, Kilmarnock, Ayr, N.B.—Imp. in pumping engines.

2044. W. Clark, 53, Chancery-lane—Imp. in apparatus used in reproducing designs in tapestry or wool work. (A com.)

2045. J. J. Révy, York-street, Portman-square—An improved construction of screw propeller.

2056. G. Kershaw, Upton Cottage, Slough, Bucks—Imp. in the construction of medico-electric surfaces.

Dated 25th August, 1860.

2047. W. Thomson, Glasgow, and F. Jenkin, Stowting, Kent—Imp. in the means of telegraphic communication.

2048. G. Davies, 1, Serle-street, Lincoln's inn—Certain imp. in the construction of bomb shells. (A com.)

2050. J. Newall, Dunkinfield, Cheshire—Certain imp. in apparatus for "Transferring the latent heat of steam to water or other fluids."

2051. J. Wilkes, T. Wilkes, and G. Wilkes, Birmingham—A new or improved method of manufacturing wire for electric telegraphs, and for such other uses as the same is or may be applicable to.

2052. E. T. Truman, Old Burlington-street, Middlesex—An improved method of cleansing and purifying gutta percha, and other like substances, and their compounds, and an improved apparatus employed therein.

2053. A. V. Newton, 66, Chancery-lane—An improved mode of treating hides and skins preparatory to the tanning process. (A com.)

2055. R. Jobson, Dudley, Worcestershire, and J. Ransome, Ipswich—Imp. in apparatus used in producing moulds for casting.

2056. J. Chatterton, Highbury-terrace, and W. Smith, Pownall-road, Dalston, Middlesex—Imp. in the manufacture of telegraphic cables.

Dated 27th August, 1860.

2058. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in salt-cellars, pepper-casters, and similar utensils. (A com.)

2059. W. Clark, 63, Chancery-lane—Imp. in fire-arms. (A com.)

2060. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of sheet tin, and in the machinery or apparatus employed therein. (A com.)

2061. J. Arrowsmith, Bilston, Staffordshire—New or improved sash-iron for conservatories and other structures, made principally of glass, and also for windows and skylights, and other like purposes.

2062. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in thrust bearings for propeller shafts, and for other purposes. (A com.)

2063. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in building water craft. (A com.)

2064. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in stuffing boxes, and the packing thereof, for the pistons rods of steam engines, and for other purposes. (A com).

Invention with Complete Specifications Filed.

[*From Gazette, September 7th*, 1860.]

2100. W. S. Underhill, Newport, Salop—Imp. in the manufacture of iron fencing or lattice. 30th August 1860.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, September 7th*, 1860.]

September 3rd.	*September 5th.*
2350. E. Lavender.	2319. L. L. H. Bertou.

[*From Gazette, September 11th*, 1860.]

September 6th.	2367. J. Mills.
2362. J. Harrison.	*September 8th.*
2371. C. Lungley.	2333. G. J. Mackelcan.
2414. W. Smith.	2358. J. Fenton, W. Thompson, jun., and T. Snowdon.
September 7th.	2395. T. S. Adshead and J. Platt.
2357. W. Jamieson.	2758. W. Shields.
2363. W. Crofts.	

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, September 7th*, 1860.]

September 3rd.	*September 5th.*
2039. G. Stickney.	2058. D. Law.
2040. G. Stickney.	

[*From Gazette, September 11th*, 1860.]

September 6th.

1060. W. Grimshaw and E. Rowland.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 21, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following addition has been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£362,600	
Mark Philips, Snitterfield, Stratford-on-Avon	100	Arts.
Grosvenor Hodgkinson, M.P., Winthorpe Hall, near Newark	100	Arts.
S. Leigh Sotheby, Buckfastleigh Abbey, South Devon	500	Arts.
William Woodcock, Manchester	100	Commerce.
Joseph Martineau, Basing-park, near Alton	1,000	Commerce.
*Waller Lewis, M.D., H.M. Post-office	100	Arts.
Total	£364,500	

By Order, P. LE NEVE FOSTER, *Secretary.*

SOUTHERN COUNTIES ADULT EDUCATION SOCIETY.—CONFERENCE.

The Institutions in Union with the Society of Arts in Hants, Wilts, and Dorset, are informed that the "Southern Counties Adult Education Society" will meet in Conference, at Warminster, on Tuesday and Wednesday, the 2nd and 3rd of October.

In the morning, the Conference will be presided over by the Very Reverend W. F. Hook, D.D., Dean of Chichester.

In the evening there will be four meetings in section:—

1st. "Night Schools." Chairman, Archdeacon Hony.

2nd. "Town and Village Institutions." Chairman, Henry Chester, Esq., V.P. of the Society of Arts.

3rd. "Education as it affects the Home, and the Home as it affects Education." Chairman, the Rev. A. Fane.

4th. "Societies having an influence on the advancement of Education." Chairman, the Right Hon. T. Sotheron Estcourt, M.P.

Members of the Society of Arts, and of Institutions in Union with the Society of Arts, are invited to attend the Conference.

Communications respecting the papers to be read, and the business to be transacted, are to be addressed to the Hon. and Rev. S. Best, Abbott's Ann, Andover.

MINERAL RESOURCES OF TUSCANY.—No. VI.

By William Paget Jervis, F.G.S.

(*Concluded from page* 750.)

Metalliferous Minerals; including the History of the Mines of the Tuscan Archipelago, from the earliest period down to the close of the Lorraine Dynasty, in 1859: with a Description of Contemporaneous Tuscan Coinage.

II.—Copper Veins in Elba.

Although copper has already been found in four distinct parts of Elba, neither of the veins have been worked for centuries, from want of funds and confidence. Until very recently, all the minerals of Elba belonged to the government, who neither allowed anyone to form mines, nor troubled themselves about them, with the exception of the iron ore. After 10 years' hard struggling Sig. Luciano Foresi (a son of the officer who became the host of the Emperor Napoleon I. and his suite on landing at Portoferrajo, in 1814) succeeded in liberating the mineral resources of Elba from government monopoly. The prohibition to work the veins is now no longer in force, and only the iron ores remain the property of the government.

A.—Copper in Serpentine.

Volterrajo.—A mile above Rio, not far from the ancient ruined castle of Volterrajo, is a spot where red oxide of copper is found intermixed with massive malachite, which might easily be mistaken for Australian ore. I have some specimens of considerable size. The matrix is *gabbro*,

the serpentine without diallage, a soft purple rock, in which small particles of silicate of copper, chrysocolla, are occasionally imbedded. The vein belongs to class A. of my second paper. I conceive this to be the most promising place in the island for commencing a mine.

B.—Copper in Amphibole Dykes (Absent).

C.—Copper in Sedimentary Rocks.

Sta. Lucia.—Copper ore is found below and on the east side of the ancient ruin of Sta. Lucia, a building crowning the summit of a prominent hill 3 miles south of Portoferrajo. It is close to the boundary of the serpentine; Sta. Lucia is on granite. One of the walls of the vein is formed by whitish porphyritic rock, the other by friable schists: it is, therefore, at the junction of two rocks. The copper ore was first discovered by accident, while some men were making one of the circular threshing-floors on the side of a hill such as are observed in every farm in Elba. In order to make a level surface, it was necessary to cut away the rock at the back part, when the labourers unexpetedly came on indications of ore. Subsequently Sig. Foresi made an experimental pit to ascertain whether any more could be obtained. Some of the specimens from this working I brought to England. The ores are imbedded in quartzose gangue and a siliceous matrix of the hardest kind. Owing to the time which has elapsed since the pit was dug, it was in a great measure filled with water, so that on descending a few yards I was unable to see the richest portion, and cannot venture positively to affirm that it is a vein in sedimentary rock (class C), though quartz gangue accompanies the copper pyrites. The other ores found here were bornite, red oxide of copper, and native copper, all these in masses, and very pure and rich; fibrous malachite and dark blue crystalline azurite were procured; but these are only small pieces interspersed in the quartz; I found the size of the outcrop to be three feet, and an analysis of the vein, just as broken off, consisting chiefly of quartz, with small pieces of malachite and azurite, gave me 6·47 per cent. of copper, though the specimen I submitted to estimation was purposely a poor one. Some of the red oxide of copper closely resembles that from Volterrajo. To work this vein would be very simple; thus a level could be driven into the hill from the bridle-path in the valley, towards the south-east, for a distance of 800 feet, and would cut it at the depth of about 100 feet, the present road to the village of S. Giovanni, on the harbour of Portoferrajo, and only half a mile distant, would afford easy transit for the ores, and the brook running through the valley serve very well for dressing them. Half a mile west of Monte Orello is a pass, of which the Elbans have availed themselves in making a horse road from S. Giovanni to the Gulf of Accona. Two or three hundred yards below the watershed line to the south, some years ago, a shepherd who was in a field spied a stone which presented an altogether novel appearance to him from its green coating, and on taking it in his hand he perceived that it was very heavy; he therefore took it to Sig. Foresi, who recognized it to be a mass of native copper, weighing 47 lbs. avoirdupois. That gentleman proceeded to sink a shaft 200 yards beyond the pass and 20 above the road, and having gone to a depth of 16 yards he found more native copper: another excavation close by reached the copper ore at a less depth. The pits were covered over, though Sig. Foresi pointed out all the localities to me in succession. Half a mile beyond this we came to another circular threshing-floor below a small farm-house. The vein was cut at the back of the floor, the matrix contains only the slightest possible traces of ore, but I could not manage to break it with my hammer, from its excessive hardness. The places where I examined the vein all lie more or less in a direct north and south line for the distance of a mile.

Capo Pomonte.—This little cape is situated at the south-west extremity of Elba, projecting for several hundred yards into the sea; the rocks of which it is composed are serpentine, gabbro, and aphanite, penetrated by quartz veins, in which copper pyrites has been discovered. I traced up three distinct veins from the very sea; two of them may be followed on the face of the cliff for 60 feet, and vary from 6 inches to a foot in width, but contain so little ore and so much quartz as to be scarcely worthy of mention. Following them along I noticed green carbonate of copper, forming a copious coating on the face of the rock, proceeding from water which had been infiltrated into the vein and decomposed the ore. About 100 yards from this point is the third vein, from 4 to 5 feet thick, from which I was able to take very promising specimens of pyrites; these furnished me on analysis 10·36 per cent. of copper. The ore is traceable for 20 yards: excellent native copper has been procured from hence, some was exhibited in the Florence Exhibition in 1854; I did not myself find any. Copper ore has occasionally been found by the Elbans higher up on the side of the hill. A small quantity was once sent to the Imperial and Royal foundries at Follonica to be smelted.

"Cava dell'Oro."—Two miles west of the Marina di Marciana, under the Concha, is a cliff of *gabbro rosso*, but I could do little more than corroborate the existence of a minute copper vein in it, a few inches broad. A short distance beyond, however, is a mysterious spot known as the "*Cava dell'Oro*," or gold mine, which I accordingly determined on visiting in a boat. A small opening is observed in the cliff, through which I entered with a light, the boatmen loudly vociferating all the while, and refusing to go before me, talking a great deal about the foul air, &c. I had heard so often about places called the *Cava dell'Oro*, that I felt anxious to know what grounds there were for the notion of gold being found in Tuscany. I was positively assured by one man that his grandfather had procured gold from this place, and I felt unwilling to be sceptical until I had ascertained the merits of the case. After proceeding some yards, I discovered the secret. It was the purposely obstructed entrance of a gallery, through which I walked for 300 paces into the rock without any signs of a termination. It is level, 5 feet 6 inches high and 4 feet broad. On coming out, I found the outcrop of a copper pyrites vein, 4 feet wide, embedded in a very hard quartzose matrix. The pyrites was rather poor at this spot, but certainly search might be made for ever in vain by driving into the rock on the same level. I was unable to ascertain from anyone in Elba of whom I inquired as to the origin of this gallery, but one day, while in Massa Carrara, I stumbled on the very gentleman who had made it for the Tuscan Government, roused by the name of *Cava dell'Oro* to prosecute the search for gold. Signor Begni told me that his orders were to disregard everything but gold, which never made its appearance.

Monte Perrone.—Eight miles from Portoferrajo, on the road to the Marina di Marciana, and two from the latter, a little path branches off towards Monte Perrone, where, at a mile from the coast, we arrive at a spot from whence the village of Poggio is visible directly in a line with Marciana Alta. Signs of very ancient mines are here seen in every direction, for while I cannot bring forward any proofs of the veins I have hitherto described having been ever worked, abundance of "burrows" are here seen all along the face of the hill. The antiquity of the workings is shown by their irregularity and shallowness, and the absence of proper galleries or shafts. They resemble in every respect the pits I had studied at Gerfalco,* which have been pronounced as Etruscan, and I feel no doubt that they were made by that people. About 100 feet below the summit of the mountain, is a large hollow, excavated in the vein like a quarry, penetrating some 20 or 30 yards into the rock. It is now so overgrown with brushwood and weeds that it is impossible to see the surface where they worked, but all around are evidences of the nature of the matrix. A kind of loose ferruginous gangue, very similar

* See pp. 693, 700, of the present volume.

to our Cornish "gozzan" accompanies the ore, and contains pieces of silky malachite in superficial fragments. None of the pieces of copper which I could pick up on turning over the burrows were of any size, for evidently the ancient miners removed whatever they extracted. I found some asbestiform minerals on the burrows, probably derived from *gabbro rosso*. Signor Begni, four years ago, made several experimental pits, to see if he could cut a vein, but having gone elsewhere, nothing came of the proposition. Exactly north of Monte Perrone, on the coast, are the Bagni di Marciana. In making the road from Marciana to Portoferrajo, in 1810, many coins of Cæsar Augustus were dug up at the Bagni, which were in all probability Roman baths at the Christian era. A few yards from the baths is an ancient gallery running from the sea-cliff for a short distance into the rock. Not having entered it myself, I cannot say if it be ancient or not. Many advantages would be found, were anyone to work the copper ore at Monte Perrone, if the vein once discovered should prove sufficiently good, for the soil is too poor to admit of any culture; it is too stony for pasture-land, only a few places afford sufficient earth to admit of brambles and brushwood taking root, even goats can scarcely find enough to live on, so that the ground is really valueless.*

A spirit of commercial enterprise is almost unknown in Tuscany, consequently nothing is done: they all seem to wish to obtain an immediate return for the capital laid out. I strongly advised Sig. Foresi, the proprietor of the copper veins, if he wished to be successful in forming a society for working the mines at Pomonte and Sta. Lucia, to lower the price of the shares from 1000 *lire* to 30 (£1 sterling), especially as the islanders, who are most interested in these undertakings, are not overburdened with funds.

Though copper is not now worked in Elba, it was so long before the days of Aristotle: "It is stated that there is an island in Etruria now called Æthalia, in which there is a copper mine, whence they have obtained the whole of the copper they have hitherto employed in making bronze vessels, but now it is abandoned, and has not for a long time produced anything. The inhabitants of those parts relate that in process of time they no longer procure copper from the island, but only the iron which they are at present in the habit of employing." "In Etruriâ ferunt insulam esse quam Æthaliam hodie vocant, in quâ ærifodina est unde æs eruitur, omne scilicit illud ex quo isthuc ærea vasa conflantur. Deficere autem, nec reddere quidquam aliquamdiu; cœterum temporum procursu non æs ut ante sed ferrum provenire, id nempe quo etiamnum utuntur Populorum incolæ vocant." (Aristotle; περὶ Θαυμασίων ἀκουσμάτων.)

III. Manganese Veins.

Magazzini.—Half a mile above Magazzini, on the harbour on Portoferrajo, and close to the horse road leading to Rio, is a fine vein of compact black oxide of manganese, 8 paces in breadth. The outcrop of the vein is visible on the surface for some distance along the summit of a hillock, and reappears at an interval of 200 yards to the north; it is apparently a north and south vein. The ore is very abundant, and being so near the sea would doubtless amply repay the trouble of working. Though this is the only regular vein of manganese in Elba, with which I am acquainted, Braunite is very common in the felspathic rocks west of Portoferrajo in minute quantities, and far too distributed to render it fit for working; it is seen as a brown powder, and also forms dendritæ of extreme beauty between the innumerable fissures of the rock, whence the hill is called Monte Albero (the tree hill).

* As the copper veins of Pomonte, Cava dell 'Oro and Monte Perone are in the Communità di Marciana, I may mention a most singular method of dividing property in this commune. Instead of dividing the ground into fields, it is cut up into long narrow strips, which on the map would have the appearance of so many pieces of riband:—but this and other points of extreme interest and little known would insensibly draw me away from my subject.

IV. Lead Veins.

Lieut. Pisani showed me specimens of galena and phosphate of lead which he had procured in the Isoletta de' Topi, at the northernmost extremity of Elba. I myself picked up some large lumps of galena on the summit of the hill at the mine of Rio; many loose fragments may be found at one spot near the Polverino, though I was not able to get any *in situ*, but unless some eccentric individual has repeated the trick employed by a traveller some years ago, who, on ascending the Peak of Teneriffe, carried up a basket of sea shells to puzzle future geologists as to the origin of the crater, I cannot but think there must be a rich lead vein close by, and not far from the top of the hill.

V.—Antimony, Cobalt, Mercury, and Arsenic Veins.

Antimony is seen at Procchio, at the junction of the two roads from Campo and the Marina di Marciana to Portoferrajo, distant only 6 miles. It was found in digging the foundations of a house. There is no regular vein. The sulphuret of antimony occurs in crystallised masses, in a slate-blue siliceous matrix. Antimony has also been found in the sea cliff almost due west of Procchio.

Cobalt evidently exists in Elba. Erythrene, a mineral containing cobalt, is found near Capo Calamita, but is very rare. A shrewd Elban offered to show me a vein of arsenical cobalt, but only on condition of being handsomely rewarded. It is very possibly only magnetic iron pyrites.

Mercury is said to have been found in Elba, and also arsenical pyrites; the latter at the Marina di Rio. There is abundant scope for further investigation.

Monte Cristo.

I believe that Professor Smyth discovered a copper vein in Monte Cristo some years ago. Unfortunately, I do not know the particulars.

Giglio.

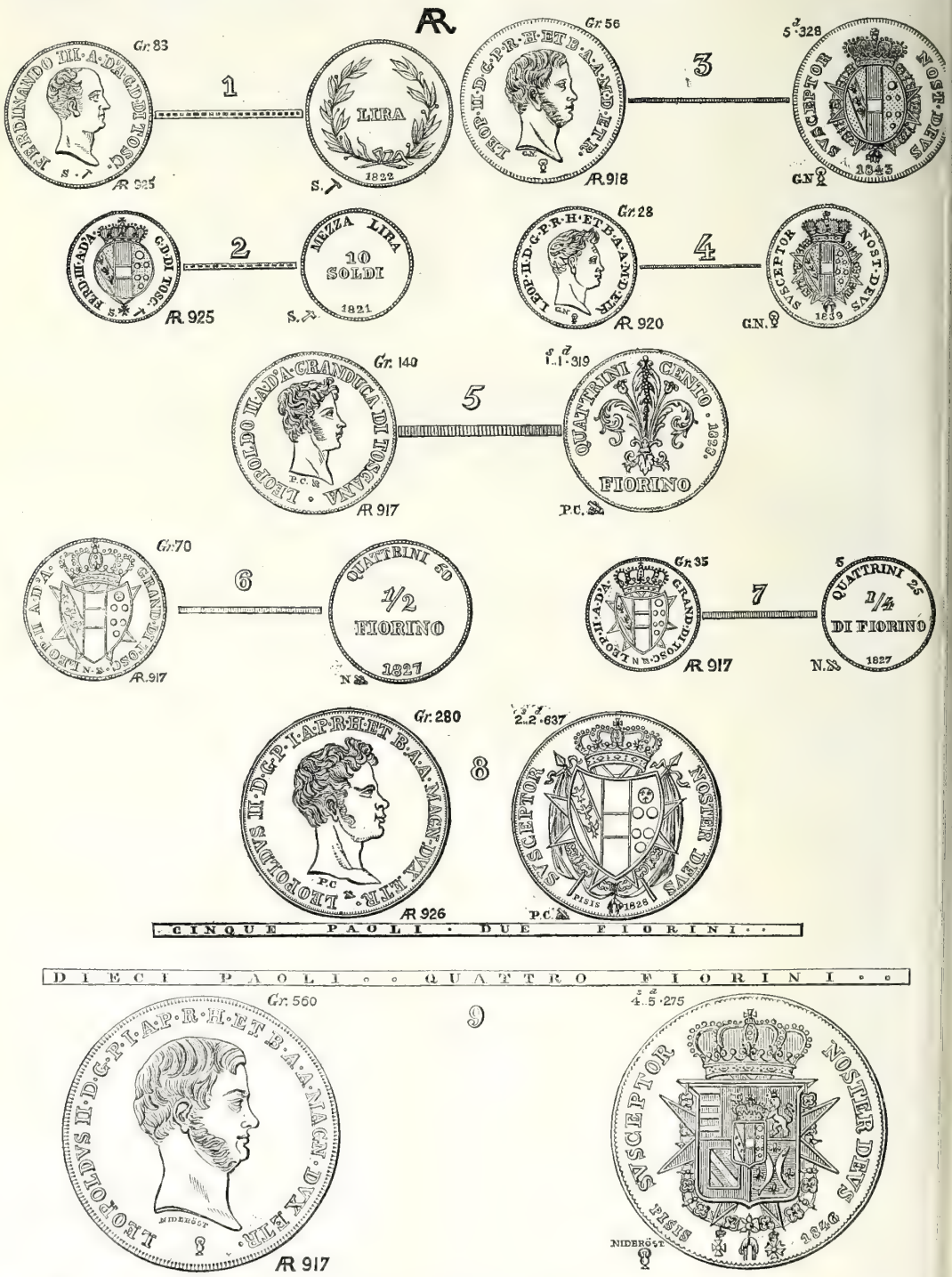
Signor Melini had just returned from Giglio, a little island south of Elba, where he had found galena associated with quartz, also copper pyrites crystallised in perfect tetrahedral crystals. These were only the outlying indications of ore, which must exist in greater quantities in the island. The copper is from a sedimentary rock. (Class C.)

Contemporaneous Tuscan Coinage.

This is the most appropriate place for me to give a sketch of the monetary system in vigour in Tuscany, so highly essential to any who may desire to investigate the financial part of the question of the mines, the more so as I have frequently alluded to many Tuscan coins in the course of my papers, and because the dies are exceedingly beautiful. After the language, weights, measures, and moneys are the first difficulties met by the traveller in any country, and I cannot do better than insist on the importance of a careful study of this abstruse subject. Two silver units of money were employed in Tuscany up to last winter, the *lira* and the *paolo*. In mercantile transactions and accounts the heading was the same as our own, the former standard being preferred: thus £. s. d., (lira, soldo, denaro). Singularly enough, the multiples were precisely the same as our's, thus, £1 = 20s. = 20 × 12d. = 240d. The silver florin was not employed as a standard, although in the Middle Ages the gold florin was the unit, and apparently silver was then little used in Tuscany from the constant mention of gold money.

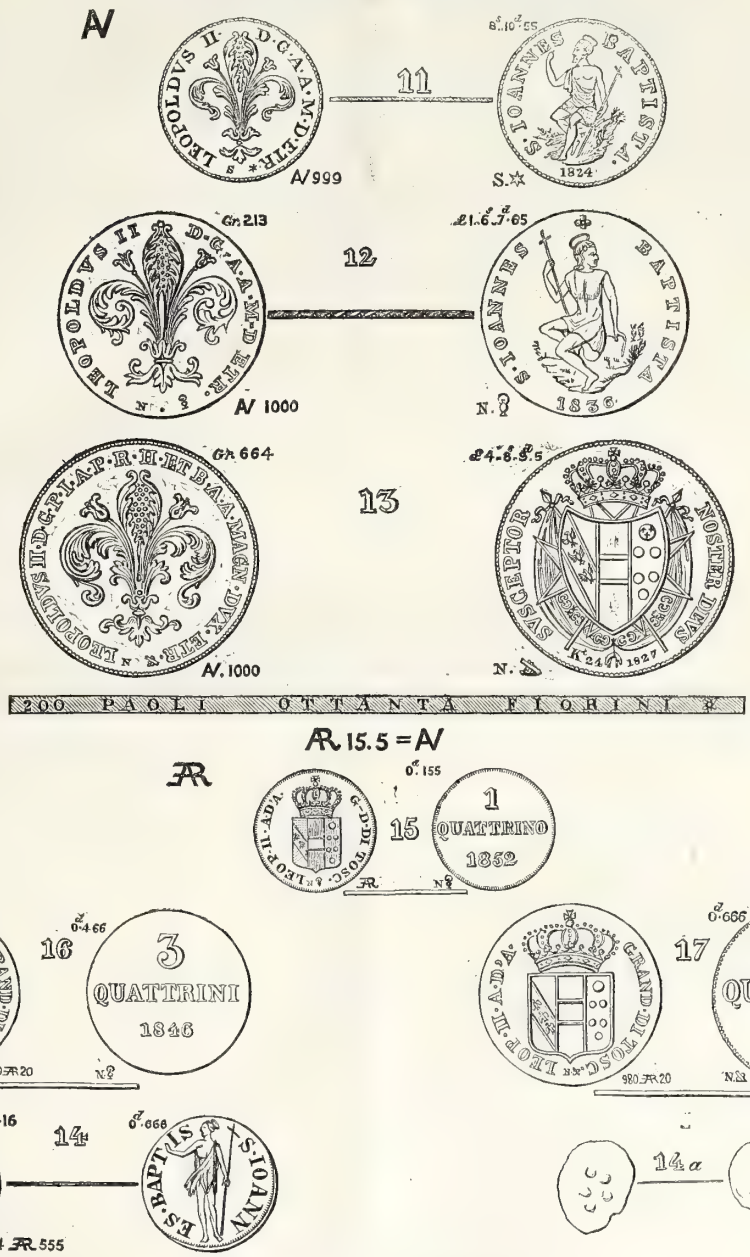
I have introduced into this *Journal* a perfectly new and improved method of representing the Coins, devised by myself; the engravings may all be implicitly relied on, (as I have drawn them from nature with the utmost care), showing the side view, unrolled, or in perspective, as a link between the obverse and reverse, instead of the ordinary meaningless bar; this seems a step in advance of the purely superficial representations hitherto engraved in books on numismatics. Above the obverse is the weight in *grani*, below it

CONTEMPORANEOUS TVSCAN COINAGE.

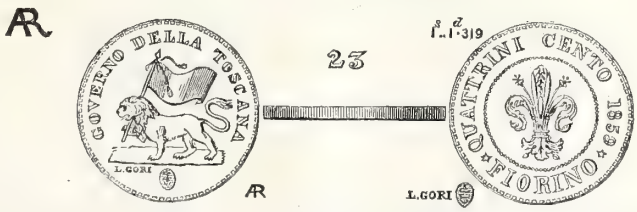


1s. = 2·253 Pauls. £1 = 45·049 Pauls. 1 Paolo = 5·3275d.

LORRAINE DYNASTY



PROVISIONAL GOVERNMENT.



W. P. Jervis, Ad. Nat. Delt.

1 lb. Troy = 3200·67 *Grani*, or 1 lb. Avoird. = 3889·75 *Grani*.—1 *Libbra Toscana* = 5240·5 Grains Troy = 0·9098 lb. Troy = 0·7486 lb. Avoird.

the sign for the metal, and its proportion in 1,000 parts; above the reverse is the value in English money, below it the mint mark enlarged. The relative value of gold and silver in Tuscany is shown in another part of the page.

Conventional signs:—A = *aurum*, gold. AR = *argentum*, silver. Æ = æs, copper. No analogous signs existing to express other metals and alloys, I have taken the liberty of adding some of my own invention: as in all these matters I have acted after due consideration, I sincerely trust that through the wide-spread influence of the *Journal*, my system may be brought before numismatists and approved of as appropriate, instructive, and simple. The combination of the letters seems to be classical, while it does not interfere with chemical symbols representing *pure* metals. These are:—VAR = *electrum*, $\frac{4}{5}$ *aurum*, *et* $\frac{1}{5}$ *argentum*; ÆR = *billon* (base metal), *æs et argentum*; Æ = brass, *æs et zincum*; Æ = bronze, *æs et stannum*; Fe = *ferrum*, iron; Pb = *plumbum*, lead; Æ = *potin gris* of the French, *æs, stannum et zincum*; Æ = *potin jaune, æs, plumbum et zincum*; Pt = platinum; Sn = pewter, *stannum, plumbum*. Thus, AR 917 means silver $\frac{917}{1000}$; 980 AR 20 means copper $\frac{980}{1000}$, silver $\frac{20}{1000}$ copper.

Each coin, as far as possible, is accompanied by its etymology and history. The value of the coins in English money, is according to the best and latest authority on the subject, that of Colonel Jervis.

Tables of Coins of the Lorraine Dynasty.

1 *Quattrino*													
3 *Quattrini*	=	1 *Soldo.*											*Billon.*
5 ,,													
5 ,,	=		=	1 *Crazia*—Base Metal.									
	=			4 *Crazie*	=	½ *Paolo*							
30 ,,	=	10 *Soldi.*	=	6 ,,	=		=	½ *Lira*					
	=		=	8 ,,	=	1 ,,	=						
50 ,,	=		=	10 ,,	=		=		=	½ *Fiorino*			
60 ,,	=	20 ,,	=	12 ,,	=	1½ ,,	=	1 ,,					
100 ,,	=		=	20 ,,	=		=		=	1 ,,			Silver.
		40 ,,	=	24 ,,	=	3 *Paoli*	=	2 *Lire or Testone*	=				
			=	40 ,,	=	5 ,, *or Franceschino*	=		=	2 *Fiorini*			
		120 ,,	=	72 ,,	=	9 ,,	=	6 ,, *or Tallaro*	=				
			=	80 ,,	=	10 ,, *or Francescone*	=		=	4 ,,			
			=	84 ,,	=		=	7 ,, *or Ducatone*	=				
													Gold.
				20 ,,			=		=	8 ,,	=	1	*Zecchino, Gigliato, or Ruspo.*
				60 ,,			=		=	24 ,,	=	3	*Zecchini, Gigliati, or Ruspi* = 1 *Ruspone.*
				200 ,,			=		=	80 ,,			

*** Where one coin does not bear any relation to another, owing to the diversity of Units, a blank space has been left between the signs of equality, except that it would be useless to give the equivalents in the higher coins of the base metal money. The *Denaro*, or $\frac{1}{12}$ of a Soldo, has long been a mere imaginary division. The name *Francescone* seems to be more fashionable than *Lire*, and may be considered analogous to our "guinea" for 21s.

A. Silver Coins.

Examples:—

1. *Lira.* Obverse, head of the Grand Duke looking towards the right hand; legend, FERDINANDO III. A. D'A. G-D. DI. TOSC. Reverse, inscription, LIRA 1822. with wreath of olive leaves. Edge, indented. Weight, 83 *grani.* Value, 7·991d.

*** *Lira* is derived from *libra*, a pound, and is the same as *livre* in French.

2. ½-*Lira.* Obverse, oval shield with Grand Ducal Arms; legend, FERD. III. A. D'A. G.D. DI TOSC. Reverse: inscription, 10 SOLDI; legend, MEZZA LIRA 1821. Edge: indented. Silver, 925.

3. *Paolo.* Obverse, head of Grand Duke looking to the right; legend, LEOP. II. D. G. P. R. H. ET B. A.A. M-D. ETR. Reverse: oval shield with Royal Arms, crown, and collar of the order of the Golden Fleece; legend, SVSCEPTOR NOSTER DEVS. 1843. Edge, milled. Silver, 918. Weight, 56 *grani;* value, 5.327d.

4. ½-*Paolo.* Obverse, same as foregoing. Reverse, same except date, 1839. Edge: finely milled.

5. *Fiorino*, or Florin. Obverse: head of Grand Duke looking towards the right; legend, LEOPOLDO II. A. [*reiduca*] D'A. [*ustria*] GRANDUCA DI TOSCANA. Reverse: lily, *fleur de lys*, or *giglio;* inscription, FIORINO; legend, QUATTRINI CENTO 1828. Edge, milled. Weight, 140 *grani;* value, 1s. 1·319d.

*** The name Florin was first used at Florence, being derived from the lily or *giglio* (the arms of that city from time immemorial), *fiorino* (a little flower) being simply the diminutive of *fiore.* Gold florins were minted in Florence as early as 1189; mention is again made of them in history in 1338. Other nations have adopted the word from the Florentines; thus, Prussia, Holland, England, Hanover, Geneva; but I believe we only have kept the etymology in view, or accidentally inserted little flowers.

6. ½-*Fiorino*, or ½-Florin. Obverse: triangular shield with Grand Ducal Arms; legend, LEOP. [*oldo*] II. A. [*reiduca*] D'A. [*ustria*] GRAND. [*uca*] DI TOSC. [*ana*]. Reverse: inscription, ½-FIORINO, 1827; legend, QUATTRINI 50. Edge: milled.

7. ¼-*Fiorino.* Obverse: same as foregoing. Reverse: inscription, ¼-FIORINO 1827; legend, QUATTRINI 25. Edge: milled.

8. *Franceschino* (little Francis); more rarely *Leopoldino.* Obverse: head of Grand Duke; legend, LEOPOLDO II. D. [*ei*] G. [*ratiâ*] P. I. A. P. [*rinceps*] R. [*egius*] H. [*ungariæ*] ET B. [*arii*] A. [*rchidux*] A. [*ustriæ*] MAGN. [*us*] DVX ETR. [*uriæ*]. Reverse: triangular shield with Royal Arms, and order of the Golden Fleece, surmounted by the Grand Ducal Crown; legend, SVSCEPTOR NOSTER DEVS. PISIS. 1828. Round the edge: CINQUE PAOLI. DUE FIORINI. Weight, 280 *grani;* value, 2s. 2.637d.

9. *Francescone* (large Francis); more rarely *Leopoldone*, though the word was seldom employed. Obverse: same as foregoing. Reverse: square shield with Royal Arms, surmounted by crown, collar of the order of the Golden Fleece, and star; legend, SVSCEPTOR NOSTER DEVS. PISIS. 1846. Round the edge: DIECI PAOLI. QUATTRO FIORINI. Weight, 560 *grani;* value, 4s. 5.275d.

10. *Ducatone.* Obverse: head of Grand Duke; legend, COSMOS III. D. [*ei*] G. [*ratiâ*] MAG. [*nus*] DVX ETR [*uriæ*] [*regni*] VI. Reverse: St. John baptising our Saviour; legend, FILIVS MEVS DILECTVS.

*** *Ducatone* means the large Duke, the Venetian ducat; probably the original one had the inscription Ducatus Venetus.

The silver with which these coins were struck was in great measure obtained from Tuscan mines, especially that of Bottino (*See ante p.* 701). The fineness of the silver is expressed in *Oncie* and *Denari.*

1 *Libbra* (lb.) = 12 *oncie*, = 288 *denari*; = 5,240·5 Troy grains.

Note.—On close inspection it will be observed that there is a square notch at the bottom of the body strokes of some letters in the legend on the Franceschino and Francescone; this is evidently a precaution against forgery; in order to shew it plainer, I have made use of those notched characters in the headings for the engravings.

B.—Gold Coinage.

Examples:—

11. *Zecchino* (Sequin); *Ruspo*, or *Gigliato*. Obverse, the *giglio*; legend, LEOPOLDVS II. D.G. A.A. M.D. ETR. Reverse, John the Baptist sitting down on a rock, looking towards the left, right hand uplifted, and holding a slender cross in his right hand; legend, S. IOANNES BAPTISTA; Edge: milled diagonally. Value, 8s. 10·55d.

*** *Zecchino* is the diminutive of *Zecca*, the *mint*, signifying a small coin from the mint; I have seen some Italian coins with the word *Zecca* inscribed on them; (*Gigliato*, with a lily).

12. *Ruspone*. Same obverse as the foregoing coin. Reverse: John the Baptist, full length, looking towards the right, and seated on a rock, on which his left hand rests, a slender cross in his right hand; he wears a camel's hair garment; legend, S. IOANNES BAPTISTA, 1836. Scroll milling. $32\frac{32}{71}$ *rusponi* were minted from 1lb. of fine gold, and are without alloy or remedy. Weight, 213 *grani*. Value, £1 6s. 7·65d.

13. Piece of 80 *Fiorini*. Obverse: Lily or *giglio*; legend, LEOPOLDVS II. D.G. P.I.A. P.R.H. ET B. A.A. MAGN. DVX ETR. Reverse, triangular shield, with Grand Ducal arms, two spears with flags, collar of the order of the Golden Fleece, and crown; legend, SVSCEPTOR NOSTER DEVS. Kt. 24 . 1827. Round the edge, which is shaded diagonally, 200 PAOLI OTTANTA FIORINI. Weight, 664 *grani*. $10\frac{34}{83}$ were minted to 1 *libbra* of pure gold. Value, £4 8s. 9·5d.

The fineness of the gold was expressed in carats and *ottavi* or eighths, or:—

Ottavi.	*Carati.*
8 =	1
192 =	24 = 1 *Libbra.*

Grani.	*Denari.*			
$32\frac{1}{9}$ =	1	*Dramme.*		
,, =	3 =	1	*Oncie.*	
$242\frac{2}{3}$ =	24 =	8 =	1	
2912 =	288 =	96 =	12 =	1 *Libbra.*

The relative value of gold and silver in the Tuscan coinage is 15·5 : 1. Silver money is vulgarly termed *moneta bianca* (white money), in contra-distinction to *moneta nera* (black money), or *billon* coins, and is further styled *moneta buona* (good money), that is, coins struck at Florence or Pisa, while an imaginary currency used in accounts at Leghorn was, till very recently, called *moneta lunga*, and had a far lower value.

C.—Base Metal.

14. *Crazia*. Obverse, scroll shield with two balls, surmounted by a crown; legend, JO. [*annes*] GASTO. [*nus*] D. [*ei*] G. [*ratiâ*] M. [*agnus*] DVX ETR, [*ruriæ*]. Reverse, John the Baptist erect, clothed with a camel's hair garment; right hand raised, a cross in his left; legend, S. IOANNES BAPTIS. [*ta*]; *no date*. Edge, plain. These coins are very ancient and perfectly worn out. Many no longer bear the slightest impression or mark, and are now little else than shapeless metal foil, as exhibited in fig. 14A. They were minted by the Medici sovereigns. The first coinage of *crazie* was by Cosmos I., in 1538; 318 *crazie* were minted from 1 *libbra* of alloy, *lega*, consisting of 4 *oncie* of silver and 8 *oncie* of copper.

*** The etymology of Crazia is curious. The first word the traveller hears in Egypt is *bakshish! bakshish!* In Tuscany, until the new pauper act last autumn, it was, "Signorina, dammi una *crazia* pel'amor della vergine." It is supposed that the word has been corrupted from *grazia*, benevolence, charity, and that Cosmo originally had them struck for distribution to the numerous beggars who might present themselves to the passer by. If this be true, they have not failed for centuries to avail themselves largely of the privilege.

D. Billon Coinage.

The chief billon coins are the pieces of 1, 3, and 5 *quattrini*.

Examples:—

15. *Quattrino*. Obverse, square shield, with Grand Ducal arms and crown; legend, LEOP. II. A. D'A. G.D. DI TOSC.; reverse, inscription, 1 QUATTRINO, 1852. Edge, plain.

*** *Quattrino* is either derived from the Etruscan *quadrans*, a quarter of an *as*, or from having been equal to 4 *denari* or *piccioli*, a former coin of Tuscany.

16. 3 *Quattrini*, vulgarly called the *Soldo*, though having no reference whatever to the florin or paul. Obverse; shield same as on foregoing. Legend, LEOP. II. A.D' A. GRAND. DI TOSC.; reverse, inscription, 3 QUATTRINI, 1846. Edge, plain.

17. 5 *Quattrini*. Same obverse and reverse. Edge, plain.

*** *Soldo* is from an ancient Roman coin, the *solidus*. *Picciolo* simply means tiny, as at the time of its being employed it was the smallest coin.

E. Lucchese Silver Coinage.

New system: 1833—1847, when the Duchy of Lucca was incorporated with Tuscany. These coins still pass in the compartment of Lucca, though now becoming rare.

Examples:—

18. *Lira nuova*: Obverse, head of Duke; legend, CARLO LUD. (*ovico*) I. D. S. DUCA DI LUCCA. Reverse, inscription, LIRA, encircled with oak and olive wreath—date, 1837.

*** The olive wreath on the coins of Lucca is doubly appropriate, not only denoting peace, but pointing to the chief source of the riches of the country.

19. Double *Lira*: Obverse, same as foregoing. Reverse, arms of the duke, with three *Fleurs de Lys*, surmounted by ducal crown, wreath, and date, 1837.

20. 10 *Soldi*: Obverse, head of the Prince; legend, CARLO L. I. D. S. D. [*uca*] DI LUCCA. Reverse, 10 SOLDI, 1838, with wreaths of leaves.

21. 5 *Soldi*: Obverse, royal arms and crown; legend, DUCATO DI LUCCA. Reverse, 5 SOLDI, 1833.

F. Lucchese Gold Coinage

Has long been discontinued; only Tuscan gold money had been employed for many years previous to 1847.

G. Lucchese Copper Coinage.

22. *Soldi* were also coined in Lucca; 20 Soldi = 1 *Lira nuova*.

Quattrini and *Crazie* were constantly brought in by the market people from Pisa and Pistoja, though the circulation was not strictly legal.

H. Tuscan Provisional Government, 1859.

23. *Fiorino*. Obverse, Passant Lion, looking towards the left, holding in its paw a tricoloured flag; legend, GOVERNO DELLA TOSCANA. Reverse, *Giglio*, or surrounded by a circle of dots; inscription, FIORINO; legend, QUATTRINI CENTO, 1859. Milled edge.

Compelled by circumstances to lay aside these papers for the present, I trust to be some day in a position to present to the public a more digested and complete description of the mineral resources of Tuscany, embodying what I have had the pleasure of bringing before the Society of Arts, to whom, if agreeable, I may perhaps have the opportunity of communicating papers on the coal, alabaster, inlaid stones, pottery, &c., thus concluding my

subject. If the interests of Tuscany will be any how advanced by my exertions, I shall be well repaid for my trouble.

To the friends who have encouraged me in bringing forward these papers I owe much. The too flattering notices of my first lecture, by Professor Miller, lay me under a debt of gratitude ill repaid by a mere acknowledgment; without it these pages might never have appeared.

> "Sunt quos curriculo pulverem Olympicum
> Collegisse juvat: metaque fervidis
> Evitata rotis, palmaque nobilis
> Terrarum Dominos evehit ad Deos."
> *Horace.* Lib. I. Ode 1.

For me in my rambles no such chariot awaited, though I, too, have delighted in collecting Tyrrhenian dust, or heavier stones. If the reader has been gratified by the perusal of a paper, the result of much conscientious study, perhaps he will not think me egotistical in making the following personal sketch, which may possibly prove instructive to travellers. The whole of the period I was in Tuscany the country was supposed to be in a state of revolution. My labours commenced as the sovereign, jumping into his coach, bade farewell to Arno's fair city, and returned across the Appenines. Without a fixed government, and an easy prey to republican demagogues, the world turned anxious gaze towards Etruria. The legions of France were summoned for her protection, and a Napoleon once more entered in triumph at the gates of Florence, where whispers were already audible that the Austrians, distant only 60 miles, could descend any day of the week. Scarcely an Englishman was left in the Grand Duchy. Such were the time and circumstances chosen for making a mineralogical tour through Tuscany. The red blush of a new day streaked the sky, and the fresh air of a political dawn was so tempting that the writer set out at once on his journey, his only conveyance his own legs; his arms a geologist's hammer; his best passport some knowledge of the language, a tricolour cockade presented on landing in Italy, thorough feeling of sympathy for the movements, and being an out-and-out revolutionist.

Our libraries are gorged with books of travel in Italy, but I might present one containing thrilling incidents too. Frankly do I confess that my description has been of a discursive character; perhaps I have often wandered rather too far from the subject with which I had to deal. For this, indulgent reader, know the cause. Mine was a "ramble" not only beyond railways, but literally "beyond roads, and without a Murray." I have, therefore, really no beaten path of description to follow; add to this the perfect newness of the subject, never yet treated by any one. Furnished with a trusty map, I proceeded alone "to discover the nakedness of the land," across mountains, through woods, and along the boisterous course of meandering torrents, without any guide, performing at least 500 miles on foot, besides riding. By this means I believe I have seen more of Tuscany than most men of property driving in their post-chaise from town to town, to whom the first hotel keepers have emulated in their civilities. Universal kindness awaited me. Emblem of life. One day I was the guest of a nobleman; the next I supped with the shepherd's family; now sleeping under the hospitable roof of the proprietor of some mine; the next putting up with a soldier's folding cot at a wayside cottage; anon, benighted, compelled to ask shelter at the door of a coast-guard station, far from other human habitation, or even lodging, on a distant rock with poor fallen humanity, in the penal settlement of Pianosa. Strange as many thought the purport of my unusual visit, only once (and that was in Modena) I had my passport endorsed with the words, "with recommendation to proceed forthwith on his journey; good for Sardinia." Three times only in my lonely rambles was I stopped and examined by the police; but these were soon perfectly satisfied by frankness of explanation and urbanity of behaviour, though at that period a gentleman and a labourer's hammer were beyond all reconciliation, except I had escaped from an asylum. On one of these occasions the reason of my detention became subsequently apparent, an Austrian spy being that day tracked, and found in the French camp at the Cascine at Florence. I might be that spy, and was, therefore, tortured with examination by the *gendarmerie.* We parted friends, and I commended them for their acuteness in discovering, by my gait, that I was a foreigner. The second time, a troop of boys, seeing me brought back by two *gendarmi*, followed in high glee. When the door was finally opened, oh! for the pen of a ready writer to paint their varied, chop-fallen physiognomy, while the first looked at me with contempt as an Austrian about to be sent into the other world, and then saw the armed men politely touch their *beretti*, apologise for the detention, and wish me a happy journey! On another occasion two foreigners, unable to give a satisfactory account of themselves, were shot without trial at midnight in the public square of a town where I entered the following morning. The moral influence of an educated man over the Tuscan masses is inconceivable. I was constantly asked my opinion regarding the desirability of union with Piedmont, and became a sort of village orator, while a group of attentive hearers listened to all I said to them about British freedom; *not a few* of the electors, I feel persuaded, voted for Victor Emmanuel through *my* instrumentality, nor am I deviating from my subject, for this was a key to the hearts of all, whom I afterwards freely questioned regarding points of interest relating to the mines, and I was sure to be answered without reserve or suspicion. The mines of Tuscany were of the deepest interest, but the study of humanity, making a sudden start towards development, was a rarer and more wonderful spectacle.

To me there is a charm in the name of Italy; the very mines are covered with the perfumed dust of antiquity. If it be the duty of the geologist to go back to the origin of things, is it not right for the mineralogist to do the same? If this be possibly the first such history of mines and minerals, surely no spot could have been better adapted for description than Tuscany. The geologist, in my opinion, leaves many an interesting stone unturned who does not connect the history of our race with that of natural objects.

Before parting I must throw off my veil; "the goal" at which I aim, and "the noble palm which shall place me among the immortals," will be nothing short of success in turning the attention of our countrymen, as well as of Italians, to the Mineral Resources of Tuscany; this I say with the more freeness, as not being in the remotest degree pecuniarily interested. I have spoken all along of the grandeur of Italy as a *fait accompli*, it is rapidly becoming so, and may be achieved ere this is published. Had Virgil seen these days he might thus have paraphrased his beautiful lines:—

> "Sicelides Musæ,* paulò majora canamus.
> Non omnes arbusta juvant, humilesque myricæ.
> Si canimus rupes,† rupes† sint consulæ dignæ
> Ultima Cumæi venit jam carminis ætas:
> Magnus ab integro sêclorum nascitur ordo.
> Jam redit et Virgo, redeunt Saturnia regna:‡
> Jam nova progenies cælo demittitur alto.
> Tu modò nascenti puero, quo aurea§ primùm
> Desinet, ac toto surget gens ferrea§ mundo,
> Casta fave Lucina: tuus jam regnat Apollo.
> * * * * * *
> Alter erit tum Typhis ut altera quæ vehat Argo
> Delectos heroas; erunt etiam altera bella;¶
> Atque iterum ad Trojam magnus mittetur Achilles."
> *Virgil.* Ecloga IV., l. i.

* Biographers of Garibaldi.—† Substituting *rupes*, *geology*, for original, *sylvæ*, *husbandry*.—‡ United kingdom of Italy.—§ Purposely transposed: *gens aurea*, the luxury of despots: *gens ferrea*, the civilising steam engine and net-work of railways.—¶ The Palermitan expedition and expected invasion of Southern Italy.

I would place a volunteer corps of 1000 geologists, well trained in a central mining school at Florence, in line with any similar number who might burn to liberate Italy. Let none despise the mineralogist's hammer; it may yet lend its aid in undermining the stronghold of tottering despotism. As the last step in the climax, I believe that a glorious future is being worked out for Italy by a Higher Power; but to obtain this end let every Italian be armed with "the Sword of the Spirit," manufactured with metal of finer temper than that of Elba, for:—

> "Deep in unfathomable mines
> Of never-failing skill,
> God treasures up his bright designs
> And works his sovereign will;
> His purposes will ripen fast,
> Unfolding every hour."
>
> *Cowper*, Book III., 16.

> "Hail! universal Lord, be bounteous still
> To send Italia good; and if long night*
> Have gathered aught of evil or conceal'd,
> Disperse it, as now light dispels the dark."
>
> *Paradise Lost.* Book IV.

INDIAN MONUMENTS OF ARCHITECTURE.

Mr. John Bell has recently called attention, in the *Building News*, to the importance of producing some adequate record of the splendid architectural monuments that are to be found in our Indian Empire. He says:—

"Britain has been in possession now for many years of a vast empire in the East, now fortunately with an appearance of more permanence than ever; yet we have no adequate work on its monuments of architecture. France, on the other hand, during her short and hurried occupation of Egypt, produced on the monuments of that country a grand work by Deran and the Institute, which, in some respects, has never been surpassed since, and which at once poured in a flood of information on the ancient condition of that country, especially of her triumphs of architecture. It may well occur to us, from this comparison, to consider what the French would undoubtedly have done long ere this in the way of illustrating and making known the architectural triumphs of India, if that empire had been in her possession instead of in ours. In many, and some of the more important respects, we are, doubtless, far more fitted to develop the resources of any country over which we obtain power than the French are, but why should there be a shortcoming in this respect of art?

* * * * *

"At the present juncture it appears probable that a new era in Indian Government has commenced. A grand phase of danger has just passed, and a new regimen of constitutional health is in the course of establishment. Our vast empire of Ind has now also become more directly under the sway of our Government and our Queen. Would not this then be a suitable time for the invocation of a Government action of some kind, perhaps of the nature of a commission, to do that which the French would have done long ago in similar circumstances—that is, to ascertain and record India's great and varied architectural glories of which I have heard, from those who had the best opportunities of judging, we have but little idea?

* * * * *

"I am aware that various scattered records exist in the British Museum and elsewhere, which afford part of the interesting information of which I speak, and I by no means suggest that we should overlook any sources which we have near us, but rather that the whole information that we have at hand, or which is to be gained by fresh expeditions, should be organised, so that the vast and poetical region which we are proud to view as part of the domains of our Queen, should no longer be neglected as regards its monuments of architecture, or the amount of information and illustration which the public should possess of them."

In a subsequent letter he speaks of the increased attention which was now beginning to be bestowed upon all the products of India, and he specially mentions the valuable paper read before the Society last session by Dr. Forbes Watson. In no department of our knowledge of that important country are we, in Mr. Bell's opinion, more backward than in our acquaintance with its art monuments. As to the mode by which this want should be supplied, he makes the following further remarks:—

"The question remains, how is this to be set about—private individuals and companies do most things in this country. Should this question be left to them in this case? I venture to think not. The East India Company certainly did not do what was wanted in this respect. Nor do I conceive it would be very easy to get up even a "limited liability" company to produce an adequate representation of the architecture of India. India has now come under the immediate domination of Government. Government, in her various civil and military officers throughout India, has all the machinery to her hand, which no individual or private company could have. These gentlemen are mostly intelligent and educated. Many of them draw—some of them extremely well—and many of them also have individually gathered information in detail, which, if it had been, or were now, collected in relation with some organised system, would supply much of that knowledge for which I plead. Photography also now lends its ready aid in the way of illustration; and the practice of this and the pen, in recording the monuments of art in the neighbourhood of a station, might be a relaxation, as healthy occasionally, and less perilous, than hog hunting or a tiger battue. At least, it would be a means of varying the amusements of the place, and would yield a satisfaction more solid than mere pastime. This is an action that is ready to the hands of Government, and one which, with encouragement, might easily be set on foot on their part.

"Government, however, probably, would not set about this of itself, but would, at least, wait for some gentle pressure from without. Therefore it occurs to consider from what quarter this pressure might most appropriately be applied. One may naturally suppose, from those Societies of the metropolis who are either learned or artistic, or who are most energetic in the cause of progress. In one or other of these categories may assuredly be reckoned the Society of Arts, the Royal Academy, the Institute and Association of British Architects, and the Society of Antiquaries. These bodies, at least, are, in some way or other, directly interested in the subject, and there are others which are collaterally so. I do not presume to any authority in suggesting a course of action, but it appears to me, as one of the public, that if in the coming session of these societies, the subject in question were brought under their notice and favourably received, a united deputation from them to the proper department of Government would have the surety of attention. The immediate result might probably be that Government would decline action, but would promise facilities. Nevertheless, a step would thus be made in advance in the right direction, and we should be by so much the nearer to that which we ought to possess—namely, a full and faithful record of the varied, numerous, characteristic, and in many cases, most beautiful monuments of structure and art in our empire in the East.'

* Original—*To send us only good, and if the night.*

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 7th*, 1860.]

Dated 27th August, 1860.

2065. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in surface blow-offs for steam-boilers. (A com.)

2066. R. A. Brooman, 166, Fleet-street—Imp. in melodeons and similar keyed musical instruments. (A com.)
2067. C. L. Platon, Lyon Town, France—Machinery or apparatus for washing yarns and other textile fabrics or materials in skeins.
2069. A. V. Newton, 66, Chancery-lane—Imp. in bakers' ovens. (A com.)
2070. C. Mather, Salford, Lancashire—Imp. in gas singeing apparatus.

Dated 28th August, 1860.

2071. P. Effertz, Manchester—Imp. in machinery or apparatus for making bricks, tiles, and similar articles, and in apparatus for transporting the same, which improvements are also applicable for the utilising of turf peat, coal dust, or similar substances.
2072. J. H. Radcliffe, Oldham—Imp. in lubricating cans or vessels.
2073. H. Marriott, Preston—Imp. in fire-escapes.
2074. C. W. Siemens, Great George street, Westminster—Imp. in engines to be worked by the expansion and contraction of steam and other elastic fluids.
2076. E. Ellis, St. Ann's Well-road, Nottingham, and W. Redgate, Nottingham—Imp. in apparatus employed in bobbin net, or twist lace machines.
2077. B. Hirst, Leeds, Yorkshire—Imp. in the construction of steam and other engines.
2078. M. J. Haines, 30, Marlborough-street, Bristol—Imp. in the manufacture of driving straps.
2079. C. Kilner, G. Kilner, W. Kilner, and J. Kilner, Providence Glass Bottle Works, Thornhill, Leeds, near Dewsbury, Yorkshire—Imp. in the manufacture of glass bottles, and the apparatus connected therewith.

Dated 29th August, 1860.

2081. R. Vines, 3, Great College-street, Camden Town, St. Pancras—Self-acting transverse floats for the propelling of steam vessels without any backwater.
2085. W. H. Wain, Birmingham, and W. Instone, Wolverhampton—A new or improved lamp.
2087. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of iron and steel. (A com.)
9089. Sir P. Fairbairn, Leeds—Imp. in the construction of rollers used in machinery for preparing hemp and flax.

[*From Gazette, September 14th*, 1860.]

Dated 30th August, 1860.

2093. A. A. Beaumont, 4, South-street, Finsbury—An engine for raising liquids.
2095. G. P. Dodge, 44, St. Paul's Churchyard, London—Imp. in pumps and in apparatus for working the same. (A com.)
2097. J. Jones, jun., Liverpool—Imp. in gun carriages.
2099. W. E. Newton, 66, Chancery-lane—Imp. in floating structures. (A com.)

Dated 31st August, 1860.

2101. C. Martin, Isleworth, Middlesex—Imp. in the form and in the method of and means for constructing beams, joists, girders, and rails, and in the permanent way of railways generally.
2103. A. S. Stocker, Clifton, Gloucestershire—Imp. in the manufacture of horse shoes.
2105. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the treatment of zinc and other ores, and in the apparatus employed therein. (A com.)
2107. S. C. Salisbury, Essex-street, Westminster, and J. F. Dickson, Nottingham—Imp. in sewing machines.
2109. W. F. Snowden, Chichester-place, Gray's-inn-road, Middlesex—Improved machinery for cutting chaff.
2111. J. G. Willans, 2, Clarence-place, Belfast—Imp. in the manufacture of iron and steel.

Dated 1st September, 1860.

2113. M. R. Pilon, Brussels—Imp in the manufacture and construction of fire-arms, and in the means of loading the same and controlling more effectually the action of the fire-lock.
2117. W. Johnston and W. Ross, Glasgow—Imp. in taps or valves.
2119. J. Fisher, Leamington, Warwickshire, and J. Fisher, Dudley, Worcestershire—An imp. in oven grates and kitchen ranges.

Dated 3rd September, 1860.

2121. W. Forgie and T. Finn, Nottingham—Imp. in the construction of apparatus for the preservation of life from drowning, and in the preparation of the material employed for this purpose, and for rendering articles buoyant in water.
2123. W. H. Muntz, Millbrook, Hants—An improved apparatus for relieving the strain upon ships' cables.
2125. C. Mason, Basford, Nottingham—Imp. in apparatus for dressing lace.
2127. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of moulds and cores for the casting of cylindrical articles, and in the machinery or apparatus employed therein. (A com.)

Dated 4th September, 1860.

2129. W. H. Delamare, 14, Clarence-place, Hackney-road, Middlesex—An improved machine for cleansing and peeling grain and seeds.
2131. J. Hughes, W. Williams, and G. Leyshon, Brookmoor Works, Brierly Hill, Staffordshire—Imp. in the manufacture of tin and terne plates, and in apparatus employed therein.
2133. G. P. Wheeler, Abinghall, near Mitcheldean, Gloucestershire—An improved mode of and apparatus for preparing half-stuff for paper makers.
2135. A. Southby, Bulford, Wiltshire—Imp. in the manufacture of paper.

Dated 5th September, 1860.

2137. S. Schuhman, Burnley, Lancashire—Imp. in looms, and in the means of driving the same.
2139. E. Vauvillé, 96, Rue de Bondy, Paris—A system of extracting juice from beetroot and other plants.
2141. J. Cooper, Bilston—Imp. in railways, railway carriages, and apparatus connected therewith.
2143. W. E. Newton, 66, Chancery lane—An imp. in belt shippers. (A com.)
2145. M. Vergnes, New York, U.S.—An imp. in the construction of magnetic or electric helices.
2147. W. R. Kinipple, Limehouse, Middlesex—An imp. in water-closets, and in flushing tanks or apparatuses.

Invention with Complete Specifications Filed.

2164. C. Stevens, 18, Welbeck-street, Cavendish-square—An improved lavatory. (A com.)—7th September, 1860.

Patents Sealed.

[*From Gazette, September 14th*, 1860.]

September 12th.
419. J. G. Jennings.
666. W. E. Gedge.
667. S. Smith and P. Hathaway.
668. J. Wright.
680. I. Horton and I. Kendrick.
691. M. A. F. Mennons.
695. G. White.
699. W. Weild.
703. T. Richardson.
706. W. N. Wilson.
711. W. Clark.
715. J. Ellis, W. Winterbottom, and J. Bradock.
717. W. Clark.
720. P. M. Parsons.
742. G. Crawshay.
745. J. Grainger.
758. W. E. Newton.
759. B. Cooper.
779. H. Goarlay and E. Kemp.
783. J. H. Johnson.
955. W. E. Newton.
1068. W. E. Newton.
1499. R. Bodmer.
1573. J. Whitehouse.
1632. J. Noone.
1660. F. C. Warlich.
1698. W. Bragge.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, September 14th*, 1860.]

September 10th.
2370. S. Colbeck and W. H. Colbeck.
2409. E. Hayes.

September 11th.
2377. I. C. Cloet.

September 12th.
2382. W. Jenkins.

[*From Gazette, September 18th*, 1860.]

September 14th.
2413. H. Greaves.

September 15th.
2401. A. R. Le Mire de Normandy and E. T. Simpson.
2411. I. L. Pulvermacher.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, September 14th*, 1860.]

September 10th.
2104. J. W. Child & R. Wilson.
2135. M. Poole.
2166. C. Nickels and R. Selby.

[*From Gazette, September 18th*, 1860.]

September 15th.
2167. H. C. Jennings.
2312. H. Clayton.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Registry.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,283	August 18th.	Improved Perforating Machine	Thomas Brightly	Saxmundham, Suffolk.
4,284	" 18th.	Railway Roof, Ship, and other Shadowless Lamps	John Pears	Birmingham.
4,285	" 24th.	Churn	Henry Wilkinson	Alston Moor, Cumberland.
4,286	" 25th.	Bedstead Fastener	Telford and Co.	15, Brottesley-street, Birmingham.
4,287	" 31st.	Knickerbocker Pants	Browne and Payne	Sackville-street, Dublin.
4,288	Septem. 6th.	Military or Volunteer Cloak	Macleod and Co	75, Buchanan-street, Glasgow.
4,289	" 10th.	Smith's Forge	Charles Seward	King's-clere, Southampton.
4,290	" 10th.	Tangential Strainer for Iron Fences	Keenan and Sons	19, Fishamble-street, Dublin.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 28, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

*** *The names marked with an asterisk are those of Members of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£364,500	
Charles Candy and Co., Watling-street, E.C.	500	Commerce.
*J. Evan Thomas, F.S.A., 7, Lower Belgrave-place, Pimlico, S.W.	100	Arts.
Total	£365,100	

By Order, P. LE NEVE FOSTER, *Secretary.*

SOUTHERN COUNTIES ADULT EDUCATION SOCIETY.—CONFERENCE.

The Institutions in Union with the Society of Arts in Hants, Wilts, and Dorset, are informed that the "Southern Counties Adult Education Society" will meet in Conference, at Warminster, on Tuesday and Wednesday next, the 2nd and 3rd of October.

In the morning, the Conference will be presided over by the Very Reverend W. F. Hook, D.D., Dean of Chichester. There will be a public dinner at half-past four.

In the evening there will be four meetings in section:—

1st. "Night Schools." Chairman, Archdeacon Hony.

2nd. "Town and Village Institutions." Chairman, Harry Chester, Esq., Vice-P. of the Society of Arts.

3rd. "Education as it affects the Home, and the Home as it affects Education." Chairman, the Rev. A. Fane.

4th. "Societies having an influence on the advancement of Education." Chairman, the Right Hon. T. Sotheron Estcourt, M.P.

There will be a second General Meeting on Wednesday, at 12 o'clock, at which a Report of the Papers read in the Sections will be presented, and a discussion held thereon.

Members of the Society of Arts, and of Institutions in Union with the Society of Arts, are invited to attend the Conference.

Communications respecting the papers to be read, and the business to be transacted, are to be addressed to the Hon. and Rev. S. Best, Abbott's Ann, Andover.

FLAX AND ITS PRODUCTS IN IRELAND.

By Wm. Charley, J.P., Seymour-hill, Belfast.

Letter XVII.

When linen goods are received by the merchant from the bleach works in the finished state, they are placed in cool store rooms, and are kept there, till required, in the uniform and simple fold that the last process leaves them in; they are afterwards refolded, or, technically speaking, "lapped," in special lengths and styles to suit the various markets of the world.

Goods for the home trade are generally folded in thick pieces, containing 25 to 30 yards each, and are neatly but plainly ornamented with fancy ribbons and papers; the linens for export are generally more highly ornamented, and great expense is thus sometimes incurred, which of course enhances the price demanded for the article. Fine linen frontings and cambric handkerchiefs are often put in elaborately-made boxes, with handsome prints on the exterior, no doubt very attractive to the children who may accompany "mamma" on her shopping excursions to town, where, of course, such commodities are eventually to be seen temptingly displayed in the bazaars.

The names given by merchants to various peculiar styles of finish, &c., in linen goods, were often originally taken from some country or district once celebrated for this peculiarity of style; however, by long use this origin is forgotten, and the name then became a generic name for a certain class. I recollect very well, while acting as juror in Class XIV., Great Exhibition, 1851, my attention being called by a German gentleman, a fellow juror, to some goods from Ireland made up in the style usual for the Mexican market, and stamped "Silesia legitima." He thought this hardly fair, but I explained to him that no fraud was intended, the name "Silesia" being now given

TABLE No. 1.—STATISTICS EXPLANATORY OF THE FRENCH TARIFF FOR BLEACHED LINENS, 1859.

TARIFF CLASSES. N.B.—Quality fixed by the number of Threads of Warp in one-fifth of an inch British.	Duty per 100 Kilos. 220 lbs. British.	Duty per lb. in British pence, Franc at 10d.	Weight of Piece 4-4 Linen, 30 Yards long.	Value at Belfast per Piece.	Present Duty per Piece, British Money.	The same per cent. British Money.	Average Tariff Duty per Piece, Light and Heavy.	*The same with addition of Peace Duty 10 per cent. on Tariff Duty.	The same with addition of War Duty, 20 per cent. on Tariff Duty.	New Duty Proposed by Treaty of 1860.	Duty by Tariff of 1836, estimated *ad valorem*.	Average of same.	Present Belgian Tariff Duty into France, estimated *ad valorem*.	Average of same.
1st. Less than 8 Threads (say 7°°, Irish count)	90 Francs	4·09d.	Heavy, half bleach, 16 lbs.	£1 1 3	£0 5 5·44	25·66	Average per centage of Duty—Light, 31·22. Heavy, 31·07.	Average, with Peace Duty, 10 per cent. additional—Light, 34·34 Heavy, 34·17	Average, with War Duty, 20 per cent. additional—Light, 37·46. Heavy, 37·27.	Not exceeding 30 per cent., to be reduced to 25 per cent.	See Table No. 2.—I have no information for Bleached Goods.	Do.		Average of Belgian Tariff Duty into France—Light, 19·90. Heavy, 18·51.
2nd. 8 Threads and less than 9 (8°°, ,,)	116 ,,	5·27d.	Heavy, ,, 14 ,,	1 1 10½	0 6 1·78	28·10							14·82	
3rd. 9 up to 12 Threads (average 10°°, ,,)	191 ,,	8·68d.	Heavy, ,, 14⅓ ,,	1 3 9	0 10 5·86	44·16						do.		
			Light, full bleach, 6½ ,,	1 0 0	0 4 8·42	23·50								
4th. 12 Threads (11°°, ,,)	219 ,,	9·95d.	Heavy, ,, 12 ,,	1 12 6	0 8 8·16	26·70								
			Light, ,, 6½ ,,	1 0 7½	0 5 4·67	26·12							15·20	
			Heavy, ,, 11½ ,,	1 13 9	0 9 6·42	28·25							16·45	
5th. 13 up to 16 Threads (13°°, ,,)	306 ,,	13·90d.	Light, ,, 6¼ ,,	1 2 6	0 7 2·87	32·17								
			Heavy, ,, 11 ,,	1 16 10½	0 12 8·90	34·55								
6th. 16 Threads (15°°, ,,)	417 ,,	18·95d.	Light, ,, 6¼ ,,	1 6 3	0 9 10·43	37·59						do.	22·98	
			Heavy, ,, 10½ ,,	2 1 3	0 16 6·97	40·19							24·57	
7th. 17 Threads (16°°, ,,)	457 ,,	20·77d.	Light, ,, 6¼ ,,	1 8 9	0 10 9·81	37·62								
			Heavy, ,, 10¼ ,,	2 3 9	0 17 8·89	40·55								
8th. 18 and 19 Threads (average 18°°, ,,)	477 ,,	21·68d.	Light, ,, 6¼ ,,	1 13 9	0 11 3·50	33·45								
			Heavy, ,, 9¼ ,,	2 10 7½	0 16 8·54	33·01								
9th. 20 Threads (19°°, ,,)	567 ,,	25·77d.	Light, ,, 6¼ ,,	1 17 6	0 13 5·06	35·79						Do.	24·14	
			Heavy, ,, 8½ ,,	2 15 0	0 18 3·04	33·18							22·38	
10th. Over 20 Threads (20°°, ,,)	817 ,,	37·13d.	Light, ,, 6 ,,	2 2 6	0 18 6·78	43·68								
			Heavy, ,, 7½ ,,	3 0 0	1 3 2·47	38·67								
,, (22°°, ,,)	817 ,,	37·13d.	Light, ,, 6 ,,	2 12 6	0 18 6·78	35·36								
			Heavy, ,, 7¼ ,,	3 15 0	1 2 5·19	29·91								
,, (24°°, ,,)	817 ,,	37·13d.	Light, ,, 5¾ ,,	3 15 0	0 17 9·49	23·72							17·27	
			Heavy, ,, 7 ,,	5 10 0	1 1 7·91	19·69							14·34	
,, (26°°, ,,)	817 ,,	37·13d.	Light, ,, 5¼ ,,	5 12 6	0 16 2·93	14·43								
			Heavy, ,, 6¼ ,,	7 15 0	0 19 4·06	12·47								

* NOTE.—I believe the new rate is not to exceed 5 per cent., and also as the franc is taken at 10d., the difference of exchange between 24 and say 25 to 25.40 per £ would cover this additional duty, leaving the average of the previous column strictly correct.—W. C.

[Arranged originally at the request of the Board of Trade, by WILLIAM CHARLEY, Seymour-hill, near Belfast.

TABLE No. 2.—STATISTICS EXPLANATORY OF THE FRENCH TARIFF FOR UNBLEACHED LINENS, 1859.

TARIFF CLASSES. N.B.—Quality fixed by the number of Threads of Warp in one-fifth of an inch British.	Duty per 100 Kilos. 220 lbs. British.	Duty per lb. in British pence, Franc at 10d.	Weight of Piece 4.4 Linen, 30 Yards long.	Value at Belfast per piece.	Present Duty per Piece, British Money.	The same per cent. British Money.	Average Tariff Duty per Piece, Light and Heavy.	The same, with addition of Peace Duty, 10 per cent. on Tariff Duty.	The same with addition of War Duty, 20 per cent. on Tariff Duty.	New Duty proposed by Treaty of 1860.	Duty by Tariff of 1836, estimated *ad valorem*.	Average of same.	Present Belgian Tariff Duty into France, estimated *ad valorem*.	Average of same.
1st. Less than 8 Threads (say 7°°, Irish count)	60 Francs	2·73d.	Heavy, 20 lbs.	£0 16 3	£0 4 6·60	28·00	Average per centage of Duty—Light, 29.28. Heavy, 29.23.	Average per centage, with Peace Duty, 10 per cent. additional—Light, 32·20. Heavy, 33·15.	Average per centage, with War Duty, 20 per cent. additional—Light, 35·12. Heavy, 35·07.	Not exceeding 30 per cent., to be reduced to 25 per cent.				
2nd. 8 Threads and less than 9 (8°°, ,,)	80 ,,	3·64d.	Heavy, 17¾ ,,	0 16 10½	0 5 4·61	31·90					14·35		12·20	
3rd. 9 up to 12 Threads (average 10°°, ,,)	126 ,,	5·73d.	Heavy, 18¼ ,,	0 18 1½	0 8 8·57	48·07								
			Light, 8¼ ,,	0 16 3	0 3 11·27	24·39								
4th. 12 Threads (11°°, ,,)	144 ,,	6·55d.	Heavy, 15⅔ ,,	1 7 6	0 7 2·67	26·26								
			Light, 8¼ ,,	0 16 10½	0 4 6·04	26·68					13·89		11·81	
			Heavy, 14½ ,,	1 8 9	0 7 10·97	27·49					14·32		12·10	
5th. 13 up to 16 Threads (13°°, ,,)	201 ,,	9·14d.	Light, 8¾ ,,	0 18 9	0 6 7·97	35·54								
			Heavy, 13¾ ,,	1 11 10½	0 10 5·67	3[illegible]·85								
6th. 16 Threads (15°°, ,,)	267 ,,	12·14d.	Light, 8 ,,	1 1 3	0 8 1·12	38·08					21·39		18·18	
			Heavy, 13¼ ,,	1 15 0	0 13 4·85	38·29					21·51		18·28	
7th. 17 Threads (16°°, ,,)	287 ,,	13·05d.	Light, 8 ,,	1 3 9	0 8 8·40	36·63								
			Heavy, 12¾ ,,	1 17 6	0 13 10·38	36·97								
8th. 18 and 19 Threads (average 18°°, ,,)	297 ,,	13·50d.	Light, 8 ,,	1 8 9	0 9 0·00	31·30								
			Heavy, 11½ ,,	2 4 4½	0 12 11·25	29·15								
9th. 20 Threads (19°°, ,,)	342 ,,	15·54d.	Light, 8 ,,	1 12 6	0 10 4·32	31·87					20·96		17·82	
			Heavy, 10¾ ,,	2 8 9	0 13 11·05	28·55					18·78		15·96	
10th. Over 20 Threads (20°°, ,,)	467 ,,	21·23d.	Light, 7¾ ,,	1 16 3	0 13 8·52	37·82						Average by Tariff, 1836, would be on Light, 17·62. Heavy, 16·14.		Average of Belgian Tariff Duty into France—Light, 14·97. Heavy, 13·71.
			Heavy, 9⅓ ,,	2 12 6	0 16 9·68	32·01								
,, (22°°, ,,)	467 ,,	21·23d.	Light, 7¾ ,,	2 6 3	0 13 8·52	29·64								
			Heavy, 9¼ ,,	3 7 6	0 16 4·28	24·24								
,, (24°°, ,,)	467 ,,	21·23d.	Light, 7¼ ,,	3 7 6	0 12 9·92	19·00					14·24		12·10	
			Heavy, 8⅞ ,,	5 0 0	0 15 8·41	15·70					11·76		10·01	
,, (26°°, ,,)	467 ,,	21·23d.	Light, 6⅝ ,,	5 5 0	0 11 8·65	11·16								
			Heavy, 8 ,,	7 5 0	0 14 1·84	9·76								

Arranged originally at the request of the Board of Trade by WILLIAM CHARLEY, Seymour-hill, near Belfast.

No. 3.—FRENCH IMPORT DUTIES, ON UNBLEACHED LINEN

Tables of Duties on Unbleached Linen Yarns, shewing the changes in the Duties, and giving an Example in each Class.

	CLASS I.		CLASS II.		CLASS III.		CLASS IV.		CLASS V.	
	6 lbs. or 8 Lea.		3 lbs. or 16 Lea.		2 lbs. or 24 Lea.		1 lb. or 48 Lea.		½ lb. or 96 Lea.	
	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.
	D.	D.	D.	D.	D.	D.	D.	D.	D.	D.
(7) 1836, ...	4	16¾	3½	14¼	2¼	9½	1⅛	4¾	0½	2¼
(3) 1841, ...	4½	19	3½	14¼	3¾	15¾	3¼	13¾	1⅝	6⅞
(4) 1842, ...	11	46	6¾	28½	7½	31¼	5¾	24¼	2⅞	12
(5) 1845, (8)...	11	46	6¾	28½	7½	31¼	5¾	24¼	3¾	15¾

Unbleached Linens.—Duty on 221 Lbs. English, and Quality fixed by the Number of Threads of Warp in One-fifth of an Inch.

	8 Threads.		12 Threads.		16 Threads.		20 Threads.		Above 20 Threads.	
	S.	D.	S.	D.	S.	D.	S.	D.	S.	D.
1826, ...	52	1	84	2	136	4	280	7	280	7
1836, ...	28	10	60	2	120	3	180	4	280	7
1842, (8) ...	64	2	115	5	214	0	274	2	374	4

DIFFERENTIAL DUTIES—UNITED

Unbleached Linen Yarns.—Example in each Class.

	CLASS I.		CLASS II.		CLASS III.		CLASS IV.		CLASS V.	
	6 lbs. or 8 Lea.		3 lbs, or 16 Lea.		2 lbs. or 24 Lea.		1 lb. or 48 Lea.		lb. or 96 Lea.	
	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.	Per Spind.	Per Bund.
From	D.	D.	D.	D.	D.	D.	D.	D.	D.	D.
United Kingdom	11	46	6¾	28½	7½	31¼	5¾	24¼	3¾	15¾
Belgium ...	4½	19	3½	14¼	3¾	15¾	3¼	13¾	2	8¼

Unbleached Linens.—Duty on 221 Lbs. English, and Quality fixed by the Number of Threads of Warp in One-fifth of an Inch.

	8 Threads.		12 Threads.		16 Threads.		20 Threads.		Above 20 Threads.	
From	S.	D.	S.	D.	S.	D.	S.	D.	S.	D.
United Kingdom ...	64	2	115	5	214	0	274	2	374	4
Belgium	24	6	51	1	102	2	153	4	238	6

DUTIES ON JUTE YARNS AND CLOTH. (9.)

Yarns—Without Classification, and on all Sizes, ... say 2¾d. per lb. of Duty.

Cloth—Classified; as an illustration of the very high Duty—

112 lbs. of Hessian, costing 51s. 4d., would be charged 33s. 4d. of Duty; and
112 lbs. of Sacking, costing 33s. 9d., would be charged 33s. 4d. of Duty.

Drawn up by

ROB. STURROCK, Secretary,

Dundee Chamber of Commerce.

Dundee, 23rd January, 1860.

YARNS AND LINENS, AND ON JUTE YARNS AND CLOTH. (1.)

FROM THE FRENCH TARIFF.

Unbleached Linen Yarns.—Duty on 100 Kilogrammes, or 221 Lbs. English.

	CLASS I.		CLASS II.		CLASS III.		CLASS IV.		CLASS V.	
	9 Lea or Under.		Above 9 and not more than 13 Lea.		Above 19 and not more than 38 Lea.		Above 38 and not more than 57 Lea.		Above 57 Lea.	
	FR.	C.	FR.	C.	FR.	C.	FR.	C.	FR.	C.
(2) 1836, ...	*		*		*		*		*	
(3) 1841, ...	17	60	26	40	44	0	76	0	76	0
(4) 1842, ...	41	80	52	80	86	50	133	70	133	70
(5) 1845, (8) ...	41	80	52	80	86	50	133	70	175	70

* No classification.—Duties equal to an *ad valorem* of from 6 to 8, 10, and 12 per cent.

Unbleached Linens.—Duty on 100 Kilogrammes, or 221 Lbs. English; Quality fixed by the Number of Threads of Warp in One-fifth of an Inch.

	8 Threads.		12 Threads.		16 Threads.		20 Threads.		Above 20 Threads.	
	FR.	C.	FR.	C.	FR.	C.	FR.	C.	FR.	C.
1826, ...	65	0	105	0	170	0	350	0	350	0
1836, ...	36	0	75	0	150	0	225	0	350	0
1842, (8) ...	80	0	144	0	267	0	342	0	467	0

KINGDOM AND BELGIUM. (6.)

Unbleached Linen Yarns.—Duty on 100 Kilogrammes, or 221 Lbs. English.

	CLASS I.		CLASS II.		CLASS III.		CLASS IV.		CLASS V.	
	9 Lea or Under.		Above 9 and not more than 19 Lea.		Above 19 and not more than 38 Lea.		Above 38 and not more than 57 Lea.		Above 57 Lea.	
From	FR.	C.	FR.	C.	FR.	C.	FR.	C.	FR.	C.
United Kingdom ...	41	80	52	80	86	50	133	70	175	70
Belgium	17	60	26	40	44	0	76	0	89	60

Unbleached Linens.—Duty on 100 Kilogrammes, or 221 Lbs. English; Quality fixed by the Number of Threads of Warp in One-fifth of an Inch.

	8 Threads.		12 Threads.		16 Threads.		20 Threads.		Above 20 Threads.	
From	FR.	C.	FR.	C.	FR.	C.	FR.	C.	FR.	C.
United Kingdom ...	80	0	144	0	267	0	342	0	467	0
Belgium	30	60	63	75	127	50	191	25	297	50

DUTIES ON JUTE YARNS AND CLOTH. (9.)

Yarns—Unclassified	65fr. 50c. per 100 Kilogrammes.
Cloth—Classified; for such as Hessians and Sackings . . .	83fr. 30c. per 100 Kilogrammes.

(1.) The duties are from the French fixed tariff, and do not include any additional per-centages on the general tariff, which vary according to circumstances.

(2.) At 1836 the only classification existing was a difference in the duty on Flax and Tow Yarns, but the duties admitted fine yarns at a very low rate. In 1840 a slight change took place, the duties on Flax Yarns being kept the same, but Tows were divided into two classes —those below No. 9 Lea being charged as before, but all finer kinds at a like rate as Flax Yarns.

(3.) Flax and Tow Yarns treated in a like manner, and divided into four classes, the duty chargeable according to their coarseness and fineness. This change pressed most heavily on the finer descriptions.

(4.) The same classification as in 1841 continued, but the duties increased heavily. The Dundee Trade affected greatly.

(5.) Fine yarns being yet imported, the fourth class was sub-divided, thus making five, as at present, the duty on very high numbers being increased about one-third. The duties then were (as now), that all yarns in Class I. paid a duty of 1.84d. per lb.; Class II., 2.25d. per lb.; Class III., 3.75d. per lb.; Class IV., 5.75d. per lb.; and Class V., 7.5d. per lb.

(6.) It may be remarked that, by the Treaty between Belgium and France, however high any additional per centage may be put upon the general tariff, Belgium cannot be charged more than the duties.

(7.) No classification in 1836, but the duties on the examples (on each size) were as above.

(8.) These duties are practically prohibitory, the total value of Linens and Yarns exported in 1858 being only £151,483.

(9.) From the low value of Jute Yarns and Cloth, these duties are entirely prohibitory.

CONTINUATION OF DUNDEE TABLE.—FRENCH LINEN DUTIES.

YEARS.	Value of Linens and Yarns exported from the United Kingdom to France.	Number of Spindles in France employed in the Linen Trade.	YEARS.	Value of Linens and Yarns exported from the United Kingdom to France.	Number of Spindles in France employed in the Linen Trade.
	Under Light Duties.		1847	£188,929	170,000
1836	£395,608	57,000	1849	131,756	250,000
1840	855,038		1850	159,483	275,000
1841	1,088,318		1851	141,377	330,000
	Under Heavy Duties.		1853	176,749	395,800 or 157 mills.
1844	£674,695	120,000	1858	151,483	

TABLE No. 4.—FRENCH TARIFFS.

CLASS.	Leas per lb.	Duty per Bundle of 60,000 Yards in French Money.	Duty per Bundle in English Money.	Selling Price in Belfast.	Per-centage of Duty on Selling Price.	Duty for 1861, say 25 per cent. on Selling Price.
1st CLASS,						
Up to 9 Leas, pays 41.80 Francs, per 100 Kilos.—221 lb. English.	3	Dundee Yarns—this quality not spun in Belfast.				
	6					
	9					
			d.	s. d.		d.
2nd CLASS,	10	5·25 Francs.	52½	10 0	43·75	30
	12	4· 0 ,,	40	8 6	39·21	25½
Pays 52.80 Francs, per 100 Kilos.	15	3·19 ,,	32	7 6	35·55	22½
	18	2·66 ,,	26½	7 0	31·55	21
3rd CLASS,	20	3·93 ,,	39	6 9	48·15	20¼
	25	3·14 ,,	31	6 3	41·33	18¾
Pays 86.50 Francs, per 100 Kilos.	30	2·62 ,,	26	5 9½	37·41	17⅜
	35	2·24 ,,	22	5 4	34·40	16
4th CLASS,	40	3· 0 ,,	30	5 3	47·62	15¾
	45	2·73 ,,	27	5 0	45·00	15
Pays 133.70 Francs, per 100 Kilos.	50	2·43 ,,	24	4 9	42·10	14¼
	55	2·20 ,,	22	4 6	40·74	13½
5th CLASS,	60	2·65 ,,	26	4 3	51·00	12¾
	70	2·34 ,,	23	4 0	47·92	12
Pays 175.70 Francs, per 100 Kilos.	80	2· 0 ,,	20	3 10½	43·00	11⅝
	90	1·77 ,,	17¾	3 10½	38·18	11⅝
	100	1·60 ,,	16	3 10½	34·40	11⅝
	110	1·45 ,,	14½	4 0	30·21	12
	120	1·32 ,,	13	4 1½	26·26	12⅜
	130	1·26 ,,	12½	4 3	24·51	12¾
	140	1·17 ,,	11¾	4 4½	22·38	13⅛
	150	1·09 ,,	11	4 6	20·37	13½
	160	1· 0 ,,	10	4 9	17·54	14¼
	170	0·94 ,,	9½	5 0	15·83	15
	180	0·88 ,,	8¾	5 6	13·26	16½
	190	0·84 ,,	8½	6 0	11·80	18
	200	0·80 ,,	8	6 9	9·88	20¼
	210	0·77 ,,	7¾	7 6	8·61	22½
	220	0·72 ,,	7¼	8 6	7·11	25½
	230	0·69 ,,	7	9 6	6·14	28½
	240	0·66 ,,	6¾	10 6	5·36	31½
	250	0·64 ,,	6½	11 9	4·61	35¼
	260	0·62 ,,	6¼	12 9	4·08	38¼
	270	0·59 ,,	6	14 9	3·39	44¼
	280	0·58 ,,	5¾	17 3	2·80	51¾
	290	0·55 ,,	5½	19 9	2·32	59¼
	300	0·53 ,,	5¼	22 9	1·92	68¼

In addition to this the cost of Freight, Commission and Exchange amounted to about 7½ per cent.

The Duties laid on Belgian Yarns, are on average about One-Half of those charged on British Yarns.

Duties on Linens sold at	1s.	1s. 2d.	1s. 4d.	1s. 7d.	1s. 10d.	2s.	
	4½d.	4¾d.	5d.	5¼d.	...	...	Brown.
	...	4½d.	5½d.	6d.	6¾d.	9d.	White.

Duties on Belgian Linens are about half of that on English Linens.

Arranged by Mr. JOHN HIND, Belfast.

to a peculiar style of fold and finish, and the expression "legitima" meaning the goods were real linen, and not mixed with cotton, a guarantee foreigners generally look for. In the same way "Cambray," a manufacturing town of Flanders, was the origin of the word cambrics, a class of light handkerchiefs now largely produced in Ireland, and so on. A certain unglazed rough finish for linens is called Courtrai finish; another, quite different, is called French finish, originally no doubt derived from those countries, much in the same way as we say French beans and Dutch tulips, Hessian boots or German silver. In another century, probably, this connection with the original localities will be forgotten, and people will wonder why those names were adopted. A very important matter in relation to the sale of linens in foreign countries is, of course, the Tariff of Custom-house duties levied by the different nations on the imports. Some governments arrange these duties with an eye to the protection of native manufactures; others with the idea of raising thereby a large revenue, while a few have adopted the more modern system of free trade, looking to other more legitimate sources for the funds required by the state. Dr. Adam Smith, J. S. Mill, and other celebrated writers on the abstruse theory of political economy, recommend the nearest possible approach to unrestricted commerce; it is therefore to be presumed that the more enlightened a nation, the closer it will follow England's generous example of giving up undue interference with the natural course of trade. With a few exceptions, it will be found on examination that this really is the case.

So far as manufactured linens are concerned, a duty appears to be levied thereon by almost all civilised nations, while the raw material, flax, is admitted generally free, or at a nominal charge. Among the protectionist nations, France certainly ranks first; the duties levied on British manufactured linens being very high, indeed, almost prohibitory, averaging 30 to 40 per cent.

As this French tariff is now an object of general interest, a copy of some carefully prepared statistics, containing a considerable amount of information regarding the rates levied on British linens sent to France, are annexed.

It is to be hoped that under the new treaty considerable concessions may be made, and that a nation really fond of linen, as the French without doubt are, may receive the benefit of commercial freedom in this article, and have the price to the consumers assimilated to the moderate rates current in this country.

It has been calculated that nearly £16,000,000 value of linen fabrics are annually used by the French nation. This may be an over-estimate, but no doubt the consumption is very great, and there is plenty of room, therefore, for a *bona-fide* competition between the productions of that country and the British Isles.

A deputation from Belfast waited on the English government last spring, and, at the request of the other members, I explained briefly our views, as follows:—

"Mr. Charley, on the part of the deputation, stated that the objection which the linen merchants had to the French tariff was, in the first place, that the principle on which the tariff was based was exceeding complicated; it caused great annoyance to traders, and pressed very heavily on the coarser articles. The duty was charged at so much per 100 kilogrammes, and the rate was a certain scale according to the number of threads and the fineness of the goods. On looking over that scale, he found that on a 1000 set of the coarse linen the duty would be about 50 per cent.; on a medium article from 30 to 35 per cent.; and from 22½ to 25 per cent. on the fine. It was singular that the French should let in the fine goods at so much lower duty than the coarse, inasmuch as their competition with us was in the former and not in the latter. (Hear, hear.) The British and Irish linen merchants objected to the French system of levying the duty, and would urge on her Majesty's Government to endeavour to induce the French Government, in any changes that were about to be made, to substitute an *ad valorem* duty for that now in operation. A duty of the latter kind would be much simpler, and lead to less inconvenience than was now experienced. In the second place, the tariff rate was almost prohibitory. As showing how injuriously the high duty levied by France on our linens since the revision of the tariff in 1841 operated, he might mention that in 1840, when the duty was only one-half what it is now, the imports into France of British and Irish linen amounted in value to £855,000, and in 1841 to over one million. It was now only £151,000 per annum. What the deputation would suggest to her Majesty's Government was, to urge on the French Government at once to return to the arrangement that existed prior to 1841, and to place British and Irish linen merchants on the same footing as those of Belgium. As a permanent arrangement they would suggest a 10 per cent. *ad valorem* duty. Under the operation of such a duty they believed the linen trade of the country would be much increased.

"Mr. M. Gibson: What duty did you pay prior to 1841 on the coarse description of goods?

"Mr. Charley: About 25 per cent. He would remind the right hon. gentleman that we had acted, and were continuing to act, with great liberality towards France. We admitted flax, plain linens, and cambrics from France free, and only levied a duty of 10 per cent. on their richly embroidered handkerchiefs. It was not unreasonable to ask that France should to some extent reciprocate. In Ireland there were at present an immense number of hands employed in the various branches of the linen trade; there were 651,000 spindles erected for spinning yarn, and at least two millions of people were more or less depending on its prosperity. Ireland at present purchased more flax than France would produce, and imported two-thirds of the entire flax worked in Irish mills from foreign countries. Under all these circumstances he thought they had a strong claim for what they now asked, namely, that France should at once return to the arrangement which existed prior to 1841, and that eventually a 10 per cent. *ad valorem* duty should be adopted." (Hear.)

(See *Times* report.)

The other important illiberally-framed tariffs are those of Austria, Russia, Spain, Portugal, and Belgium. Next in order, but rather less exclusive, are the Roman States and Two Sicilies. The Zollverein and Tuscany can scarcely be called moderate, nor can that of Turkey, but the latter two have the advantage of being to a certain extent *ad valorem*, while all the others named are framed on the complicated system of specific rates.

As the French tariff has hitherto been the model of protectionist policy, so the United States is the leading example of the Revenue system.

Tariff.—United States.

Flax unmanufactured	Free.	
Codilla, or Tow of Hemp and Flax ...	12 per cent *ad valorem*.	
Linen Manufactures		
Bleached		
Unbleached		
Lawn		
Sailcloth	15	ditto.
Tablecloths		
Ticking		
Canvas		
Ducks and Drills...		
Thread, Laces, and Insertings... ...		
Twines and Packthread	24	ditto.
Cables and Cordage	19	ditto.

Our Transatlantic cousins are occasionally rather fickle, and this year an attempt, nearly successful, was made by Congress to adopt the retrograde policy of doubling the duty on linens and various other imports. This movement has however been postponed by the Senate, and it is to be hoped will not be revived next session.

The United States system of an *ad valorem* duty is so eminently simple and workable, that it is almost inconceivable to find so much partiality displayed by European nations for the complicated plan of specific duties. In time, no doubt *ad valorem* tariffs will become more general. Till then much annoyance will be experienced by shippers.

Among the nations that adopt the revenue tariff may be classed also Mexico, and the various republics of South America, and, in Europe, Norway, Sweden, Denmark, and perhaps Greece.

Besides our own country, the only others that approximate closely to commercial freedom are Sardinia and Holland.* The former still adheres to the system of specific duties, but they are very moderate indeed, while the latter has introduced to some extent the *ad valorem* system.

It must be admitted that both of these nations are like our own, distinguished for enlightened progress. They perceive the advantages of promoting commerce, and of procuring every commodity on the most favourable terms. They see that monopoly enriches the few; that competition benefits the many, and that nations receive many mutual advantages from reciprocal exchange of native productions. Certainly not the least important of these advantages is the feeling of dependence on each other thus created, a feeling that tends to prevent or mitigate those misunderstandings and antipathies which otherwise might end in war and bloodshed.

Looking over the various tariffs leads one to reflect how intimately the progress of sound enlightened views on general questions is connected with free and liberal institutions.

It will be found as a general rule that despotic governments cling to protection and a high tariff of duties, that free governments adopt either a revenue rate of 10 to 15 per cent., or even a closer approximation to untramelled commerce.

Is there not great truth in Dr. Livingston's remark that commerce and civilisation go hand-in-hand, and that to enlighten and civilise a people you must teach them business habits and commercial industry, as well as improved agriculture.

If the free nations of the earth are correct in adopting liberal tariffs, and if their prosperity continues to exhibit satisfactory proofs of their wisdom, no doubt in time the new system will be universally established; and it is to be hoped, by encouraging industry and by cheapening the necessaries as well as the luxuries of life, it will contribute greatly towards promoting the comfort and happiness of the human race.

SOUTH STAFFORDSHIRE UNION.—DISTRIBUTION OF PRIZES AND CERTIFICATES.

A public distribution of the prizes and certificates awarded by the Society to successful candidates connected with the South Staffordshire Institutions, took place on Monday evening, the 10th inst., at the Corn Exchange, Wolverhampton, the Right Hon. Lord Lyttelton, Chairman of the Local Board, presiding. The meeting was numerously and respectably attended, and among those on the platform were the Mayor of Wolverhampton (B. Hicklin, Esq.), the Revs. F. D. Maurice, Principal of the London Working Mens' College, J. H. Iles, T. H. Campbell, and J. Lloyd, Mr. H. H. Fowler, Mr. J. N. Langley, Mr. Bidlake, Mr. T. S. Hatton (Bilston), Mr. F. Talbot (hon. sec.), &c.

Lord Lyttelton, in opening the meeting, said that letters explanatory of the cause of their absence that evening had been received from the Earl of Dartmouth, W. O. Foster, Esq., M.P., Mr. Harry Chester, and other gentlemen.

Mr. F. Talbot, Honorary Secretary of the South Staffordshire Union of Educational Institutes, then read the report of the Board, which gave a history of the formation of the union, and the efforts of the local board to carry out the objects for which it was formed. It stated that 24 out of 25 candidates, who had passed the preliminary examinations held in March, came up to the final examinations. They were of the average ages of 19 three-fifths years; and, out of the 24 no fewer than 21 succeeded in gaining certificates. An analysis of the occupations of the students showed that they were precisely of the class for which the system of examination is intended. It was a striking circumstance that two of the candidates from South Staffordshire should have gained the first and second prizes for logic; and it was gratifying to find that the examiner had reported the logic papers as on the whole creditable to the candidates. The report further stated that the result of the examination augured well for the future seasons, and seemed to hold out a prospect of a goal being at last presented that should offer to the numerous scholars of our day and Sunday schools incentives to honourable exertion in the course of mental improvement, and a scheme that went far towards realising the project of a Working Man's University. The Board asked the attention of working men particularly to the fact that the scheme of the Society of Arts was especially adapted to their circumstances, and quoted figures showing that the system was fast growing into popular estimation. The Board had engaged the services of Mr. John Jones, an experienced and competent teacher, for the especial purpose of organising, instructing, and examining classes in connection with the institutions in union, and he had been engaged since July in visiting the institutions of the district, with the view of making arrangements for the commencement or re-opening of classes during the autumn and winter. The great object and end of his exertions would be to prepare candidates for the Society of Arts' examinations. A sub-committee had reported to the Board the establishment of a system of examinations for young persons over the age of 14 years, of very humble attainments, and it proposed to give to such as passed a creditable examination, certificates indicating two degrees of proficiency. The Local Board then asked for funds to enable them to carry out this essential object in their work, as also the payment of the organising master's salary and expenses, and concluded their report by expressing a hope that all the institutions in South Staffordshire and the neighbouring parishes of Worcestershire would see their way to unitiug themselves in the effort now being made to promote the instruction and education of the adult population of the locality.

The Chairman said that he felt honoured in presiding at that meeting; he esteemed it an honour to have that position upon the local board that had been assigned him. Having heard the report his lordship hoped that the meeting would be inclined to congratulate itself on the degree of success which had been attained, and that the future existence of the society would be a progressive growth. He then called attention to the scope and object of the Society of Arts in relation to such proceedings as those which were now engaging the attention of the meeting, pointing out the advantages which it had conferred by affording the privileges of examination to the middle classes, particularly a class somewhat below that embraced by the Oxford and Cambridge examinations. To meet that class he was not aware that any other system had been introduced—nor was it clear that any other system would be introduced—than that of the Society of Arts, and this was now before them. As far as he had been able to test them he believed that the examinations of the Society recommended it to the confidence of all classes in the country. They all knew that the Society did nothing in the way of education direct; they held out certain rewards for attainments in certain branches of education. They did this in the most elaborate manner. In proof of this he would invite attention to the names of the examiners and the solid manner in which the exami-

* To these states may be added the Hanse Towns of Germany, whose entire prosperity is owing to free commerce and liberal institutions. They stand out, clearly defined instances of wealth, prosperity, and intelligence derived from untrammelled industry, and in no part of the world is honour and integrity more remarkable or more relied on among the bulk of the people. The latter remark applies especially to Hamburg, and is a direct contradiction to the idea that honour is weakened in great commercial communities.

nations were conducted. It was this system of the Society of Arts that he (the chairman) and others were desirous of bringing widely to bear upon that and the surrounding district. They had secured a beginning, and for a beginning they had secured a not inconsiderable number of prizes; but he trusted that as the principles of the Society became better and more widely known the number of competitors would increase largely. The first prize in all England had been obtained in this district on a subject of no less importance than that of logic. There was a great preponderance from two Institutions in the district (Messrs. Chance's Library and the Wolverhampton Working Men's College), but he hoped that the next distribution would comprise members from a larger number of institutions. His lordship then invited attention to the preliminary examinations by local agency, and then commended the appointment of an organising master or travelling secretary, as also announced in the report. In this latter appointment they had had the direct approval of Sir James Shuttleworth, whose efforts in this direction in another—the northern part of the kingdom—had been conspicuous. The chairman then combated the notion, which he said widely prevailed, that these examinations were unfriendly to religious attainments on the part of the students. It must be borne in mind that these examinations were for limited attainments in certain branches of knowledge, and had nothing to do with education in a large sense. It would be an occasion for extreme alarm if the growth of the practice of competitive examinations were to induce a carelessness about religion, and he would urge upon the parents to see that religion had its due place in the instruction communicated in the schools to which they sent their children, and that religion and morality received the paramount respect which was their due from those persons in whose hands they placed their children's education. He had not feared the alarming result he referred to as likely to proceed from the examinations of the Society of Arts in South Staffordshire, nor did he think there was reason for any one else to apprehend them.

Lord Lyttelton then distributed the prizes and certificates to the successful candidates.

The Rev. J. H. Iles moved, "That the scheme of examinations as proposed by the Society of Arts is worthy of the cordial support of the Institutions of South Staffordshire." He sketched the history of the Society of Arts, showing its great benefit to the country, in promoting her educational and thereby her material well-being; and specified the precise description of help that it was proposed to render to all institutions that might be placed beneath its fostering care. The Society's examinations were open to women as well as young men, and why should they not be? Complaints were rife that there was not employment for women, that they could not get employment. Young women were now desiring in England to become assistants in shops, and book-keepers and clerks, as in some other parts of the world they were. Because of the greater cheapness of female labour over male, he believed that efficient female labour would always find a market; but he did not believe that at present young women were fit for the duties to which they aspired. This, in his opinion, was the cause of their want of employment, of which complaint was now being made. How better could a young woman prove her fitness for employment than by coming forward and claiming certain of the certificates which the Society of Arts was ready to give her? With such certificates in her possession she would go forth into the world with a certain prospect of employment.

The Rev. T. H. Campbell seconded the resolution, which was unanimously passed.

The Rev. F. D. Maurice spoke to the first part of the following resolution:—"That for the purposes of this scheme, and the general promotion of education in South Staffordshire, the formation of classes in connection with the various Institutes is essentially important; and that the appointment of a teacher to organise and instruct such classes is likely to produce most beneficial results." He said he had felt strongly in the course of his life the objections to emulation, but he saw the correction for the evils arising from it in the proposition which he was then making to the meeting. What was wanted was that the examinations should have classes for their foundation; not that a man should be merely crammed for an examination, but that he should acquire that general knowledge of what he had been examined in previously, and should become so interested in it that he should feel how it related to his own life, while at the same time he should pass his examination far better, and more advantageously, than if he had merely got ready in order to gain a prize or a certificate. What the resolution said was, that it was desirable the examinations should not stand alone, but that those institutions which prepared candidates for them should prepare them by classes. Now classes, as it appeared to him, took away the evil effects of that rivalry which might be introduced by examinations. By learning in classes students learned to feel for one another and with one another; they tested their powers by comparison with those in whose company they worked; this led them to feel sympathy with all their fellow workers, and hence they rejoiced when one of their number succeeded, even if they themselves failed. Therefore he said these classes were the proper antidotes to any evil that resulted from emulation, and furnished the proper security that examinations should produce their true effect.

Mr. J. N. Langley seconded the resolution. Speaking to the latter part of it he explained that although the Society did not absolutely preclude the examination of those who had prepared themselves silently and individually, yet its arrangements were based on the supposition that class work was continually going on, and that the examinations were only a test of the intellectual results of that class work; for the moral and social results of such class work, as their experience told them, could be tested by no examination. The speaker then drew particular attention to the appointment of Mr. Jones as organiser and examiner of classes formed in connection with the institutions of South Staffordshire, and explained the object of the Local Board in making the appointment.

The meeting concluded with a cordial vote of thanks to Lord Lyttelton for his conduct in the chair.

MILLSTONE MAKERS' CONSUMPTION.

It appears, from a paper in the *Medical Times and Gazette*, that there are in London a certain number of masons whose special avocation is to prepare for use a peculiar kind of millstone known as the French Burr. This stone consists essentially of flint, and has for centuries been quarried at La Ferté, on the Marne, to the east of Paris. The peculiar hardness of this stone renders it much more dangerous to work, and it is much more liable to chip into small particles of extreme sharpness than are the stones more commonly employed in grinding, such as the Yorkshire or Derbyshire grit, the Scotch granite, or the German basalt. The "picking" of these "burrs" is effected by a steel chisel, struck by a hammer, and every stroke is attended by a flash of light and a cloud of dust and small particles of stone. There are, it seems, only four shops in London where these stones are worked, and Dr. Peacock estimates the whole number employed upon it as probably not more than fifty. Having seen many of these men as patients at the Victoria-park Hospital on account of chest affections brought on by their employment, he was led to make extended inquiries at the places of work, the results of which he embodied in the paper referred to. The subjoined are the principal of his conclusions:—1. That the average age of those engaged in this occupation is very low indeed. Of 23 who had been apprenticed to it the average age was only 24.1 years; and one of the foremen stated that the longest period he had ever known a man to work at it was 13 years. 2. That the fatality among these men is directly due to their

inhalation of particles of silex; but that the injurious influence of the latter is much aggravated when the men are intemperate. 3. That the form of the disease induced may be either chronic bronchitis or phthisis, according to the predispositions of the patient. 4. That the presence of the siliceous particles in the lung-tissue may be proved by chemical examination.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 21st*, 1860.]

Dated 10th July, 1860.

1663. F. Boex, Bruxelles, Belgium—Imp. in ornamenting glass surfaces. (Partly a com.)

Dated 24th August, 1860.

2043. F. P. J. V. Ouwelant, Paris—Imp. in apparatus to be applied to fire-places, for obtaining absorption of the smoke and a better combustion of the fuel employed therein.

Dated 29th August, 1860.

2080. H. Chandler, Clement's-inn Passage, and A. Hempson, Southampton-buildings, Middlesex—Improved seats for theatres or other public buildings.
2082. J. Edwards, 77, Aldermanbury, London, and C. Iliffe, Birmingham—Imp. in the manufacture of buttons.
2084. J. Wilson, Birmingham—A new or improved warm bath.
2088. R. Perrott, jun., and J. Molony, Cork—An improved mode of applying roasting jacks to kitchen ranges and cooking stoves.
2090. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for manufacturing embossed or figured fabrics in colours. (A com.)

Dated 30th August, 1860.

2092. H. Mège, 4, South-street, Finsbury—Imp. in making bread and ship biscuit.
2094. E. Lockett and H. Goodwin, Great Fenton, Stoke-upon-Trent, Staffordshire—Imp. in stacking earthenware during the process of firing, and in apparatus used for that purpose.
2098. C. J. B. Renault, Paris—Imp. in the manufacture of shirts and chemises.

Dated 31st August, 1860.

2104. P. M. Belton, New York, U.S.—The manufacture of a compound to be used as a substitute for animal charcoal in refining sugar and otherwise.
2106. W. Gerrans, Tregony, Cornwall—Imp. in horse-rakes.
2108. W. E. Newton, 66, Chancery-lane—An imp. in compositions for tanning skins and hides of all descriptions. (A com.)
2110. W. E. Newton, 66, Chancery-lane—Imp. in air engines. (A com.)

Dated 6th September, 1860.

2149. J. Walker, Bradford, Yorkshire—Imp. in self-acting temples.
2151. J. Davies, Manchester—An improved application of material to the manufacture of coupling apparatus to be employed in connecting locomotive engines, tenders, and carriages, together upon railways.
2153. R. Wright, Grosvenor-street, Camberwell, Surrey—Imp. in the manufacture and refining of sugar, and in apparatus employed therein.
2155. B. Oldfield, Coventry—Imp. in looms.
2157. G. Herring, 3, Albert-terrace, Hatcham-park, and D. Lichtenstadt, Peckham, Surrey—Imp. in treating a certain substance to obtain textile fibres and materials for paper making, and charcoal for gunpowder, pyrotechnic, and other purposes.

Dated 7th September, 1860.

2159. A. D. Lacy, Hall House, Knayton, Yorkshire, and W. C. Homersham, Adelphi-terrace, Middlesex—Imp. in machinery and implements for ploughing and cultivating land.
2161. C. Stevens, 1B, Welbeck-street, Cavendish-square, Middlesex—An improved method of preserving various alimentary substances. (A com.)
2163. C. Stevens, 1B, Welbeck-street, Cavendish-square, Middlesex—Improved bags to be used in the manufacture of sugar. (A com.)
2165. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in the manufacture of cast steel, and in the re-manufacture of old steel. (A com.)
2167. P. E. Aubertin, Great Winchester-street—Imp. in the manufacture of soap. (A com.)
2169. J. Spratt, Camden-road-villas, Camden-town—Imp. in electrical conductors and their fittings.

Dated 8th September, 1860.

2171. E. Weiskopf, 5, Claremont-square, Middlesex—Imp. in the manufacture of certain kinds of artificial combustible for the lighting of wood and coal.
2173. P. R. Cross, Sudbury, Suffolk—Imps. in means or apparatus to give protection to the mouth and nostrils in respiration, and to the throat and chest against the injurious effects of atmospheric influences.
2175. E. Horton, Darlaston, Staffordshire—New or improved machinery, to be used in the manufacture of bolts, nuts, and screws.
2177. W. E. Gedge, 11, Wellington-street, Strand—Improved means of extinguishing conflagrations. (A com.)
2179. J. Fourdrinier, 17, Grove-terrace, New Peckham, Surrey—Imp. in kilns for drying grain, seeds, and other agricultural produce.
2181. J. J. C. Kleinfelder, Paris—Imps. in carriages and harness for horses, and in the means of attaching harness to carriages.

Dated 10th September, 1860.

2183. F. J. Cantagrel, 7, Rue Buffault, Paris—Apparatus for ascertaining the existence of escapes in pipes and vessels for conveying (and holding), lighting and heating gases, which apparatus he denominates "escape indicator."
2187. T. Turpie, North Shields—Imp. in furling sails.

Dated 11th September, 1860.

2189. J. Greenwood, Halifax—Imp. in looms for weaving.
2191. D. Nicoll, Regent-street, Westminster—An improved overcoat, particularly adapted to military purposes, to be called "Nicoll's Lacerna."
2193. R. C. Clapham, Walker, Northumberland—Imp. in the manufacture of bleaching powder and apparatus employed therein.
2195. D. Peacock, 6, Walpole-street, New-cross, Kent, and T. R. Truman, 6, Edwin-place, Peckham, Surrey—Imp. in the construction of wheels for traction and locomotive engines.
2197. E. Clemo, Toronto, Canada—An improved mode of manufacturing stock for paper, from straw, and other vegetable substances.

INVENTION WITH COMPLETE SPECIFICATION FILED.

2199. J. C. de Louvrié, 18, Boulevard Beaumarchais, Paris—Imp. in moulding without models.—12th September, 1860.

PATENTS SEALED.

[*From Gazette, September 21st*, 1860.]

September 19th.

718. C. F. Bielefeld.
721. J. Williamson and F. Williamson.
723. J. Aspell, E. Booth, and J. Hurst.
724. E. Gardner.
728. J. Brown.
730. J. I. Taylor.
732. T. Sykes, B. C. Sykes, and J. W. Crossley.
736. W. S. Macdonald.
740. J. Stainthorp.
741. W. Turner.
743. G. J. Calvert & C. L. Light.
746. G. B. Rennie.
747. D. Millard.
750. J. P. Jennings and F. S. Scott.
752. C. Prater.
755. C. Ashworth.
756. J. Watts.
761. S. C. Lister.
762. J. Deane, J. Deane, jun., and W. Harding.
765. H. Haywood.
766. J. Dale.
769. M. A. F. Mennons.
772. I. Blackburn.
774. J. B. Corry.
776. J. M. Carter.
777. J. Ronald.
780. J. Mitchell.
785. E. G. Renshaw.
794. D. Millard.
802. J. Leonard.
806. C. Stevens.
830. D. K. Clark.
834. E. J. Hughes.
895. L. J. Repelin.
923. J. Hill.
960. C. Vaughan, W. J. Vaughan, and R. Vaughan.
1014. G. H. Birkbeck.
1036. A. K. Eaton.
1100. A. V. Newton.
1255. J. Green.
1290. J. Paddon and W. Lowther.
1618. J. Shipley, J. Taylor, and J. Shuttlewood.
1733. P. Vallance.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September 21st*, 1860.]

September 17th.

2422. S. Faulkner.
2476. L. Newton.

September 18th.

2441. H. Ormson.
2460. W. E. Newton.

September 19th.

2513. E. Thompson and W. J. Nicholson.

[*From Gazette, September 25th*, 1860.]

September 20th.

2463. F. C. Bakewell.
2481. J. Chubb.
2508. R. Bodmer.

September 22nd.

2503. J. C. Pearce.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, September 21st*, 1860.]

September 18th.

2192. P. R. Arrowsmith and J. Newhouse.

September 19th.

2188. A. V. Newton.

[*From Gazette, September 25th*, 1860.]

September 21st.

2187. A. V. Newton.

September 22nd.

2197. J. Leetch.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Registry.	Date of Registration.	Title.	Proprietors' Name.	Address.
4291	Sept. 15	Lever Fore End for Firearms.	Messrs. Wilkinson and Son	27, Pall Mall, S.W.
4292	,, 22	Improved Pneumatic Inkstand.	Maudsley and Son	Liverpool.

Journal of the Society of Arts.

FRIDAY, OCTOBER 5, 1860.

NOTICE TO INSTITUTIONS.

The Programme of the Society's Examinations for 1861 is now ready for issue. A copy has been sent to each Institution and Local Board. Institutions and Local Boards should distribute copies of the Programme amongst those persons likely to become candidates, for which purpose additional copies will be supplied gratis on application to the Secretary of the Society of Arts.

The Papers set at the last Examination are now printed in a collected form, and copies may be had of the Society's Publishers, Messrs. Bell and Daldy, Fleet-street, E.C.—Price 6d.

INTERNATIONAL EXHIBITION OF 1862.

The following addition has been made to the List of Guarantors and of the sums guaranteed since the announcement in last week's *Journal*:—

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount announced last week	£365,100	
Lord Wenlock, Escrisk-park, York	100	Arts.
Total	£365,200	

By Order, P. LE NEVE FOSTER, *Secretary.*

COCOA—ITS CULTIVATION, MANUFACTURE, AND USES: ITS ADVANTAGES AND VALUE AS AN ARTICLE OF FOOD.

By J. A. Mann, F.S.S., M.R.A.S., &c.

No. 1.—Cultivation and Growth.

Cacao, more commonly known as cocoa, though an article of considerable consumption, is but imperfectly known to the general public, especially as regards its production, manufacture, and value. Anterior to the commencement of the present century, the cultivation was almost entirely in the hands of foreigners, which in a measure accounts for our seeming ignorance, while the confusion of the cocoa tree (*Theobroma Cacao*), the cocoa-nut palm (*Cocos nucifera*), and the cocoa shrub (*Arum esculentum*), has tended still further to complicate the matter. Moreover, the trade in cocoa in this country, until within the last thirty years, was so unimportant, most of that imported being again exported without undergoing any process of manufacture, that but little interest has attached to the subject.

The earliest account of any extended cultivation of cocoa was in Mexico, whence it spread into and over the whole of the northern portion of South America. Our knowledge of cocoa as an article of diet, dates from the discovery of the Western World by Columbus, who took home with him samples of the article, which early attached itself to the Spaniards' tastes; for a long period of time, the cultivation was confined to the Spanish who, in South America and some of the West India Islands, carried on the cultivation to a large extent. From their first settlement in Trinidad it seems probable the Spaniards cultivated the tree and thoroughly understood its value, the prepared article being always much esteemed and of high value in the then opulent mother-country. The British colonists seem only to have cultivated it when other crops failed, and to have acquired but a limited taste for the article in the prepared state.

In the "Harleian Miscellany," vol. 9, page 422, in an account of the rise and growth of the West Indian Islands, by Dalby Thomas, written in 1690, is the following amusing account of the attempt and failure by the English to cultivate cocoa:—"Cocoa is now no longer a commodity to be regarded in our colonies, though at first it was the principal invitation to the peopling of Jamaica, for those walks the Spaniards left behind them there when we conquered it produced such prodigious profit with little trouble, that Sir Thomas Modiford, and several others, set up their rests to grow wealthy therein, and fell to planting much of it, which the Spanish slaves had always foretold would never thrive, and so it happened; for though it promised fair and throve finely for five or six years, yet still at that age, when so long hopes and cares had been wasted upon it, withered and died away by some unaccountable cause, though they impute it to a black worm or grub, which they found clinging to its roots." Again it continues:—"And did it not almost constantly die before, would come to perfection in fifteen years' growth, and last till thirty, thereby becoming the most profitable tree in the world, there having been £200 sterling made in one year of an acre of it. But the old trees, being gone by age, and few new thriving, as the Spanish negroes foretold, little or none now is produced worthy the care and pains in planting and expecting it. Those slaves gave a superstitious reason for its not thriving, many religious rites being performed at its planting by the Spaniards which their slaves were not permitted to see. But it is probable that wary nation, as they removed the art of making cochineal and curing vanilloes into their inland provinces, which were the commodities of those islands in the Indians' time, and forbade the opening of any mines in them for fear some maritime nation might be invited to the conquering of them, so they might likewise in their transplanting cocoa from the Caracas and Guatamala, conceal wilfully some secret in its planting from their slaves, lest it might teach them to set up for themselves, by being able to produce a commodity of such excellent use for the support of man's life, with which alone and water some persons have been necessitated to

live ten weeks together without finding the least diminution of health or strength."

The genus *Theobroma* (from θεός and βρῶμα, the food of gods) which produces the cocoa of commerce, belonging to the natural order *Byttneriaceæ* (formerly included in the order *Sterculiaceæ*) is indigenous to tropical America, but acclimatized within the twenty-fifth parallels of latitude. It is customary to ascribe cocoa to the species *Theobroma Cacao* of Linnæus, and notwithstanding that botanists have discovered several different species, in that formerly cultivated in Guatamala, New Grenada, Surinam, Essequibo, &c., it has never been yet proved that the cocoa of commerce is yielded by any other species. The cocoas now known in Trinidad and Grenada are of only two kinds; in the former they are called *Cacao Forastero* and *Cacao creola*, while in Grenada the first is known as *Caracas*, whence it was introduced, and the latter *Creole cocoa*, and it seems probable that the two kinds are but varieties of the *Theobroma Cacao*. The two trees are both evergreens, and certainly very closely allied. The fruit borne by the caracas cocoa is, however, longer and narrower in proportion, the rind being much thinner; it also contains a greater number of seeds, which are generally larger, more plump, of a far better flavour, and contain a less proportion of fatty matter, than those borne by the creole cocoa, which is in every way inferior to it.

The trees themselves, if allowed to grow unrestrainedly and naturally with sufficient space, would grow to the height of thirty feet, the branches almost all tending upwards, the trunk being very stunted, owing to the luxuriance of the branches and foliage abstracting largely from its vitality, and preventing the development of the trees' productive powers. Owing to this peculiarity of the tree, it is necessary to its fullest production to prune very largely. As usually seen when cultivated, the cocoa tree is about 14 to 18 feet in height; the leaves about 7 inches in length, elliptic-oblong, acuminate, and quite smooth, principally growing at the upper part of the tree, or ends of the branches. Sometimes a few leaves present themselves upon the trunk, springing directly from the wood where the flowers and fruit are borne, and this peculiarity is very marked. To a stranger, the pendant fruit has the appearance of having been artificially placed there, so contrary to his experience of the general habits of the vegetable kingdom is it. The flowers are very small and in clusters; the calyx composed of five sepals, petals five, lengthened into a strap-like form at the apex, the stamens five, with double anthers, and a horn-like appendage between each filament; style filiform, with a five-parted stigma, of a yellow colour, turning to pinky violet. The fruit is five-celled without valves, about seven to nine and a half inches in length, and three to four in breadth, of an elliptic oval pointed shape, somewhat like the vegetable marrow, only more elongated and pointed at the end, tough and quite smooth, the colour varying, according to the season, from bright yellow to red and purple. The rind of the fruit is very thick, and similar to a very hard tough apple in substance, but quite tasteless; if allowed to ripen, this changes into a shell of a weak nature. The seeds contained in each pod vary in number from 20 to 40, embedded in a soft, pinky, white acid pulp.

As before observed, cocoa will grow within the 25th parallels of latitude, but flourishes best within the 15th parallels, at an elevation of not less than 500 feet above the sea. While growing in that portion of the earth wherein the heat is greatest, it yet requires a sheltered situation for its perfection. It is grown more or less in Mexico, Honduras, Guatamala, Nicaragua, and throughout almost the whole of Central America, Brazil, Peru, Ecuador, New Grenada, Venezuela, Surinam, Demerara, Essequibo, and the West India Islands; it has also been grown in Africa, Mauritius, Madagascar, Isle de Bourbon, the East Indies, Australia, and the Philippine Islands, though not to any considerable extent up to the present time. Trinidad and Grenada are the sources whence we have received the greater part of our supplies, and they perhaps afford upon their western shores the finest sites for a cocoa estate that it is possible to have. It may be remarked of the latter particularly that it is of a very mountainous character, the mountains even attaining an elevation of 3,000 feet, forming many fertile valleys, producing a great number of fine rivulets, perhaps more numerous than in any other island of equal extent, and differing essentially in this respect from all the other sugar-producing colonies; for this reason, it is peculiarly well suited to cocoa cultivation. The many peculiarities of the situation in which the Theobroma luxuriates, render particular spots marked out for its cultivation, as in Grenada the West Coast, particularly the St. Mark and Gouyave valleys, which ere long will be entirely covered with it. In Trinidad the Arema, Santa Cruz, and San Fernando valleys are the centres of cocoa cultivation, and the quality of the produce grown there is superior to that of Grenada, though the quantity yielded per acre is not so great.

The following remarks on the cultivation of cocoa will have special reference to the mode to be followed in Grenada, though their application may be equally adopted in regard to any other cocoa growing countries, always bearing in mind that the period of the wet and dry seasons differs considerably on the South American continent. Having had occasion to visit both Grenada and Trinidad several times, with the view of gaining all the knowledge possible, as to the cultivation and trade in cocoa, for a commercial enterprise, and having minutely studied the habits of the tree, and the best modes of cultivation, they will, it is hoped, carry with them some weight, and be of more general use by their publication by the Society of Arts in this form.

Site.

It may be asserted that cocoa will not thrive upon an east coast, the wind in such a case is almost invariably too strong and chilly. Upon ground of a steep hilly nature, such as that of Grenada, the site, if possible, should have a west, or south-westerly aspect. In Trinidad, or in places where most of the estates are upon comparatively level land, this does not so particularly matter; but a cocoa estate composed of hills and valleys is decidedly the best, yielding a more regular crop and better return; such a situation has always that natural moisture and mellowed warmth during the day, with tempered coolness during the night, so essential to the growth of the tree, while the winds are also in a measure excluded; and this last is most important, as the cocoa tree, from its tenderness, is very easily stripped of its flowers: in such of the West India Islands as are affected by hurricanes and high winds it forms an almost insuperable obstacle to its successful cultivation. For this reason the planter will do well carefully to examine the site of his intended operations; should he discover that the trees in the locality are much covered with moss, and bent in one direction, indicating the prevalence of strong winds, he should consider well before committing himself to it: for the soil and climate may be everything that can be desired—the trees fine healthy trees—yet year after year, at the blossom season, the bloom may be regularly destroyed, and the planter discover to his cost, when too late, that he can only obtain uncertain and defective crops. The elevation of the proposed land forms a point of equal importance; in Grenada, from 1,000 up to the extreme altitude of 3,000 feet appears to be best fitted, nor do the winds at such an elevation become more troublesome; it is the gusty, fitful, whirling wind which taxes and despoils the planters' crops, and these are more prevalent in the low grounds; the climate at the greater elevation is more equable, more free from drought or extremes of moisture. An alluvial plain, where obtainable, with the necessary qualifications, and in the proper situation, grows a fine quality of cocoa, but does not necessarily yield the best return; when planted on such a site the cocoa requires to be interspersed with tall trees, to obtain the necessary coolness, moisture, and protection from the winds.

The *Erythrina umbrosa* or *Corallodendron*, called in the country "Bois Immortal," is much planted in Trinidad; but it must be said of the system, that the trees keep out light and air, which are great necessaries. Much moisture is necessary to the perfection of the cocoa, and where near a running stream of water it grows most luxuriantly, but near a stagnant pond withers and dies; while in the former case the water furnishes a supply of moisture to the roots which seems to act beneficially, in the latter it chills the roots and destroys the tree. The leaves of the cocoa tree absorb a large quantity of moisture, and it is necessary for the nurture of the tree that the atmosphere generally have a tendency to decided humidity.

Soil.

The soil must, in all cases, be deep, free, and porous, a loamy virgin forest soil, or vegetable mould is best adapted to the perfection of the cocoa, but so long as the soil is deep and free, deficiencies in other respects may be in a great measure made up by the care of the planter. Dr. Verteuil, in his recent work on Trinidad, committed an unintentional error in asserting that a virgin soil was indispensable; the writer has seen numbers of pieces of fine cocoa planted on lands which were only just before, and for a long time previous, under sugar cultivation, though it may be said with great truth that a virgin soil produces finer cocoa—almost throughout the whole vegetable kingdom would such be the case. A red loam is generally not so advantageous as the black soil, though there are numberless exceptional cases, but, as a rule, the former should not be employed unless quite new and unworked. A stony soil is none the less adapted to the cultivation; the roots have a tendency to cling to the stones, receiving a beneficial coolness and moisture from them, while, at the same time, the density of the soil is considerably modified by their presence. Speaking of the Gouyave Valley, particular caution is necessary in the selection of the site; in many spots there are extreme cold clayey soils, while here and there, as the strata crops out, it will be found to have mineral properties inimical to the growth of the tree; after attaining the elevation of 500 to 800 feet, however, this difficulty will be found to lessen considerably. One principle must ever be borne in mind, that a retentive soil is fatal to its prosperity, and that a swampy soil, or any stagnant water about the roots, will infallibly create cold and destroy the tree.

Clearing.

Having then determined the site, with the proper qualifications of position, soil, climate, moisture, and facilities of transport to the market, the first, and sometimes difficult, undertaking is the clearing of the land. In Grenada there is scarcely any timber land, most of that available, or the abandoned estates, being covered with mere brushwood, and the method therefore universally adopted as the cheapest, is that of burning off the brush, which may be readily effected in the dry weather which prevails from January to May. The brush having been cut down and allowed to remain about a week or more to dry, fire may be kindled in the spot whence the wind comes, care being taken that the flames do not extend to the destruction of other property, and generally the land is by this means effectually cleared; if any wood should, however, remain unburnt, it must be gathered and piled for burning, the wood ashes being left upon the land as very friendly to the cultivation. If there is very little brushwood, as for instance if the land has only been one year abandoned, it may be almost better to collect it at once and burn it in heaps. In the case of forest land, the disposal of the timber sometimes becomes a matter of considerable trouble, and numberless circumstances will enter into the question which it would be quite impossible here to enumerate. The two primary considerations in the matter are whether the timber is to be employed or destroyed. Generally, the elevated and comparatively inaccessible position of a cocoa plantation renders the first very unprofitable, except it can be employed on the works, or in the immediate vicinity; but where such an alternative presents itself and is adopted, the negroes and many planters still think it essential for the quality of the wood that the tree should be cut at the time of a full or waning moon; if cut upon the increase of the moon, it is supposed that the abundance of sap would render the timber susceptible of very early decay.* But now to treat of the operation of destruction, it is essential that a good supply of axes and cutlasses should beforehand be provided, with a good Newcastle grindstone, and the men may at once be set to cutlass the underwood or brush from the low lands up the side of the hill, while the fellers follow, cutting deep incisions in the lower side of the trees; so soon as sufficient is thus prepared, a few of the upper and largest may be simultaneously cut entirely through, which in their fall will also force down those beneath, and thereby save a great deal of needless labour; if to be burned, the branches must all still be lopped off and placed under or around the trunks, and both allowed to dry for a month or six weeks, after which fire may be applied; it will probably require, however, to be assisted by even more light wood, carried thither for the purpose of assisting in the demolition of the larger trunks, but it is advisable to apply the fire after a slight fall of rain, which prevents the too quick consumption of the brush and branches before the large wood has come under the influence of the flames. No clumps of trees must on any account be left standing, nor should any such be in the vicinity of the plantation, the effect of which would, in almost every instance, be to destroy the blossom by the eddies of wind around them; while the great objection to isolated trees among the cocoa is, that in their ultimate fall (which, where the incision has nearly encircled the tree or cut into the heart, is certain to be the case very soon), they inevitably break down and destroy the surrounding cocoa trees. The remnants of wood which remain unburnt should now be collected and burned; while, if the weather has been dry, the ashes, where they are abundant, may be gathered together and preserved for the future operation of planting; and, where labour is abundant and cheap, the roots may be grubbed out, which will greatly assist to loosen and pulverise the soil, which then requires little further to be done to it.

Planting.

The proper manner of planting cocoa has not yet been clearly defined, a great contrariety of opinions existing, no doubt in a measure attributable to difference of position and soil, which would in itself necessitate different systems of treatment. As the cocoa tree, although hardy when of full growth, is exceedingly tender when young, it requires protection from the scorching sun and chilling night air; and in order to effect this, and with a further view to obtain some return during the three years which elapse before bearing commences, provisions of several kinds are planted, more particularly the plaintain or bananna, whose umbrageous leaves afford excellent shelter, assist in preventing the growth of weeds, which would otherwise destroy the tree, and, when withered, furnish manure adapted to the reinstatement of the soil. Several other kinds of provisions are, however, planted, and many perhaps more with regard to their own productiveness than that of the tree they should be employed to nurture—such as the yam, a plant climbing on poles, like the convolvulus or hop, and yielding in its root an excellent substitute for the potato; where this is planted, care must be taken that it is not allowed to climb upon the cocoa, which it is apt to do, to the great detriment of the tree—the tanya, an article of a somewhat similar character—the pigeon pea, a bush bearing pods of peas much similar, when boiled, to our English peas: this last, however, is not well adapted to the protection of the cocoa, and on that account should not be employed; there is also the cassada,

* Mr. Alexander Smith, of Kew, (to whom the writer is indebted for having revised the botanical part of the paper), as well as botanists generally, deem this a perfectly futile precaution, it never having been proved that the moon exerts any influence on vegetation.

the farina of the roots of which is made into cakes, and eaten by the natives as bread. It will thus become the first duty of the planter to establish his provision garden, except where, on the level lands, the bois immortal is to be permanently planted, and in such cases this is usually done about every third or fifth row of the cocoa; in either case they must be planted with regard to the positions intended to be occupied by the future cocoa plants; as it will be his object to cover in the land as speedily as possible, the provisions will be planted so thick that it will be almost impossible to stake out the ground, a good deal of care will therefore be required to ensure the trees being in parallel lines, which is essential to the full employment of the land. As it is very unfruitful planting within the tropics in the dry season, which is, as before said, from January to May, the provisions will be planted according to the time at which the cocoa is planted, a little earlier than that takes place, so that they may be sufficiently advanced by the required time to afford the needful shelter to the cocoa. The time best fitted for the successful planting of cocoa is April to June, but if there is a large extent to be done, or other circumstances arise to render it prudent, it may be effected after December, though the want of moisture during the intervening months renders it very precarious, especially in the low grounds. In Grenada and Trinidad, the planting or sowing of the seed is still effected by the natives and many planters at the new moon, (the planting of plants or shrubs, on the other hand, being performed on the decrease of the moon), or from that to while the moon is on the increase, and in such a case therefore it requires to be performed expeditiously; it must, however, be understood that the planting is, and can without doubt, be performed throughout the entire year. On an economically and well-managed estate, however, as before stated, the operation is generally performed in the months of April, May, and June, and the waste of time and labour occasioned by the adoption of any other course does not commend it to the planter except under very extreme circumstances. The distance at which the plants should be separated varies according to the quality of the soil; the most satisfactory distance seems to be 10 feet asunder for a poor soil, 15 feet for good land, and on rich virgin soils as much as 17 to 18 feet; taken throughout in Grenada, if planted about 12 feet apart, it is about the best average distance. The system adopted by the natives in Grenada, of close planting, is a great fallacy, as is evidenced by the yield obtained by them. It is not, however, expedient to allow the tree to grow larger than can be thoroughly nourished; indeed, to obtain the fullest extent of fruit, the cocoa-tree must be pruned in, and in a measure stunted, and the earlier the land can be covered in the better, as the weeds, so long as they have light and air, will grow stronger and more rapidly than the cocoa.

Before planting commences the provisions must be weeded and the ground thoroughly cleared, care being taken that the young provisions are not injured in the operation; the weeds should in this case be pulled out with the hand by the roots, and so soon as this has been effected, the planting cannot commence too early. It is for many reasons indispensable that the arrangement of the lines of trees should be laid out with care, and as much as possible parallel with each other, the avenues being at right angles; the greatest number of trees can thus be grown on a given extent of land, while it admits of the labourers working in lines when picking or cleaning, and thereby more readily under the eye of the overseer. If the land is free and loamy, the holes may be dibbed, which is effected by a bar of iron, pointed at one end, being pressed into the ground to the required depth. If the land be hard and dry, the holes should be dug out to the width of twelve inches, in order to pulverise the soil, otherwise the tender roots would be unable to penetrate; but where the land is at all of a retentive nature, it is advisable to scrape together some earth, in which, when thrown up into a small mound or cone, say about six inches in height, e holes may be dibbed to the depth of about three inches; by this arrangement the dampness is prevented which would otherwise chill the roots, from the water lodging in the hole without the means of draining away, and the soil is, moreover, thus pulverised so as to assist the gentle and tender roots to penetrate until the land is permanently thrown up into broad ridges, which is strongly advisable, especially in comparatively level lands. It is always advisable to plant not less than three seeds in each spot where a tree is required, but as the chances are very much against their growth when placed together in one hole, owing to their latent moisture causing them to adhere together, become mouldy and rot, it is advisable to place them in three distinct holes, about four inches asunder, in a triangular form, so as to maintain as far as practicable the regularity of the lines, the additional labour being amply repaid by the comparatively greater success. If the land on which the planting is taking place is poor or has been lately worked, it is better to apply a little pen manure as the planting proceeds, and this, by inserting a small quantity in each hole along with the seed, having it previously chopped up and mixed with loam (and wood ashes if obtainable, which particularly favour the germination of the seed), to admit of it, and that it may not force the roots too much so as to make them too tender to penetrate the surrounding soil; the warmth will much assist germination, and place the embryo plant so far progressed before the heavy rains that it may not be destroyed; the plantain then will be ready to protect it with its umbrageous leaves. Speaking of the application of manure in the cocoa cultivation, if it should be deemed necessary and advisable afterwards to apply it, it should be done by digging out a ring around the tree, some twenty to thirty inches from the trunk, and literally burying the manure, which on no account should be other than pen manure; by this means the nourishment is given to the extreme tender roots, which are the points whence nourishment is received from the soil; unless applied, however, at the time of planting, it should not be applied in either manner until the removal of the spare trees.

As to the seed which is to be employed, the natives pick the pods from the mother tree the same day that the seed is required to be planted, planting the seed with all the pulp enclosing it; this practice, however, is much to be deprecated, there being little certainty of its germinating under such circumstances. The pods must be quite ripe, and the generality of opinions of the more experienced planters are in favour of stacking the pods in heaps unopened for the space of two or more days, that a slight degree of germination may ensue, as from the wet nature of the pulp by which the seed is surrounded it is very apt to chill and rot, therefore the quicker germination progresses, the more is this liability diminished. It almost becomes a question whether it would not be better to allow the seeds to remain in the pods a period of time until all the pulp is absorbed or hardened, and the seeds rattle in the pods. It is proved that under this treatment the seeds equally retain their vegetative powers, the principal objection to it is therefore removed. If new seeds were imported from foreign countries this would have to be done, and there cannot be a doubt that an interchange of seed is highly advantageous, and productive frequently of marvellous results.

Weeding.

Having completed the operation of planting, the attention of the planter will be mainly required to keep the weeds from preying upon and choking the young cocoa and provisions; weeding or clearing the land should, if possible, be performed in wet weather; hoeing, when necessary, in fine dry weather. Far too little attention is at present paid to the operation; although the soil being covered in with weeds tends to prevent the abstraction of moisture by the sun, the weeds also tend to prevent the admission of air, which is very essential. On the score of economy alone, as a rule, one or two men should be constantly employed in weeding; the land should be gone

over once every month or six weeks, and by this means the weeds would be prevented seeding, which adds much to the labour otherwise required.

"Provisions."

According to the kinds which have been planted will these commence to bear fruit and require attention. If the yam be among the number, for instance, it will require staking at a very early stage; poles about 15 feet long should be provided for the purpose, and they may afterwards be employed in the subsequent operations of the cocoa cultivation. The provisions, while fostering and protecting the young plant, will also, if properly marketed, reimburse the first three years' expenditure, so that they reasonably deserve a good share of the planter's attention. In the West Indies they form a very valuable crop. Grenada now exports large and increasing quantities to Trinidad, Barbadoes, and other places, the prices varying much according to the season.

Trimming.

Supposing that the young cocoa tree is now fully established, the spare trees may in the second year be removed, care being taken in their removal that the roots of the remaining trees are not destroyed, and the operation will greatly assist their growth by the loosening of the earth about their roots; the spare ones can in some cases be employed to fill up vacancies. If on the low or level lands, the earth may be banked up about the trees into ridges, allowing the furrows to be in the centres of the avenues between the trees, and a few stones may be advantageously placed around the foot of the stems or trunks (if not already done), with a view to preventing the soil becoming parched or being washed away.

Means must now be adopted to trim the tree; the object will be to obtain three or four healthy primary branches, pruning in any more, and generally to cover in the land to the fullest extent, without allowing the trees to injure each other, or exclude the action of the light and air. If the branches show signs of rising directly upwards in too great a degree they must be brought down. To do this, a common method adopted is to place a piece of wood or stone to act as a wedge between the branches while they are young and supple, with some soft substance between it and the tree to protect the bark from being chafed; the common practice of the natives of using litter for that purpose is fraught with much evil, as it forms a means of harbouring damp in the cavities, and insects and rot thereby prey upon the heart of the tree. The branches must, however, be kept down as much as possible, to render more easy the operation of picking the fruit and cleaning the tree, and to permit of pruning in the "suckers." This term, used by the cocoa planters, implies a particular branch which the tree frequently sends forth; whenever they present themselves they require to be pruned off; when matured, they are easily distinguished by the difference in the bark, which has a smooth surface and pinky hue, and from their running up to a considerable height with leaves only at the top. In a well-managed estate they should always be nipped off when young and succulent. In this stage, however, they are difficult to distinguish from the fruit-bearing branches, and can only be distinguished by practice. One peculiarity is, that the suckers generally run up perpendicularly from the trunk, or more generally from the primary branches, and throw off leaves in pairs at right angles, while the fruit-bearing branches strike off at an angle, lying somewhat horizontally with the leaves budding diagonally. These suckers but very seldom bear any fruit, and grow to a great height if allowed, extracting much from the strength of the tree. When, however, very old trees, which have nearly expired, are wished to be made productive, they are sometimes employed; the old tree is cut down just above the sucker, which should be as near the ground as possible, and by a system of judicious pruning it sends forth branches; they are, however, never so productive as the original tree; indeed, they are not, nor should they ever be, had recourse to, other than to fill up a blank in the centre of an otherwise thriving cocoa piece.

The cocoa tree throws out a great many branches, which injure the productive powers of the tree. It is most important they should not be too numerous, nor the foliage too redundant; the one is the result of the other, and together they weaken the tree and keep off that strength and vigour which the access of the sun's rays and the circulation of air naturally produce. Though the leaves of the tree are the imbibers of much moisture, and sources thus whence equally with the roots the tree is nourished, it is essential to allow only the growth of a necessary quantity, in order that the rays of the sun may penetrate and the air circulate among the branches. It will therefore form the most important part of the planter's duty to prune into form the young cocoa tree.

The primary branches, which are those which first strike off horizontally, are in the case of cocoa the largest fruit-bearing parts of the tree, and their number does not often require regulation, as the object is to cover the ground expeditiously. Generally three or four are selected and trained out, and they will not require to be checked until they have attained the desired length, when they must be carefully pruned in. From off these primary branches grow the secondary or lateral ones, which are equally fruit-bearing, but are more generally pruned-in in the early stages while the primary ones are growing. The shoots which are allowed to grow should be about the extremities of the tree, so as to admit the circulation of air about the branches. As a rule, when any extensive pruning has to be performed it is caused by the neglect of the planter; the operations already indicated can and should always be performed while the shoots are young, they are then easily nipped off with the finger, care being taken not to strip off the young bark. To witness the distorted appearance of the trees on some of the native pieces is truly heart-sickening. In Trinidad, however, more care is now bestowed on the important operation of pruning, and the San Antonio estates are a model in this respect. The symmetry of a well-trained cocoa tree is very pleasing, and the labour bestowed in these earlier operations is well repaid by an immense saving of anxiety and labour in the after years. As the tree progresses, topping the upper branches will be necessary, to prevent the tree becoming of an unmanageable height, and this should be done early, in order that the use of the knife may be as much as possible dispensed with. The employment of the knife should ever be tempered with discretion and caution, for it is invariably followed by the creation of new suckers and shoots, which in like manner require to be checked. The branches will often require support, especially when the trees are densely planted, and so soon as there appears the least sign of bending or drooping, which is generally in the year of the first crop, or immediately preceding it, support should be afforded; the bamboo rods, which are always at hand, are well adapted to the purpose, care being taken to prevent their chafing the bark, by the inter-application of some soft substance, other than such as would rot, or cause damp and vermin.

Cleaning.

The important task of pruning, weeding, and cleaning must be persevered in regularly, a few steady hands being always employed in it, the humidity causing vegetation to be very profuse and rank. The young trees will, however, require comparatively but little cleaning, as the mosses and lichens have not yet begun to establish themselves, but in removing any that may appear, great care must ever be taken not to rub off the flowers, which are very small, and spring directly from the woody part of the trunk and branches in clusters. The best, indeed the only time when the trees should be cleaned of these or any other foreign bodies, is in wet weather, and, if possible, not when the flowers are out. It is effected by rubbing or picking them off with the hand, or when the wood is matured and aged, by rubbing off the smaller kinds with a brush or leather glove; as the trees grow old they be-

come more rank and wild, and seem to delight in the decay of the tree.

The *Parasites** which prey upon the cocoa tree are very numerous, and must be carefully watched for and destroyed, and the trees kept clean; the most formidable among them is a wild cabbage, of pine apple-leaf appearance (probably one of the *Bromelia* family), whose roots fix themselves upon the tree, generally in one of the upper branches, and grow so rank, if unchecked, as to close in and destroy a whole branch; but this could never be seen on a well-managed estate, as the epiphytical stem would be detected directly it had attached itself to the tree. A very troublesome parasite is that called by the natives the *Captiaine Bois*. *Mosses* grow largely, particularly upon aged trees, more, however, upon the trees inland, or at a great elevation, where the atmosphere is more humid and cold, than upon the coast; they are considered by some as parasites, by others as simple epiphytes, to which latter class they would seem to belong; and the opinion of an old West India cocoa planter (the late Dr. Thomas Duncan, of Edinburgh and Grenada), who had for a considerable period studied their habits, leads the writer to the conviction that simple moss is, not only not a parasite, but a protection afforded by nature to guard against those extremes found in tropical climates, which without that protection would infallibly destroy vegetable life; without doubt it exerts a protective power—it protects from the scorching sun—it guards from torrents of rain—it shields from nightly chills—and shelters from high winds—and even if it does abstract nourishment to a small extent from the tree, the other advantages more than compensate for it. Who can but admit the description of the mosses in the 5th volume of Ruskin's Modern Painters. "Meek creatures!" says he, "the first mercy of the earth, veiling with hushed softness its dentless rocks; creatures full of pity, covering with tender honour the scarred disgrace of ruin, laying quiet finger on the trembling stones to teach them rest. Strong in lowliness they neither blanch in heat nor pine in frost. To them slow fingered, constant hearted, is entrusted the weavings of the dark eternal tapestries of the hills." Nevertheless, even the mosses should not be allowed to overrun the trees, else other enemies will find cover under their cloak. There is a *Lichen* which may pass for moss with a cursory observer, but it is a noxious parasite, and should be removed; its close adhesion to the tree gives it the appearance of disease or abrasion, and may thereby be detected. The *Mahoe tree* (*Hibiscus elatus*) frequently establishes itself in a cocoa plantation, and must on no account be allowed to grow, as it will give great trouble to eradicate.

While on the subject of parasites, the cocoa tree has also its enemies in the insects, which at times do much damage; in a plantation kept well cleaned and weeded, the difficulties are, however, much lessened. If litter or leaves have been inserted between the wedges or stakes employed to trim or support the trees, dirt will have become deposited there, and the louse probably have taken up its quarters; these should be trapped and destroyed, though the harm done by them is only in the accumulation of dirt in the cavities of the tree. There is a bug which is very destructive; it mostly infests the very wet districts. The black grub is another troublesome enemy; in a black soil of a rich nature its ravages are more frequent, and in the case of young trees frequently ends in their destruction; as it attacks the roots of the tree there is little or no chance of destroying it until the tree is pulled down; if the tree droops from this cause it may be at once cut down, the ground well limed and pulverised, taking care the grub is destroyed, and another tree planted in its place. One other insect only requires particular mention, and it is perhaps the greatest enemy of the Theobroma; it is called by the natives the slug, by others the borer, it is a worm which eats into the heart of the wood, and travels throughout its extent until the tree is dead. Its course is almost always upwards, and the leaves soon manifest the effect it produces by drooping and withering from the top of the tree downwards; when satisfied that this is the cause, the planter must have recourse to the saw; for this purpose a fine-toothed saw should be employed, the hole sought for, and the tree cut off just below the worm, taking care that it is extracted and destroyed. By this means other branches will speedily appear, one or more of which must be trained up as the other trees have been, and will soon acquire equally good fruit-bearing powers.

In the third year the cocoa-trees will have so far established themselves as to have closed in and destroyed the provisions which were planted for their protection, and these should then be cut down and buried, and allowed to decay as quickly as possible, or be burned to form a return to the land, and the yam poles used as further supports to the cocoa if required. According to the quality of the soil, and the care which has been bestowed upon it, or if manure has been applied at the planting, the cocoa will in the third year bear a few pods of fruit, but not sufficient to require any special preparations to be made for them.

(*To be continued.*)

* The term "parasite" here used is not strictly correct, including as it does both *Parasites* and *Epiphytes*; it is not employed technically, but as a term common in cocoa-planter phraseology.

UNITED ASSOCIATION OF SCHOOLMASTERS.

The seventh winter session of this association was opened on Friday, 29th September, at the house of the Society of Arts, under the presidency of the Rev. Dr. Jacob, head master of Christ's Hospital. Mr. James Tilleard, the corresponding secretary, read the inaugural address, which consisted chiefly of a *resumé* of the proceedings of the society during the past session. Since its establishment, seven years ago, 70 papers had been read; 33 on individual subjects of instruction, 18 on general principles of teaching, 11 on educational politics, 5 on professional interests, and 3 on the history of education. One-fourth of the entire number had been devoted to the general question of method, "the most important department of all, he said; "for let us once succeed in fixing the general principles of our science on something like a firm foundation, and the proper treatment of individual branches of knowledge will follow as a matter of course. It will be a mere question of the application of general rules to particular instances." The department of educational history had received the smallest share of attention, and it was desirable to have more papers upon that subject. He alluded to the advantage which would arise from drawing up a scheme on the question of educational method in all its ramifications, and from having a printed journal of the proceedings of the Association. A paper entitled, "A few Suggestions from an Old Teacher," by Mr. T. Bilby, who had been engaged more than forty years in education, was then read to the meeting by his son. He strongly advocated infant schools, and recommended their establishment in every parish; complained of the present system of supervision by the government inspectors of schools, whose knowledge, he said, was theoretical and not practical, and suggested that there should be a court to which schoolmasters might appeal against their decisions; and, while fully admitting the improvement which had taken place in the education of pupil teachers, he lamented to see a great deficiency in their religious and moral training. He thought that sufficient attention was not paid to the selection of teachers, and gave these as the qualifications which they should possess,—moderate attainments, much good common sense, love of children and of education, fitness for teaching, ability for singing, and, above all, practical Christianity. Further, he condemned the parsimony generally shown in the payment of teachers, which, he observed, placed them in the same rank as artisans, and precluded

them from securing the means of self-improvement. A brief discussion followed the reading of the paper, and votes of thanks were awarded to Mr. Bilby and the chairman.

Home Correspondence.

COINS OF TUSCANY.

Sir,—Mr. Paget Jervis having requested me to bear testimony to the accuracy of the drawings he has made of the coins of Tuscany which have been engraved on wood, and inserted in the *Journal* for the 21st Sept., I have much pleasure in doing so, having compared the coins and proofs of the woodcuts for that purpose. In the notices which he has given of the coins he has embodied a great deal of information and arranged his materials in a very systematic manner, giving the weight of the coins; the alloy to a fractional part; the mint mark enlarged; the value of the coin; the relative value of gold, silver, and copper money in each country separately; the value in English money in the foreign unit and *vice versâ;* the geographical and mineralogical account of coins referred to certain mines; the etymology of the coins, and minute imitation of the lettering; all of which gives to his researches a completeness, and I think a novelty, not to be found in the usual numismatic treatises. Mr. Jervis has also proposed a new series of monograms to designate the nature of the metal of which each piece is made, the letters of the monogram containing the initials of the metals of which the alloy is composed. Such a principle, which is an extension of that at present used by numismatic authors, is ingenious and worthy of consideration, but is perhaps too complex to be readily adopted, and the simplification of the monogram is a point for consideration; it is, however, a step towards technical accuracy, and has not, that I am aware, been carried out to the extent proposed by Mr. Jervis, who, I think, deserves credit for the idea.

I am, &c.,

S. BIRCH.

British Museum.

STREET RAILWAYS.

Sir,—It may be in the recollection of your members that, nearly four years back, I read a paper* on the subject of the application of rails to streets and roads, so laid as not to interfere with the ordinary traffic. It was not the first time, by many years, that I had advocated the same thing, but there was no inducement for engineers and contractors engaged in making lines of steam railway, at from thirty to forty thousand pounds per mile, to waste their time on lines of two thousand pounds per mile. Time has brought the system to pass as a national want, and now, under the stimulus of the incessant agitation of Mr. Train, even Great George-street is moving through some of its members, who think they see an opening for profit.

By the report of the *Times*, it appears that Mr. Palles, of Philadelphia, and Mr. James Samuel, of Great George-street, have been appointed engineers to lay down the Birkenhead line, though what more could be wanted than an ordinary road surveyor I am at a loss to comprehend. There is no more in the matter—nay, rather less—than street-paving, for a long length of rail is easier to make level than a series of detached stones. The best form of rail to comply with the requisite conditions, and the best form of carriage to elude friction, are mere questions for the mechanician, but all this appears to have been provided by Mr. Train's patent, ready to the use of the two engineers, if we may judge from his pamphlet, which has just been put into my hands.

It is a very useful pamphlet in the way of agitation, and gathers together the practical facts of the great success of horse railways actually in use in the United States, a very plain answer to objectors who raise up all kinds of imaginary obstacles in this present age of the world, as they have done in all time in the case of new and useful things. Even after the perusal of Mr. Train's book, it appears that he does not quite comprehend all that is before us. He speaks exclusively of street railways, not apparently aware of the great question at issue, namely, the conversion of all our ordinary roads to rail uses, first by horses and then by chemical machine power, steam or other. The roads exist, the inns and stations exist, the bridges are made, and all is complete save the insertion of the iron bands in the road surface. The main railways are the arteries of commerce, but they do not subserve the purposes of intercommunication, and it is probable, nay certain, that the road surveyors will be the engineers of these new lines, where great works of construction are not needed. And it is capable of demonstration, that laying down rails in the main highways which the main railways have bordered will create a traffic of their own not now existing, and so far from diminishing will increase the traffic of the main railways. They will be as branches and feeders, from the simple circumstance that the rate of speed on the one will be eight or ten miles per hour, while that on the other is from thirty to forty.

There is something very ludicrous in an epistle from Mr. James Samuel, Chief Engineer of the Birkenhead Street Railway Company (Limited), to Mr. Train, telling him that he considers some eight of the main thoroughfares of London well fitted for the purpose of laying down rails, and that "he has secured the services of Mr. Palles, a young engineer from Philadelphia, practically to overlook the work." Surely a chief engineer would be as much required to lay down street gutters. Two engineers to set up a row of lamp-posts would be quite as much to the purpose. But, in truth, it is not engineering at all, but what the Americans call "bunkum." It has an imposing effect on parish authorities and would-be shareholders. In any other point of view, it is a mere farce. Any competent paviour would be competent to the operation and supervision, and we can imagine how quietly Mr. Palles will be laughing in his sleeve at the gullibility of John Bull, and his liability to be imposed on by words.

And now to the analysis of the rail, as shewn in the drawing of Mr. Train's book, with a view to its material efficiency.

A number of any sleepers of a section 5 in. × 10 in. and 7 feet long are laid twelve inches below the surface of the road. On these are laid longitudinals, notched into them like a piece of carpenter's framework, measuring eight inches deep by six inches wide, iron corner-plates being used to connect the longitudinals to the transverse. On the top of the longitudinals are spiked down the rails, which are bars of iron six inches wide and about half an inch thick, with two small ribs below to clip the timber. At one edge, is a raised surface about $1\frac{1}{2}$ inch wide and $\frac{3}{4}$ inch deep, making altogether $2\frac{1}{4}$ inch, and on this raised surface the wheel travels, guided by an ordinary flange. The road is macadamised both in and outside the rails. The guage of way is apparently about 5 feet 2 inches. The flat surface is about five inches wide, and is apparently intended for the wheels of ordinary vehicles. The weight of rail is from 45 to 50 lbs. per yard. The central portion of the macadam between the rails is $\frac{3}{4}$ of an inch lower than the outside, tending to hold water in wet weather.

Now street rails require to be stronger and more massive than ordinary rails. They have not a heavy engine on them, but they have coal and other waggons striking them at right-angles and diagonally, and rolling along them. The proof of this is that while in America 56 lb. rails are commonly used on railways proper, the street railways use rails of 72 and 74 lbs. per yard.

The probability, therefore, is that the rail will bend vertically under the wheels of heavy vehicles, and get bent on the timber, and at the joints it will get wholly out of order, and may become dangerous by starting up into "snakes' heads." There is yet another consideration—

* See *Journal*, Vol. V., p. 187.

the cross-sleepers carry the weight of the loads. If they sink or give way, the surface must be taken up to the depth of twelve inches to get at them, and pack below—a very serious inconvenience in crowded streets; and, moreover, unless some very efficient mode of drainage be provided, they will rapidly rot. The depth at which the sleepers take their bearing will also be found in many streets—in London at least—to interfere seriously with the pipage.

In a frontispiece Mr. Train gives a carriage, the weight of which cannot be a trifle, yet two fiery horses almost show a desire to run away with it—or perhaps they are gibbing. The standing position of the driver, in the end gallery, does not seem favourable to mastery over them if the weight be not sufficient. A second carriage, with a Chinese pavilion on the roof, for outsiders, is christened Napoleon the Third, and is surmounted by a crown. They show no springs, and yet Mr. Train calls the French street railway a clumsy, bungling affair, which has always been an eyesore to the Emperor. Is this bidding for a new concession?

What is the mystery of this "chief engineering" from Great George-street? How is it to be compensated for, if not in obtaining concessions, *i.e.* practical monopolies in running carriages, getting a railway without paying for land or levelling, and afterwards getting compensated for giving it up. If Mr. Train can persuade people to take exclusively to his rails and carriages, that is legitimate enough, and no one will grudge him the recompense for his agitative system, serving himself and the public at the same time. No more engineering is needed than the skill required to lay down iron gutters in the pavement, and to measure the width of a street to ascertain if there is room for three breadths of vehicles, the rail being in the middle. The real question is how to make a good and permanent way, and that is a subject for the skilled mechanician to furnish a reply to, and not for an engineer of bridges and cuttings, and embankments. I have always regarded the road surveyors and authorities as the true engineers in this case, and should any of these gentlemen wish it, shall be happy to give them any information which may be lacking in this or my former papers, either as to rails or carriages.

It is obvious that, consistently with comfort, the narrower the carriages can be made the better, to be out of the way of obstruction. Six feet six inches in width is the limit, which leaves two feet on each side for the riders, and two feet for passenger way, and this is altogether a less width than the wheels of existing vehicles, which are outside. The reduction in the size of wheels, permitted by the improved surface of the road, allows the wheel to be placed underneath, but it must not be forgotten that the wheels are practically a safeguard to the passengers, taking the shock of any badly-driven vehicles running against them. The vehicular apotheosis of "Napoleon the Third" would "come to grief," if disputing the right of way with Sir John Barleycorn, represented by Barclay's draymen.

In the engraving two horses are represented abreast. It is very doubtful if this will not put the foothold of the horses in a bad position for draught. Tandem has its inconveniences, but they would be less then the inconveniences of two horses abreast. As the guiding and stopping of the carriage is all performed by the rails and break-works, all that is wanted of the horses is to pull on the centre of the track. There is one inconvenience in the tram system as compared with the ordinary road—the feet of the horses travelling in the same track wear it out very rapidly, and good paving will be required in crowded streets.

The disadvantages alleged against the system are unfounded. With regard to getting at the pipes and sewers, the rail system is the only one which will admit the transit of omnibus passengers while the ground is opened, and the fact of carriages keeping a regular line tending to facilitate traffic has been proved already on London bridge. All that is required is to keep the rails away from the sides of the road, in order not to interfere with vehicles drawing up to the door.

The quantities of material in the Birkenhead line, as set forth by the Engineer-in-Chief, appear to be per mile:—

Rails	79 tons.
Longitudinal timber	3,500 cubic feet.
Cross sleepers ...	say 900 in number.
Corner plates ...	1,800
Pipes for ditto ...	7,200
Welding and spikes...	3,500

Nothing is said about joints, which are a very important element in preventing destructive wear.

I am open to correction, having taken these data from the very meagre drawing.

It appears, therefore, that the cost of this somewhat complicated and not very desirable structure, without laying down or paving, will be from £1,300 to £1,400 per mile, exclusive of the "engineering."

It seems clear that something cheaper, more durable, and simpler than this is desirable, and whether it is desirable to make a tramway available to all carriages, or one expressly for passenger vehicles, always supposing that the surface is to be flush, so as to offer no impediment to curving, is yet a moot point.

But at any rate, it would be a very costly mode of paying the "enterprising" engineer to give the exclusive monopoly of passenger carriages, for to that these enterprises practically amount.

The true thing is to regard the rail as simply a part of the paving, and therefore to be dealt with by the road surveyors, who will scarcely need to call in consulting engineers. The proposed laying down the line in Victoria-street, Westminster, and running a large omnibus upon it, will simply prove what everybody knows beforehand—that wheels will run on rails,—but leaving untouched the real questions at issue. Sir Benjamin Hall may have been very ignorant in the details of his opposition, but he was right in the main. He would not make over to a company of irresponsible speculators the streets of the metropolis, as a practical monopoly to put down all opposition omnibuses, and establish an "exploitation" of the public like that of Paris, the one thing needful to make a general omnibus company a "perfect success." The public will not permit the "hedging in of this cuckoo." Rails will be laid down, but if an exclusive right on them be granted, the *quid pro quo* will have to be carefully studied, unless the road commissioners determine to do the work for themselves out of the rates.

I am, &c., W. BRIDGES ADAMS.

Sir,—My attention was called to the subject of Street Railways in 1855, when I happened to be in Paris at the time of the Great Exposition, and there I experienced the comfortable travelling of the carriages on the French construction, working on the tramways laid down from Paris to Versailles and St. Cloud in the public road; and it occurred to me that the system would be very desirable in England, if the difficulty of the "right of way" could be satisfactorily surmounted, as I foresaw that if such a privilege as that granted in France and America were proposed in England the right would not be granted; and as the English roads are not, as in America, straight and broad, with a limited traffic, but narrow and crooked, with a very large traffic, however desirable the system might be, its introduction would be impossible, unless the carriages were made upon such a principle that they could travel both on the rail and the road, and be transferred from the one to the other with perfect facility at any moment and any place at the will of the driver. With these impressions, I contrived a carriage with shifting or moveable flanges, and took out patents for the invention in 1856. In 1858 I obtained permission from the committee of the Mersey Docks, at Liverpool, to work a carriage as an ex-

periment on the line of rails or trams laid along the line of docks; in March, 1859, the first carriage was set to work, and with such success that I offered to place as many carriages upon the line as would suffice for the entire traffic of the road. I was not able to induce the committee to grant me such a lease of the line as I considered necessary to induce capitalists to embark money in the undertaking; but the omnibus proprietors along the road, with whom I had made written contracts to work my patent, instead of keeping faith with me, pirated my patent; and six carriages, bad copies of my invention, are now daily in use along the line of docks with such success, that the ordinary omnibuses on the line of route are to a very large degree superseded, and would be so entirely but from a customs regulation forbidding the tramway carriages to pass through the enclosed docks after four o'clock in the afternoon.

The form of rail used at Liverpool is the ordinary double-headed railway bar; the stones, or road, are perfectly level across, so that ordinary vehicles cross at any angle whatever with perfect facility. The rail I purpose using is the same in section as that used in France, so that vehicles of all kinds, as at Liverpool, can cross the road, or travel along it with perfect facility, and without any inconvenience whatever.

I may add that the Enterprise, the original carriage, has been exhibited on three occasions in the most crowded streets of the City and the West-end of London—on the last occasion on Monday, the 3rd of September, when it was drawn through Lombard-street, and all the busy crowded thoroughfares, and then taken westward through Fleet-street and the Strand, &c.

I by no means recommend that trams should be laid down in the crowded London streets; the rails could not be kept, if even the "right of way" was granted. My proposition is to lay down the rails up to a certain point, as in the case of the City-road, northwards to Finsbury-square or Moorgate-street, and at this point to convert the carriages into ordinary vehicles by raising the flanges, and thus to pass through the streets in the ordinary way, and when necessary to put on additional horses; but this is not found to be necessary in Paris, where my plan has been adopted. The same horses which drag the tramway carriages from Versailles take them on to the Rue du Louvre, and return thence to the Place de la Concorde, where they are changed.

My omnibus, which carries fifty passengers, weighs empty, three tons, and loaded, four tons more. This carriage was worked for upwards of two months—the horses in most cases travelling at the rate of eight miles an hour, including stoppages—by two cab horses taken from the streets of Liverpool, and ordinarily made three journeys of six miles, equal to eighteen miles, without being taken out of the harness, and sometimes crossed from one line to the other, or off the road altogether, five times in a journey of three miles.

As respects steep gradients, that on the Versailles line at Sèvres is as steep and three times as long as Skinner-street, and this the French carriages surmount without any difficulty. At Liverpool there is a considerable rise at the Brunswick Dock, which I never had the least difficulty in travelling over.

I may observe that in 1853 the American system was introduced into France, but it was found so inconvenient that all the American carriages were set aside, and those now in use substituted for them, which turn round like a common omnibus, and other changes made which were great improvements over the American model.

I have received permission from the Commissioners of the Metropolitan Roads to lay down a line of trams along the Liverpool-road at Islington. The rails are now on the ground, and within a very brief period the public will have an opportunity of judging of the value of the system.

I am, Sir, yours, &c., W. J. CURTIS.

1, Crown-court, Old Broad-street,
London, E.C., Sept. 21.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 28th*, 1860.]

Dated 6th June, 1860.

1394. W. McIntyre Cranston, 68, King William-street, London Bridge—Imp in reaping machines. (Partly a com.)

Dated 27th July, 1860.

1818. C. Schon, Minden, Prussia—Imp. in the construction of propelling wheels for ships.

Dated 22nd August, 1860.

2022. F. R. Grumel, 42, Bridge-street, Blackfriars—Imp. in the albums of collections of photographic and lithographic proofs, engravings, and other drawings.

Dated 23rd August, 1860.

2026. R. J. Cole, 21, Chepstow-villas West, Bayswater, Middlesex—Imp. in the construction of brushes.

2021. S. Purchas, Worcester—Certain imp. in the application of brakes to railway carriages. (A com.)

Dated 24th August, 1860.

2035. W. E. Gedge, 11, Wellington-street, Strand—Imp. in turbinical hydraulic apparatus. (A com.)

2042. J. Fleming, jun., Newland's-fields, Renfrew, N.B.—Imp. in washing, cleansing, and preparing textile fabrics and materials, and in the machinery or apparatus employed therein.

Dated 30th August, 1860.

2091. W. Kirrage, and A. Ripley, 5, Albion-place, Vauxhall, Surrey—The amalgamation of certain materials forming a plastic composition applicable to works of the fine arts, building purposes, imitations of marbles, ancient carvings, and various other uses.

Dated 31st August, 1860.

2102. G. Richardson, Alma Park, Levenshulme, near Manchester, Lancashire—An improved instrument to be used for ascertaining distances.

Dated 1st September, 1860.

2112. F. Allen, 70, Seymour-place, Bryanstone-square—Imp. in a machine called a dumb jockey, used for the breaking and training of horses.

2114. W. Holroyd, and S. Smith, Halifax—Imp. in looms for weaving.

2115. C. Bowler, Bowden, near Manchester—Imp. in electric telegraphs.

2116. C. W. Harrison, Plumstead-common, Kent—Imp. in electric telegraphs.

2120. G. Hollands, Rochester, Kent—Improved apparatus to be used in the process of fermentation.

Dated 3rd September, 1860.

2122. J. E. Boyd, Hither Green, Lewisham, Kent—Imp. in machines used for cutting, scattering, and collecting vegetable and other substances.

2124. Henry Moore and Samuel Newberry Burnley, Lancashire—Imp in machinery for sizeing or dressing warps or yarns.

2126. G. E Donisthorpe, Leeds—Imp. in sizeing yarn or thread previous to warping.

Dated 4th September, 1860.

2130. J. J. Stevens, Darlington Works, Southwark—Imp. in iron bedsteads. (A com)

2134. G. P. Wheeler, Abinghall, near Micheldean, Gloucestershire—An improved mode of, an apparatus for, preparing bleaching agents.

Dated 5th September, 1860.

2136. H. Potter and A. Peek, Manchester—Imp. in treating or preparing textile materials and fabrics.

2138. D. Y. Stewart, Glasgow—Imp in moulds for casting.

2140. W. E. Gedge, 11, Wellington-street, Stand—Improved cylinders for laminating metals. (A com.)

2142. F. Ransome, Ipswich—Imp. in preserving stone, bricks, and other porous building materials, and in cementing porous and other matters in manufacturing blocks and other articles thereof.

2144. G. Bedson, Manchester—Imp. in annealing, cleaning, and galvanising, or otherwise coating wire and sheets or strips of metal with metals.

2146. G. F. Wilson, Belmont, Vauxhall, and J. Jackson, 24, York-street, Bromborough Pool, near Birkenhead—Imp. in lamps and lamp wicks.

2141. J. Huggett, Eastbourne, Sussex—A method of and apparatus for regulating the light in street and other lamps, whereby the re-lighting and extinguishing of the same may be dispensed with.

Dated 6th September, 1860.

2152. W. H. Burke, senr., and W. H. Burke, jun., Brompton, Middlesex—A method of preparing fabrics composed of or containing caoutchouc, to enable them to resist the action of colours and varnishes containing oil.

2154. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of archil. (A com.)

2156. A. Lester, Coventry—An imp. in looms for weaving.

Dated 7th September, 1860.

2160. J. S. Travis, Stretford, near Manchester—Imp. in traction engines.

2166. J. Hamilton, junr., Liverpool—Imp. in sockets for receiving the lower parts of the posts or uprights employed in constructing electric telegraphs.
2168. J. H. S. Wildsmith, Wolverhampton—A new or improved lubricating material or compound, which said material or compound may also be employed in the manufacture of soap.

Dated 8th September, 1860.

2172. Capt. D. J. Hoare, 7, Albemarle-street, Piccadilly—Imp. in locks.
2176. A. L. A. Herbelot—An improved method of manufacturing paper from wood.
2178. J. B. Duvergé, Bordeaux, France—Improved machinery or apparatus for horizontal, vertical, or inclined boring.
2182. G. Zanni, Upper King-street, Holborn—Imp. in apparatus for roasting.

Dated 10th September, 1860.

2184. T. Thornton, E. Thornton, and J. Thornton, Elland, York—Imp. in looms for weaving.

Dated 11th September, 1860.

2188. H. C. Hill, Stalybridge, Chester—Imp. in the construction of stays for steam boilers.
2192. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved apparatus for sealing letters and other documents. (A com.)
2196. T. Boyle, Belfast—Imp. in preparing machinery for flax and other fibrous substances.

Dated 12th September, 1860.

2201. W. Massey, Linacre Marsh, near Liverpool—Imp. in the manufacture of artificial mineral teeth, and the means whereby the same may be more securely attached to artificial gums and palates, formed of vulcanite or other similar materials.
2202. F. A. N. Freppel, Paris—An improved preservative and sizing compound for sizing cotton, wool, linen, or other yarns, for weaving and for dressing textile fabrics.
2203. R. H. C. Wilson, 12, Wilson-street, Gray's-inn-road—Imp. in registering thermometers.
2204. J. Petrie, jun., Rochdale—Imp. in cocks or taps for liquids.
2205. R. H. Gratrix, Salford, Lancashire, M. P. Javal, Thann, France—Imp. in dyeing and printing textile materials and fabrics.

Dated 13th September, 1860.

2207. J. Wright, 42, Bridge-street, Blackfriars—Imp. in the construction of safety or Davy lamps. (A com.)
2209. N. Thompson, jun., 15, Abbey-gardens, St. John's-wood—Imp. in boat building, and in apparatus used therein.
2211. G. Price, Wolverhampton—An imp. in the manufacture of wrought-iron drill-proof safes.
2212. J. Chesterton, Leicester—A new or improved method of constructing portable buildings.
2213. E. Field, 18, Carlisle-street, Soho-square, Middlesex—A covering for the moustache or hairy parts of the face.
2214. F. M. Murton, Strood, Kent, and J. Millington—Imp. in throttle and expansion valves for engines worked by steam or other vapour, or by liquids or gases.
2215. W. C. Somerville, 13, Upper Albany-street, Regent's-park—Imp. in apparatus for supplying locomotive tenders with water.
2216. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the processes of cementation or case-hardening and softening iron. (A com.)
2217. N. Rosinsky, St. Petersburgh, Russia—A new kind of oil for cosmetics, soaps, and other like articles for the toilet.

Dated 14th September, 1860.

2219. F. Scheithauer, Vienna—An improved machine for printing calico and other fabrics.
2221. J. Cooke, Manchester—Imp. in singeing, treating, or finishing textile fabrics, yarns, felts, and other similar materials.
2223. A. Burdess, Spon-street, Coventry—Imp. in railway brakes.
2225. J. Petrie, Rochdale—Imp. in steam boilers.
2227. T. Till, Birmingham—Certain imp. in machinery for making nails, applicable in particular to the making of that description of nails called "horse nails."
2229. P. A. Beddat, 53, Place Imperiale, Lyons—A new propellor.
2231. W. E. Gedge, 11, Wellington-street, Strand—Apparatus for goffering felt or cloth hats or other analogous articles. (A com.)
2233. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.
2235. M. Henry, 84, Fleet-street—The employment of a certain sorting process for silk and other fibrous materials, and an apparatus for the purpose of performing the same. (A com.)

Dated 15th September, 1860.

2237. D. Davies, Manchester, and J. Allen—Imp. in apparatus for preventing the explosion of steam boilers.
2239. G. J. Wainwright and C. T. Bradbury, Dukinfield, Chester—Imp. in the manufacture of damasks and other similar fancy goods.
2241. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in lamps for burning coal oil and other like combustible fluids, part of which improvements is applicable to gas fittings. (A com.)
2243. J. Horsey, Belvedere-road, Surrey—Imp. in india-rubber teats.
2245. W. Rumbold, St. Louis, Missouri, U.S.—An improved mode of constructing domes.
2247. J. M. Napier, York-road, Lambeth—Imp. in machinery for the manufacture of sugar.
2249. S. Barnwell, Coventry—Imp. in combining and mixing certain solutions of pyroxylene with animal, mineral, and vegetable substances, by which its quality is altered in such manner as to produce hard, resistent, adhesive, plastic, or resilient compounds, and articles unalterable in their nature and varied in colour, which said compounds, in a state of solution, may also be advantageously employed as paints or varnish.
2251. A. V. Newton, 66, Chancery-lane—An imp. in the construction of brooms. (A com.)

Dated 17th September, 1860.

5253. J. Hansor, 2, Portland-place, Wandsworth-road, Lambeth—Imp. in the manufacture of coal gas.
2255. J. H. Walsh, Kensington, Middlesex—Imp. in breech-loading fire-arms.
2261. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of files. (A com.)
2263. R. Crawford, Beith, Ayr, N. B.—Imp. in machinery or apparatus for weaving figured or plain fabrics.

Dated 18th September, 1860.

2265. C. Golden, Bradford, Yorkshire—Imp. in breech-loading fire-arms and in projectiles.
2267. J. Strathearn, Glasgow—Imp. in preparing cotton and other fibrous materials for spinning.
2269. W. E. Newton, 66, Chancery-lane—Imp. in gas meters. (A com.)
2271. G. Owen, Boston Lodge, Merioneth—Imp. in the construction of sawing machines.
2273. R. J. Cole, 11, Pembridge-gardens, Bayswater, Middlesex—Ornamenting the external walls of houses and buildings.

Dated 19th September, 1860.

2275. E. Hunt, Glasgow—Improved apparatus for preparing saws. (A com.)
2277. R. J. Cole, 11, Pembridge-gardens, Bayswater—Imp. in the manufacture of brushes.
2279. E. Martin, 16, Rue d'Antin, Lille, and T. Gudin, 20, Rue Balzac, Paris—Imp. in apparatus for manufacturing gas when dissolving zinc or iron in dilute sulphuric or other acid.
2281. F. W. J. Zorn, London-wall—Improved apparatus for charging and closing the ends of cartridges. (A com.)
2283. M. Simon, Little Moorfields, Middlesex—An imp. in sewing machines.

Patents Sealed.

[*From Gazette, September 28th*, 1860.]

September 27th.

786. A. R. Le Mire de Normandy.
789. E. Pohlman.
791. M. Craufurd.
793. J. Langstein.
796. J. Weems.
797. C. Barthélemy.
798. J. L. Hancock.
800. E. Ewer.
801. A. P. P. Dagron.
804. R. H. Collyer.
805. S. R. Smith.
807. G. Haseltine & J. A. Knight.
809. J. Farmer.
810. I. Holden.
813. J. Monks.
815. N. Smith and R. Smith.
820. J. Reidy.
824. J. Davies and G. Paine.
826. W. M. Chambers.
827. S. B. Haskard, J. Dean, and E. Dean.
828. R. Lakin and J. Wain.
836. R. A. Jefferson and M. Jefferson.
838. H. Jones and J. Jones.
841. J. S. Starnes.
843. R. A. Brooman.
846. C. Johnson.
847. J. Robertson.
848. W. Houldsworth.
855. W. Rimington, and W. Rimington, jun.
857. J. Schloss.
861. T. Ingram.
862. A. Pullan & T. Cresswell.
872. W. Parsons.
875. J. Smith.
898. W. E. Newton.
937. F. Fontenau.
953. J. B. A. Carpentier.
959. C. Stevens.
969. W. E. Newton.
1020. D. G. Berri.
1119. T. Heatley & W. Paddock.
1152. J. Howard and J. Lilley.
1196. W. E. Newton.
1266. W. Clissold.
1337. W. R. Bowditch.
1426. F. C. Calvert, C. Lowe, and S. Clift.
1438. R. Hyde.
1574. T. Wilson.
1593. R. H. Bishop.
1598. C. Stevens.
1772. M. A. F. Mennons.
1781. J. W. Sullivan.
1863. J. Roberts.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, September 28th*, 1860.]

September 24th.

2474. J. Barber.

September 25th.

2484. J. Lewis.

September 26th.

2643. P. Heilmann.

[*From Gazette, October 2nd*, 1860.]

September 27th.

2517. W. Henderson.
2521. E. Leigh.
2523. J. M. Napier.

September 28th.

2514. C. C. Creeke.
2541. W. E. Newton.

September 29th.

2522. J. G. Jennings.
2531. P. Kerr.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, September 28th*, 1860.]

September 25th.

2210. J. Ellisdon.

September 26th.

2293. J. Bullough, J. Walmsley, and D. Whittaker.

[*From Gazette, October 2nd*, 1860.]

September 28th.

2334. W. H. Muntz.

September 29th.

2251. R. Halliwell & W. Johnson.

Journal of the Society of Arts.

FRIDAY, OCTOBER 12, 1860.

COCOA—ITS CULTIVATION, MANUFACTURE, AND USES: ITS ADVANTAGES AND VALUE AS AN ARTICLE OF FOOD.

By J. A. Mann, F.S.S., M.R.A.S., &c.

(*Continued from page* 780.)

No. II.—Manipulation and Trade.

Roads.

While spare time yet remains, attention will have to be directed to the preparation of the mule traces or roads which will become necessary; no plan can be laid down here as to their number or extent, but the very best general guide in the matter will be the several paths struck out by the natives, who in most cases will have discovered the best and nearest route to the several pieces. The main point in their formation will be that they have a gentle and equal descent, and that they be raised above the adjoining land, or, if this is not practicable, that channels be cut on either side for the drainage of the water; this last should be had recourse to as little as possible, as from the heavy rains that fall, they require frequent cleansing, which entails great expense and trouble. Drainage, in any case, is indispensable, but, wherever practicable, stones should be laid down, and these as close as possible, else the earth between and underneath them will be frequently washed away. The first additional expense is amply returned from the greater amount of work performed by the cattle on such a road, and the comparatively small expense required for maintenance. Where rivers have to be crossed it is not advisable to expend money on the formation of bridges; it is far better, except in particular cases, where the current is very powerful, to have a good ford constructed. A good road to the coast or market is very necessary, but as this generally lies with the parish or government authorities, it scarcely enters as one of the duties of our planter.

Works.

Attention is now equally necessary to prepare for the manipulation of the cocoa, the two primary operations in which are the sweating and drying processes. The site of the intended works must be well chosen, it must be in as convenient a proximity to the several cocoa pieces as possible and at the same time near to the market or shipping place, the last is most important, that the dry cocoa may not become wetted at the time of shipping. The spot, if possible, should be an elevated plateau, at the foot of the estate, or, if that is far in the interior, it is better to select one near to the shipping port, as the cocoa would be draining on its way down, and could not receive much harm; in any event the site must be well drained, dry, and in that position where a gentle breeze is generally blowing, with a south or south-westerly aspect.

The building in which the storing and packing has to be performed, is the largest work to be executed; it is, in West India parlance, called the *bocan*. In its design, the object is to have as large a surface of flooring available in it as possible, while it is all-important that it should be perfectly dry; it should be raised from the ground on stone or brick walls, say about six feet, and built of wood, the perpendicular posts or stronger parts being of the hard woods grown in the country, while the smaller and less important parts, and that which is indoor and not exposed, may be of pine lumber. The building may be of a light character, so long as it is dry, and sufficiently strong to resist the effect of the storms which prevail in the wet season. This is advisable on the score of comparative cheapness. It must have a perfectly sound roof, of slates or patent tin plates. The former are even too heavy, the latter decidedly preferable, as they will last a long time, with an annual coat of a mixture of pitch and tar, which maintains them in perfect repair. The roof should have a deep slope, in order efficiently to carry off all water, which must, in every respect, be excluded. As it is essential that the circulation of air should be assisted as much as possible, so that the cocoa may be thoroughly dried, and dampness prevented, which the cocoa quickly imbibes, the sides of the building will be formed of jalousies or frames of moveable laths, such as the "Louvre frame," which can be readily closed, the same as Venetian blinds, whenever rain threatens, and admit a draught of air without admitting rain, if by any chance they should inadvertently be left open while it is falling. The bocan need not exceed eight feet in height to the eaves of the roof, and the superficial area depends upon the extent of the crop. About 30ft. × 15ft. would amply suffice for a crop of 30,000 to 50,000lbs., or for an estate of 30 to 50 acres of cocoa plantation.

At one end of the building should be a small shed or sweating room, which must have a stout brick wall separating it from the bocan, to prevent the steam or vapour which arises from the sweating of the cocoa penetrating into the building where the dry cocoa is stored. Should there appear any probability of the vapour entering the building, the sweating room must be made separate. The only object to be attained in its erection is security, and the preventing rain getting in among the cocoa. The sweating house must be furnished with moveable sweating-boxes, which are merely plain deal boxes with wooden lids on hinges, and the front made of moveable boards, fitting into grooves made for the purpose, with several holes in the sides at the bottom, to admit of the cocoa draining; the best size and shape they can be made is about three feet deep, two feet broad, and three feet long; they would each thus be capable of containing about 500lbs. of cocoa, wet as it comes from the plantation. The number of them to be provided depends on the extent of the plantation.

Platforms or trays are then required to be erected for the purpose of drying the cocoa; these are raised from the ground, about six feet generally, on wooden pillars; they should each be twelve feet broad by sixty feet long, having a roof thirty feet long, moveable on wheels, for which a tramway on either side is provided. The roof should be as light as possible, consistent with strength, tin plates being decidedly the best covering; while the ends are boarded up, one alone having a door, by which, in wet weather, when it is covered over the tray, access may be gained to it. Half the platform is boarded, so that the cocoa may be placed to dry upon it, and with the contrivance of a moveable roof, when rain threatens, it is readily covered over. This is the cheapest method of properly drying the cocoa, and the one universally adopted in Trinidad. It nevertheless has several disadvantages, not the least of which is its comparative insecurity; but there is another and even more important objection which should be got over, that, in a continuance of wet weather, the drying is effected almost in darkness, which in a marked degree renders the colour of the cocoa dull, and even detracts from its marketable qualities in a considerable degree. In Grenada, where the pilferage committed is considerable, it is almost safer to have the drying effected within the bocan, or on trays, which at night, or whenever it rains, could be easily wheeled into the building from a platform or raised terrace adjoining. Could the drying be satisfactorily effected under a glazed roof, with plenty of air admitted by the jalousies and from the floor beneath, this would save an immense amount of labour, prevent pilferage, and much improve the colour of the cocoa. The operation has never been tried practically, so that whether it would succeed or not has yet to be learned. In front of the bocan, a barbicue, or terrace of flat stones, may be laid, with a deep fall and drain, to admit of the wet cocoa being thrown out to drain as it comes from the plantation, before being

carried to the sweating boxes; there is a diversity of opinions as to the necessity for this, and many think it an unnecessary operation, and at once carry the wet cocoa to the sweating boxes.

A great enemy to the works on a cocoa estate is the mouse and rat, especially where there is much bush or stagnant water about them; for this reason, the land around should be kept particularly clean, with a view to affording as little encouragement to them as possible. Men are usually regularly employed for the destruction of vermin, especially the rat and agouti (the latter is very good eating).

Crop.—Preparatory Cleaning and Picking.

In the fourth year a very fair crop will be yielded on a fertile soil and well-managed estate, and great care, therefore, is required in the cleaning of the trees and the land, that the blossom is not destroyed. The flowering season is from April and May until Christmas. The flowers are frequently abundant without producing much fruit, dependent in a great degree upon the state of the weather, and in particular upon the character and force of the periodical winds and rains; upon this one period all the planter's hopes will be centered; it is upon the force of those winds and rains that the extent of his crop depends. While the fruit is yet ripening, it will be necessary that the land be preparatorily cleared for the picking, and for this purpose a gang of active labourers will be required, that the estate be thoroughly cleaned before one pod is picked. It will be observed that sometimes, and not unfrequently, a dry season preceding the ripening of the pods, when the crop borne by the trees is heavy, will cause the pods to turn yellow, and ultimately black and shrivel up, in which case the cocoa is spoiled. In such an event, it sometimes becomes a policy for the planter at once to pluck off all that show signs of this yellowness, in order that the next crop may not be affected by the drain upon the resources of the trees.

In November and December the first crop begins to ripen, but the time varies according to the seasons. The first crop or picking begins generally at the turn of the year. As soon as a sufficient quantity is yellow, it is proper to take advantage of the weather to pick. As the rains generally cease about December, and the fine weather or summer commences in January, this is the most suitable season of the year for picking; as the wet weather is unfavourable to the operation, and as the rains fall more or less at the changes of the moon, these should be observed and studied. The quantity that should be picked in a week depends upon the probability of fine weather, the means of carriage and curing. In the operation two hands proceed together, one to pick with a knife those pods which are within reach, while the other, with a long pole, having two prongs or a knife at the extremity, adroitly cuts off those up in the trees. They are then gathered together by boys and girls into heaps, where they should lie one night and day, after which time they are broken open; this is effected by men or women with cutlasses, one cut with which suffices for the purpose, and pulling out the seeds with the hand which is easily done, they are separated and thrown into the baskets, in which they are carried to the works, if near upon the heads of labourers, or if distant on the backs of mules or donkeys in panniers.

Sweating.

As the cocoa arrives at the works it should be emptied on to a sloped pavement, or barbacue, or, if this has not been provided, into another basket with open wicker work, so that the acid pulp may be allowed to drain off, and as soon as it is sufficiently drained, the cocoa may be emptied into one of the sweating boxes until it is filled, taking care that the time occupied in filling it is not too long, else the quality of the cocoa will be mixed; it is then closed down, and the cocoa allowed to sweat.

The acid juice which drains from the cocoa can be manufactured either into vinegar or arrack. It is, however, never so employed, owing to the abundance of excellent vinegar made from the skimmings of the cane juice on the sugar estates, and to the stills employed in the manufacture of rum being of such capacity, that a sufficient quantity of juice could not be obtained even for a single charge. The quality of spirit manufactured from it, however, is good; but it is thought more advantageous to allow the juice to run to waste than to attempt to manufacture it.

The operation of sweating is a very nice operation. The cocoa must be carefully watched, that it does not heat too much. The period it should remain in sweat depends upon the then and probable future state of the weather. Upon this almost all the operations of the cocoa planter are dependent. His plans must always be arranged with regard to his views of the future state of the weather, and it is therefore with him a study. In all tropical countries it would appear that the foreshadowing of the future is more in the temperature, winds, and appearance of the clouds, the heavens, and moon and its changes, than by any indication of the barometer, which there varies in so small a degree as to render it to a certain extent inoperative. In this respect the natives will be found more competent to judge of the weather than a European unacquainted with the tropics. Having regard, however, to the one particular operation of which we are speaking, the writer has tested the immediate advantages of a study of the hygrometric condition of the atmosphere through the medium of a simple hygrometer on the wet and dry bulb principle. This instrument, costing not more than a couple of pounds, will almost invariably admit of a very truthful knowledge being obtained of the weather, at all events, for a day or so in advance, that is when regarded in conjunction with the other circumstances of wind and temperature. Supposing the weather, however, to be very fine, and unlikely to continue so long, the cocoa may be taken out of sweat at the end of 24 hours; one day and a half, or forty eight hours, nevertheless, is the best time for the operation to continue, but on no account should it remain in sweat after two and a half days, upon the termination of which period, even if it is rainy weather, it must be taken out. The object of this sweating or fermentation is to produce a certain extent of germination to develop the principle or aroma, at which stage it is checked and fixed, while the acid produced by the fermentation likewise, combining with the oxygen of the air, along with the action of the sun's rays, produces the fine red colour so much desired. If the sweating process is continued for 24 hours, the colour obtained will be greyish or yellowish; if 36 or 48, it will be a bright red; if 60, it will be darker and inclined to a deep purple colour; and if more than that it becomes brown.

Drying.

As soon as it is taken from the sweating boxes, the cocoa is removed to the drying platform and spread out, and all seeds which may have adhered together, carefully separated. The process of drying occupies generally about three weeks, the only labour necessary in the operation being to keep the cocoa constantly turned and shifted about, and daily exposed to the action of the sun's rays, or if that is not obtainable, at all events to a current of air, while any extraneous matter it may have contracted is at same time removed, one hand being abundantly sufficient for the purpose. The condition of the atmosphere, as before observed, during the time the process of drying is progressing, exerts a most marked effect upon the subsequent colour of the cocoa. If fine sunny weather, the cocoa will be constantly exposed to the atmospheric air, and the brightness of the sun's rays will produce a fine dark red colour (that is if the operation of sweating has been properly conducted), which in the London market commends it for a high price. The early crop, however, from the yet unsettled condition of the weather, is generally of a dark or dull colour, the second and third, or Lent crop, being superior both in colour and quality. The kernel notwithstanding of the dark coloured cocoa, when the operation of sweating

has been properly performed, is really but very little inferior to the bright dark red sorts. Could the drying be performed under a glazed roof, a good part of the depreciation by reason of the dull colour would be avoided.

Packing.

The cocoa is now taken to the bocan, and the different colours and qualities arranged in heaps, where it is turned over frequently still further to dry, and so soon as this is perfected, it is quite ready to be packed. If dry, the seeds should rattle together like pebbles, whereas if they are at all damp they will create a dull sound. It is most particular that the cocoa when packed should not retain any acquired moisture, as it inevitably becomes mildewed, heated, or mouldy, and ranks very low in the market. It is better in this matter to be on the safe side of caution, and even have the operation of turning continued longer than may appear necessary, rather than incur the risk of injuring the quality by too hasty bagging.

When the operation of packing is performed the cocoa should really be so thoroughly dry as to break readily in the hand. The mode in which it is packed varies considerably, according to fancy and the means at disposal; the more usual mode now adopted is in bags, which are either made of new Osnaburg cloth, or of the old East India gunny bags, containing 150 to 200 lbs. each. Although a cheap system, these old gunny bags are frequently single and worn so much that they do not sufficiently protect the cocoa, and are frequently burst at the end of the sea voyage, when the contents go to add to the sweepings in the hold of the vessel. It is sometimes shipped in barrels, which hold 140 lbs. and upwards, and this mode, though adding a little to the freight to be paid, seems the best fitted for its preservation, while the barrels cost but little more than new double gunny bags, if obtainable. It is also sometimes packed in hogsheads, but this is not a good method, from the liability of so large a body heating and becoming mouldy. When marked the packages will be ready for shipment, which should be effected at the earliest possible opportunity, taking care that the cocoa is kept as much separate from the sugar on board as possible, and in no case beneath it, and that it is not placed alongside or near any article, such as pepper, which would impart a bad flavour to it, and which it is very likely to contract.

Crops and Yield.

Returning to the plantation, almost as soon as the first picking has been completed, the second crop is ready, and so again the third. The period of crops in Grenada is generally, the first in January, the second in March, and the third in May, after which flowering commences again.

The yield or quantity produced by the cocoa-tree is dependent first upon the adaptability of the site and soil, and then upon the care and judgment bestowed upon the planting and after processes of cultivation. The quantity to be obtained is still an open question, as may be inferred from the diversity of the expressed opinions; it has been frequently grossly misrepresented, estimates having even attained the extent of hundreds of pounds per tree; the present yield per acre in Grenada, taking the average actual yield of a number of pieces, and allowing for all possible contingencies, may be safely set down at 550 lbs., and the quantity exported from the island when regarded with the extent of land under cocoa cultivation, is abundantly confirmatory of this; but it must be borne in mind that this is under the most rude and careless system of cultivation. On a well managed estate there is not a doubt but that this yield may be greatly increased, and three pounds per tree obtained throughout, even if the trees are 12 feet asunder, or 310 to the acre, and with such a crop, therefore, the yield per acre would be 930 lbs. of dry cocoa. In Trinidad, Mr. Purdie states (quoting from Simmonds's "Products of the Vegetable Kingdom," p. 25) the yield to be one and a quarter pounds per tree, but he likewise says that this is capable of great improvement and extension. It may appear inconsistent that while in Trinidad, where the care bestowed upon the cultivation is avowedly much greater than in Grenada, the yield is only 1¼ lbs., the yield in the latter place should be even greater, but the anomaly is in great part explained by the relative circumstances under which the cultivation in the two islands is carried on. In Trinidad the cultivation is almost entirely on level land, and the tree subject to be deflowered by the force of the winds to so great a degree that it is found necessary to intersperse the "Bois Immortal" tree among the cocoa for its protection, and this not only lessens the number of cocoa trees in a given space, but also prevents the free access of light and air, sometimes erroneously stated to be unnecessary; another reason for the disparity may even be that while the virgin character of the soil in Trinidad produces a finer quality of fruit, it also tends to the production of abundance of leaves, which may detract from the ability for the formation and maturation of the fruit.

Cocoa planters usually calculate their crops by the barrels of wet cocoa; a barrel of cocoa, and the juice somewhat strained off, ought to yield 100 to 106 lbs. of dry cocoa; less than this argues unfair play, and when not over ripe upon the tree, it sometimes yields 110 lbs.

Profits, &c.

Having said thus much of the best modes of cultivation and manipulation of the cocoa, it will be observed that the cultivation of cocoa, from the time it takes before it commences bearing, is only suited to those who are content to settle down in the country, and is therefore carried on only on a small scale from the limited means at the disposal of the generality of such persons; moreover, the comparatively insignificant demand hitherto existing for the article has not warranted a greatly extended sphere of action; and the management of the sale of the provisions has been so entirely a native trade, that the operation has presented but little attraction for Europeans of any extended means. But these difficulties are to be surmounted, and the cultivation may yet come into the hands of those who will bring science to bear upon its management.

The present value of land in many of the West India Islands, so incompatible with that of the produce it is capable of bearing, the result of the inadequate supply of labour and capital, certainly presents a field for the operations of the capitalist. In Grenada, lands which in the time of abundant labour realized ten times as much as they are now worth, are frequently seen to lie abandoned for years for want of a purchaser, even at this immense decline, arising from the paucity of labouring hands; for this reason the cultivation of cocoa, which requires but little labour, is peculiarly fitted for their employment; and the profits derivable from it in situations suited to its growth, its adaptability to the tastes and wishes of the people, and the comparatively inexpensive form of machinery required, particularly commends it to the attention of those holding eligible lands.

Although some few years elapse before bearing commences, and therefore some little capital is sunk, the income from the provisions will have very nearly reimbursed it, and when the cocoa is in bearing (which lasts for thirty and forty years), taking the price obtained for it on the spot as three pence per pound, which is considerably under the average obtained for a number of years past, the net annual profit on 200 acres in cultivation, on an estate of 400 acres, after allowing for every possible contingency, is equal to five pounds sterling per acre of cocoa. Lands for such a purpose, in the most eligible positions in Grenada, can be purchased for less than three pounds per acre, and generally with some portion already rented by the labourers, and planted in cocoa. The great advance which is now taking place in the value of sugar estates, must, however, inevitably react upon the abandoned lands fitted for cocoa cultivation.

The desire of the people to become their own masters, and rent pieces of land, can, in Grenada, be turned to good

account. Land purchased at three pounds per acre can be gradually rented out in small plots at five dollars (or £1 0s. 10d.), the lessee binding himself to plant cocoa along with the provisions. At the expiry of this lease, which is usually for three years, the rent can be raised to £2 10s., and even afterwards to £3, and £3 10s., while it can then be frequently disposed of at the enormous sum of £20 per acre if the cocoa has been properly cared for, and the lessee is pleased with the site and soil. Many planters have adopted the system of opening up their estates in cocoa by thus renting out the land. A planter's expenses of living in Grenada range from £200 to £250 per annum.

Of the climate on the cocoa plantations, it may be stated that the finest quality of Grenada cocoa is grown in the interior of the island, about Qua-qua or Belvidere, which is about 2,500 feet above the level of the sea. There the climate is such that a European can readily adapt himself to it with very ordinary care, the temperature all the year round ranging about 68° to 78° of Fahr. Almost all the European fruits will flourish, the soil being remarkably fine, the only drawback to the spot, healthfully considered, is the excessive humidity, the rain falling almost incessantly, and rendering a European liable to rheumatism and other complaints; as the cocoa-tree, however, forms a shelter from the rain, and the clothes worn may be warm woollens, these effects can be guarded against in a great degree. In this particular neighbourhood land can be purchased as low as one pound and ten shillings an acre, with a great deal of light wood upon it. Down near the coast the temperature ranges from 78° to 90° of Fahr., the atmosphere is less humid, the rainy months lasting from May to December, but Europeans are there more subject to epidemic as well as endemic diseases, though the West coast, where the cocoa is grown, is considered the most healthy part of the island, if we except those parts at a greater elevation in the hills. The cocoa grown on or rather near the coast, though not so fine in quality as that grown in the centre of the island, yields a net return not much inferior, from the comparatively smaller expense of transit, &c.

Qualities of Cocoa.

The qualities necessary to recommend cocoa to the British manufacturer are a pleasant grateful taste, with a proper proportion of the butter or fat to allow of its being more readily worked up; great stress is laid upon this latter quality—and this because the facility of supplying the consumer's wants in a cheap preparation is dependent upon the extent to which it may be diluted with starch, or other cheap matter, which is at present effected to the extent of upwards of 50 per cent., where the cocoa is reasonably rich in fat; thus the extent of the aromatic principle contained in the cocoa is of secondary consideration; it is sufficient that the cocoa possesses this quality in moderate proportion, so long as there is no astringent or acid taste to mar the smoothness to the palate. The freedom from this astringency is of first importance; it will be found particularly present in the Grenada and St. Lucia cocoas, and especially in that grown from the native or creole variety, but its extent depends in a very great degree also upon the manner in which the processes of sweating and drying have been conducted; it will be found that the maiden crop contains this astringency in a great degree, and for this reason it will require to be left longer in sweat. If the extent of the aromatic principle formed the criterion of value (as it would do in the Spanish market) the Guayaquil cocoa would certainly stand second only to the finest of the Caracas kinds, but the larger proportion of fat in the Trinidad cocoa recommends it for a higher price to our manufacturers, consequently the large demand and relatively high price which Grenada cocoa has of late commanded, with all its disadvantages of astringency, want of the aromatic principle, and preponderance of fat. The appearance of cocoa is generally a very good indication of quality, thus, if the outer skin or husk be of a dull grey colour, it evidences inferior sweating and drying, arising in all probability from the dull wet weather existing at the time it was effected; the nearer the colour approaches to a bright dark brick red the better; a yellowish gray or black colour is decidedly the worst. The seeds should break readily in the hand, and crackle crisply under slight pressure. The interior of the kernel or nib should be well defined, that is, the parts though plaited into each other should be distinct, having between them the filmy horny substance or parchment; the colour should be dark chocolate brown, a dull or pale colour towards the heart tells an inferior seed; when rubbed in the hand the feel should be smooth and greasy. The seeds in shape should be large and plump; an indented flat seed (like much of the common Grenada cocoas) contains invariably a flinty hard kernel, and realises an inferior price. The colour of cocoa darkens considerably on the homeward passage, and the steam from the sugar in a sugar ship increases this change. Cocoa should rather increase in weight in a sailing ship, while it will be found to incur a loss in weight of nearly 2 per cent. when carried by the steamer.

Sources of Supply.

Though the West India Islands have hitherto supplied the larger proportion of the English demand, the quality of the cocoa yielded by them is inferior to that produced by many other countries. The finest cocoa is said to be the Soconusco or Mexican; the beans are small, and of very fine flavour, with scarcely any acid taste, but a very small quantity has hitherto found its way to Europe, being almost wholly monopolised by the Mexicans themselves, notwithstanding that the quantity produced is very considerable. The Guatamala cocoa can scarcely in point of quality be placed before those kinds with which we are more familiar; it differs from those just mentioned in the appearance and size of the bean, being the largest kind known, very convex, often angular, and much pointed at one end, it contains much oil, and is very mild, and of a pleasant flavour.

Guayaquil.—The quality of Guayaquil cocoa is very good and uniform; in point of flavour it fully equals, if it does not surpass, the finest of the Trinidad kinds with which we are supplied, but from its containing less fat, and therefore not admitting of so extensive adulteration, it does not command so high a price. The beans are large, round, plump, and usually of a dark and rather dull red colour.

The quantity of cocoa exported from Guayaquil has been very considerable of late years, and bids fair to continue to increase so long as prices are maintained about present remunerative rates. A very small proportion has, however, hitherto reached our markets, the larger part having been exported to Spain and Mexico. There has been a great extension of the cultivation throughout the whole of Ecuador, and since the equalisation of the duties on British and foreign cocoas imported, a considerable diversion of the exports has taken place to this country. The quantity we receive thence will be seen from table No. 3. As far as the statistics at our command extend, the progress of exports from Guayaquil may be thus seen:—

	lbs.		lbs.
1833	6,605,786	1852	14,161,017
1834	10,999,853	1853	13,445,741
1835	13,800,851	1854	13,990,665
1836	10,918,565	1855	15,300,955
1837	8,520,121	1856	no returns.
1838	7,199,057	1857	14,972,724
1839	12,159,787	1858	20,134,085
1840	14,266,942		

The rate of freight from Guayaquil, and places round Cape Horn, which to England ranges about £5 per ton, militates much against supplies to this country; but even with this drawback, if internal peace is granted to Ecuador, there is little doubt but that it will compete successfully in the supply of the finer kinds of cocoa to our market.

New Grenada formerly exported considerable quantities of cocoa to Europe. With the wars which have at times disturbed the country, however, the quantity has sensibly diminished. There are now signs of progress for the future, which will doubtless be assisted and accelerated by the operations of the South American Land Company. We have no statistics to help us to a view of the trade; the quantity imported into this country may be seen from Table No. 3. The larger proportion of the produce of the country has always been employed for home use. The cocoa known as Magdalena and Carthagena, which constitutes the greater proportion of our imports from New Grenada, is much inferior to the Caracas or Venezuelan kinds.

Venezuela produces considerable quantities of cocoa. The quantity exported from the port of La Guayra has been as follows:—

	lbs.		lbs.
1852	5,705,290	1855	4,858,941
1853	5,552,709	1856	4,135,855
1854	5,466,041	1857	4,283,660

Formerly the exports were much larger, for, in 1810, they equalled 13,000,000 lbs.; but, in 1837, had declined to 6,000,000 lbs. A glance at the Table No. 3 will show the very small quantity which reaches this country. The quality of the Venezuela cocoa, known as Caracas, is exceedingly good; it is among the more highly-prized kinds which reach Europe. The beans are of medium size, and very oily. Chocolate made of Caracas cocoa alone is not very agreeable, and on this account other qualities are employed along with it.

Brazil produces some quantity of cocoa, but not to so great an extent as formerly, having somewhat declined since the abolition of the external slave trade. The same Table, No. 3, furnishes the quantities imported from Brazil into this country. The largest quantity of Brazilian cocoa is exported from the port of *Para*. The statistics of the trade have not been received to a later period than 1856, up to which date it had experienced a considerable decline, as compared with the three years, 1851-2-3. Thus the quantities exported and average prices were:—

	lbs.		Average Price per arroba.*
1851	7,843,024	Milreis†	2·375
1852	6,704,538	,,	2·260
1853	10,178,264	,,	2·462
1854	4,576,394	,,	3·000
1855	5,516,904	,,	4·100
1856	5,330,266	,,	6·262

"The varieties of cocoa indigenous to the forests of the district (Para)," says Mr. Consul Vines, "may be said to be naturally of superior quality, that is say, that with proper treatment, if not quite equal to that of Trinidad, the cocoa of this country would be but little inferior to it. Until lately, however, Para cocoa was generally and deservedly despised, because it was always in such bad condition—carelessly gathered, and cleaned from the pulp, very partially dried at best, and often cast into heaps and left to heat before it was sent down from the interior to the port, then as carelessly thrown into the bottoms of leaky boats; and even when here, stored without hand-picking and drying, it was very commonly musty before shipment. The great demand created in France during the late war to supply the large military contracts, naturally directed the attention of buyers to the port,‡ where, in consequence of the above-named circumstances, cocoa could be purchased cheaper than in the West Indies. The consequence has been that even in 1855, and still more in 1856, much greater attention was paid to the collection and treatment of the cocoa; and what between its superior condition, an active demand, and a supply rendered scanty by a foregoing season of drought, it has lately risen to more than three times its former price."

Para cocoa classes in our market somewhat lower than Grenada; the beans are small, and rather flat, of a bright red colour generally, and contain much oil, with rather deficient flavour.

Bahia also exports a small quantity of cocoa, of an inferior quality to that from Para; the exports of the last eight years may be thus seen:—

Years.	Bags.	Pounds.*	Price per cwt. in Sterling.
1851	5,775	1,039,500	18s. 8d.
1852	4,163	749,340	16 0
1853	6,514	1,172,520	14 3
1854	6,843	1,231,740	16 4
1855	7,100	1,278,000	18 4
1856	7,362	1,325,160	31 10
1857	7,152	1,287,360	28 6
1858	8,465	1,523,700	... ...

It will be remarked that the great rise which took place in the price in 1856, was equal to ninety-one per cent. on the average of the previous five years.

It will be seen from the following figures that the origin of the trade in cocoa in Bahia is comparatively recent, though there has been a steady increase in the exports since the opening of the trade; thus the annual average exports triennally have been:—

	Bags.	Lbs.
1841–3 ...	1,380 ...	248,400
1844–6 ...	2,780 ...	498,400
1847–9 ...	3,860 ...	694,800
1850–2 ...	5,150 ...	927,000
1853–5 ...	6,820 ...	1,227,600
1856–8 ...	7,660 ...	1,378,800

British West Indies.—As nearly the entire produce of these islands is exported to Great Britain, the Table, No. 4, will furnish a very good idea of the progress of the trade in them; nevertheless, a small quantity finds its way to continental Europe, mostly indirectly, through one or other of the Foreign West India possessions. In Trinidad, excepting the fluctuations in the crops caused by destructive storms, the export has continued slowly but steadily to increase for nearly forty years, notwithstanding the very low prices at times received. In the case of Grenada, it is curious to mark the change in the relative position of the two articles, cocoa and sugar; thus, looking at the official statistics, the exports have been:—

	Sugar.	Cocoa.
1831 ...	24,555,028 lbs. ...	273,152 lbs.
1845 ...	7,839,776 ...	467,488
1857 ...	10,908,016 ...	1,033,872

which evidences the adaptability of the colony to the cultivation, or the cultivation to the colony. In St. Lucia, St. Vincent, Jamaica, and Dominica, small quantities are produced, but neither of these islands, perhaps excepting St. Lucia, would compare with Grenada in its fitness for the cultivation; indeed the fluctuations in the crops in Trinidad, and all the other islands, compare unfavourably with the steadiness of the Grenada cocoa crop, for the island is almost free from the effects of the destructive hurricanes and storms with which the other islands have been frequently visited.

The exports of cocoa from the principal producing of the British West India Colonies in 1857, were:—

	Lbs.
Trinidad	4,942,600
Grenada	1,033,948
St. Lucia	251,349
Dominica.....	64,626
Total. .....lbs.	6,292,523

* The arroba is 32·38 lbs.
† The average exchange per milreis, is 2s. 3d.
‡ In 1854-5 and 6, France took nearly the whole of the cocoa exported from Para.

* The bag is taken as containing 180 lbs.

In the Great Exhibition of 1851, samples of several kinds of cocoa were exhibited, among which were some Demerara of very poor quality, and Barbadoes without merit. But of the finest sample of Trinidad exhibited, the Report of the Jurors states, "samples as prepared for the Spanish and English markets were exhibited; the former is never seen in our markets, and is truly magnificent. Every bean is large, round, clean, and of a fine bright red colour. The English is good of its kind, but is nothing but the refuse of the Spanish, the beans being lean, flat, half ripe, flinty, and often bitter."

Martinique and Guadaloupe, as well as other of the *Foreign West India Islands*, produce small quantities of cocoa; they do not, however, call for any particular notice.

Other Places.—Cocoa is also cultivated, as we have already said, in many other places than those we have enumerated in the American continent. They do not, however, call for particular notice, from their comparative unimportance so far as affects our trade. A sample of Mauritius cocoa was exhibited in the Great Exhibition of 1851, and was said to be of very inferior quality. A small quantity of cocoa has latterly been received from the West Coast of Africa, and it is possible this may be the inauguration of a larger trade. The tree has only been grown experimentally in the East Indies, and it is doubtful if the period of drought will not there prevent success. It is, however, satisfactory to state, that a friend of the writer is about to try the experiment, on a large and practical scale, in Wynaad, on the Malabar coast, and that, from a comparison of notes, it appears highly probable that, at all events in that locality, the cultivation may be established.

Trade.

The consumption of cocoa in Europe, in 1806, was estimated by Humboldt, at 23,000,000 lbs., while in the present day it would not appear to exceed 36,000,000 lbs., made up as follows:—

	Lbs.
Spain	15,000,000
France	6,000,000*
Germany, &c.	4,500,000
Great Britain	5,500,000†
Italy	1,800,000
Austria	1,000,000
Russia	100,000
Denmark	100,000
Sweden	30,000
All other places	1,970,000
Total consumption of Europe... lbs.	36,000,000

In the United States of America the consumption is about 2,000,000 lbs. The consumption of coffee in Europe is 492,000,000, and in the United States 224,000,000 lbs. Of tea, the consumption in Europe is 99,000,000, and in the United States 30,000,000 lbs.

The quantity of cocoa consumed in Mexico and the South American continent, where it is produced, cannot even be estimated, but the evidence of all those travellers who have visited the different States, confirms the belief that it must be very great when compared with the extent of the European consumption.

Although considerable quantities of foreign cocoa are imported into this country, as will be evident by a glance at Table No. 3, the London market is almost exclusively supplied from the British West Indies; the greater part of the foreign cocoa imported being again exported to Continental Europe. Indeed, the differential duties which existed until 1853, as shown by Table No. 5, caused those foreign countries which produced the best qualities to export them to Mexico, Spain, France, and Italy, and forced our manufacturers to be contented with the more inferior kinds. The relative quantities of the two kinds taken for consumption in the United Kingdom even since the equalization of the duties, present the following figures:—

Years.	British West India.	Other kinds.
	lbs.	lbs.
1854	4,062,832	389,697
1855	4,085,410	297,613
1856	3,343,069	291,066
1857	1,975,209	672,261
1858	2,701,399	158,635

The present relative market prices (October 6th) of the different kinds (in bond) in the London market, are:—

Trinidad Red	69s.	to	94s.	per cwt. in bond.
do. Gray	65s.	,,	68s.	,,
Grenada	61s.	,,	67s.	,,
Dominica and St. Lucia	58s.	,,	62s.	,,
Para	64s.	,,	68s.	,,
Bahia	55s.	,,	57s.	,,
Guayaquil	68s.	,,	70s.	,,

(*To be continued.*)

* Estimated.
† Including quantity taken for the navy.

FRENCH AND ENGLISH MACHINERY.

The Paris correspondent of the *Economist* says:—

The evidence taken before the French Superior Council of Commerce on the subject of the treaty with England is really of very great interest. Given by practical businessmen both of England and France, it throws light on the position of the principal trades of the two countries which has never been cast before. In previous letters I have noticed some of the principal facts set forth in it; and here are a few more culled from the reports of the sittings of the 21st, 22nd, 25th, and 28th June, which are the last that have been put into type:—French machines for spinning are dearer than those of England, and the reason, according to M. Kœchlin, of Mulhouse, is, that the raw material, the fuel, carriage, lighting, models, tools, interest on capital, &c., are all higher in France, whilst the demand for machinery is less regular, and not large enough to justify the construction of vast establishments. On the whole, M. Kœchlin calculates that such machinery in France costs 310f. a ton more to make than in England; and he and his fellows, consequently, ask for protection of 25 or 30 per cent., declaring that, "with less, competition would be difficult, if not impossible." But, though below England in this description of machinery, it is admitted that, in the manufacture of locomotives, France has made such extraordinary progress, that she can do without any protection on them, and that, in fact, she exports to Spain and Italy in competition with English makers. In the production of carding machines, France is being defeated by the English; at Lille, for example, out of five manufactories, not fewer than four have been shut up. The builder of engines for steamers ask for 20 or 25 per cent., but would prefer a duty imposed by weight instead of value. Though, however, demanding this protection, one of them, representative of the Forges et Chantiers of the Mediterranean, a great engine-building company, declared that French steam engines for vessels are quite as good as English, and that considerable quantities of them are exported to Sardinia, Egypt, Rome, Naples, and Russia. As a specimen of what France can do in the building of steam vessels, it was stated that that company, in the space of three months, built twenty gunboats, of 20-horse power each, for China; and that in the course of a year all France can turn out engines of 30,000-horse power, which would be sufficient for forty vessels. It was alleged, as an argument for protection, that whereas in England, a screw engine of 100-horse power can be constructed for 100,000f., one in France cost 120,000f. It was stated incidentally that of late, builders of Glasgow

and Newcastle have begun constructing an inferior description of engines,—"for sale rather than for use." Touching agricultural machines, it was stated that it was the display of the Exhibition of 1856 of those used in England which first made agriculturists understand their immense utility; and that since then considerable imports from England have been effected. But loud complaints were made that the Customs laws and regulations are so absurdly contrived as to throw on such objects an enormous amount of import duty. As examples, it was stated that a Crosskill roller costing 600f. has paid 400f. duty; that a boiler for cooking vegetables, which cost 28f. in Germany, actually paid 147f. to the Customs!—also that a Belgian manufacturer of agricultural implements had positively refused to execute an important order, because the "silly Custom-house regulations of France" on such things occasioned endless trouble and expense. A large importer of English agricultural machines (a Frenchman) expressed the opinion that 10 per cent. *ad valorem*, or 10f. or 12f. the 100 kilogs., would be ample protection for French makers; and, in proof of it, he stated that haymaking machines on Nicholson's plan can be manufactured in France for 500f., though they cost 575f. in England. But Count de Kergorlay, a great authority on such matters, declared that, in order to bring machines into general use in French agriculture, the free import of all foreign ones ought to be allowed—at all events, for many years to come. After exhausting the inquiry respecting machinery, the Council returned to the iron question; and the well-known M. Talabot once more entered into elaborate arguments to prove that, without high protection, the French iron trade cannot live. M. Flachat, a very distinguished railway engineer, who was examined on the same matter, showed that ironmasters are subjected to certain grievances under the mining and forest laws, and also as regards the construction of tram-roads to their establishments; the practical consequence of those grievances being to make their iron dearer than it otherwise would be. There can be no objection to granting the ironmasters redress on these point; but assuredly they do not afford any justification for protecting those persons by high import duties, and so impose a heavy tax on the general public. In connection with the iron question, two French engineers, sent specially into England to make inquiries respecting the cost of production, gave much valuable evidence. They, I perceive, bore testimony to the fact that the proprietors of several large ironworks in England not only answered all questions, but offered their books for inspection. The recent sittings of the Council have been directed to the cloth and cotton manufactures.

MEMORIAL TO THE LATE AUGUSTUS N. WELBY PUGIN.

It has been resolved to do honour to the memory of the late Augustus Welby Pugin, for his services in the promotion of true principles of Mediæval Architecture, and in furtherance of this object, to solicit donations and devote them to the endowment of a permanent fund, to be entitled the "Pugin Travelling Fund," the interest arising therefrom to be awarded to an architectural student in such manner and at such periods as many hereafter be decided, and to be expended by the recipient within one year of the time of its allotment in travelling in the United Kingdom, and in examining and illustrating its Mediæval Architecture, Sculpture, and Painting. To the studentship it is proposed to add a medal. The Royal Institute of British Architects will be asked to become trustees to the fund.

This memorial, whilst providing a lasting recognition of the services rendered to art by the late Augustus Welby Pugin, will be the means of promoting in a thoroughly practical manner the principle so ably advocated and applied by him, and each occasion of the award of the fund will form a special commemoration of the great artist in whose honour it has originated.

A large and influential Committee of well-known names has been formed to carry out this object. A. J. B. Beresford-Hope, Esq., is chairman of the Committee, and one of the treasurers of the fund with George Gilbert Scott, Esq. The honorary secretaries are Joseph Clarke, Esq., 13, Stratford-place, London, W., Talbot Bury, Esq., 48, Welbeck-street, London, W., to whom communications should be addressed. Donations are received by Messrs. Biddulph and Co., Bankers, 43, Charing-cross, to the account of "The Pugin Memorial Fund."

THE SEWING MACHINE.

The question as to the right of Mr. Howe, the inventor of the new sewing-machine, to a renewal of his patent, which has for some time been regarded in America with great interest, has just been decided in his favour. A renewed term of seven years has been granted. In the argument before the Commissioners of Patents the counsel for Mr. Howe took the ground that it is the law and established practice of the United States Patent-office to decide such applications, not according to the profit received by the patentee irrespective of the public value of the invention, but according to the ratio between the profit and public value, and that value in the present case, he contended, has been extraordinary. According to certain detailed computations, it was stated that the value of the sewing in the United States capable of being done by the sewing machines is at least £58,000,000 per annum, and that Howe's machine, even if applied to the work in the exact form in which he first introduced it, would save to the public £34,000,000 per annum. Looking only at the actual results achieved, it was pointed out that the sewing machine has already entered into and revolutionized more than 37 distinct departments of manufacture, besides enlarging many and also creating new ones. In the city of New York alone the yearly saving by the machine is asserted to be £1,500,000 on men's and boys' clothing, £92,000 on hats and caps, and £170,000 on shirt fronts; while in Massachusetts, in the manufacture only of boots and shoes, the labour value of its performance is £1,500,000.

Home Correspondence.

MECHANICS' INSTITUTES.

Sir,—At this season of the year, when your columns are not occupied by the able papers read before the meetings of your Society, and when the time is approaching in which to commence the active operations of Literary and Educational Institutions, it would be well if those who are interested in the management and the prosperity of such Institutions would make use of the *Journal* to interchange their experience and make suggestions for improvement. There are many points on which much information must be needed, particularly in small towns, and in places where there is little experience of former failures or successes to which to refer for warning or example.

It cannot be too strongly urged that much of the success of an Institution will depend upon the activity and intelligence of the secretary, and that great care should be exercised in the selection, preferring, however, the benefit of energetic zeal, tempered with discretion, to more showy acquirements, without either devotion or business habits. Inferior intelligence, with energy, method, and perseverance, may do far more than either literary or scientific ability without such aids, although when such qualities are combined the advantage will be the greater.

In the choice of a committee of management, attention is not always sufficiently paid to the preference of those who will devote themselves to the performance of the

duties required. A name and a position in the town may serve as an ornament to the list, but adds little value to the Institute, and though there are many men very respectable and very able in their respective positions in life, they are far less efficient members of a committee than a young man, of comparatively obscure station, who from a conviction of the importance of the duty he is called upon to perform, devotes his energies to the accomplishment of success. The merchant, the manufacturer, or the gentleman, may have the best sounding name, but the workman will most often do the work better.

This question, however, is one which I am aware depends mostly upon the members who take part in the election, but when chosen it is desirable that considerable discretionary power should be given to the secretary. If he be an efficient officer he will necessarily understand much more of the details of management, and many cases will arise in which, from the difficulty of summoning a meeting of the Committee, he must either act on his own responsibility, or the business will be left undone. In many Institutes it is usual to have a rule, fixing a certain number of the Committee as necessary to form a quorum, and making their consent to any proposal indispensable. The consequence of such a practice is almost inevitable—the time of the secretary is wasted in issuing notices to the members of the committee for a meeting which they neglect to attend, the opportunity is lost, and the same ceremony has to be repeated, with, perhaps, similar results, until the uselessness of the task becomes self-evident; the secretary finds himself hampered and obstructed where he should be assisted and supported; the Institute languishes, until some spasmodic effort is made for its revival, and the population of the locality is libelled with the charge that they have no taste for learning, no desire for self-improvement, no higher aspirations than sensual gratification, or idle, frivolous, and perhaps vicious amusements.

More than one instance might be adduced where, the good sense of the committee having placed confidence in the secretary, the Institute proved a great success, increased its members, proved self-supporting, and was a credit to the locality. But, in course of time, a new committee, with less judgment, insisted upon their rights of management, reduced the secretary to be the mere registrar of their decisions, which were not always wise nor given in time to be of any real service, and the consequence, as might readily be supposed, was the dwindling of the Institute to a mere handful of members, whose subscriptions were inadequate to pay unavoidable expenses.

If the management of an Institution be too important for the power to be delegated to a single officer, however able and zealous, the difficulty may be obviated by the appointment of small sub-committees whose proceedings, should be laid before the whole body at every general meeting. One or two members would be sufficient for each, and their duties might be directed to the several departments of the Institutes, one for lectures, another the library, a third the reading-room, a fourth the classes, and a fifth the expenditure. Should any question arise demanding immediate attention, the secretary would find it much easier to consult one or two members of a sub-committee than be obliged to summon the whole body with the probability of not obtaining a quorum. For instance, a gentleman of distinction may unexpectedly visit the town, and offer to deliver a lecture if it can be accepted at a very short notice; a very advantageous offer of an addition to the library may be made on condition of its immediate acceptance, and other cases which require instant attention will readily suggest themselves. If these are to wait for the decision of a committee whose attendance is the exception and their absence the rule when summoned to a meeting, the opportunities of advantage are inevitably lost, and the secretary, wearied with the sense of the uselessness of his exertions, may resign his post, and the Institute, left to an incapable committee, suffers annihilation.

Wherever class instruction forms an important feature in an Institute, and it should do so in all, a sub-committee should be appointed for the especial duty of their supervision. Competent teachers may be engaged, and much desire for improvement may be evinced, but the regular supervision of a committee is highly desirable, as not only helping to secure the punctuality which is indispensable to success, but strengthening the hands of the teacher and inspiring confidence. A record should be kept of the meeting of each class and the attendance of the members, with all of whom the members of the visiting committee should be familiar. A word of encouragement does much to stimulate exertion, and if success be not achieved the causes of failure and best probable remedies can be more correctly ascertained.

There is, perhaps, no department of an Institute more important in its effects, both present and for the future, than well-ordered classes. Without them something may be done, but comparatively little. Lectures are not, nor should they be, other than of a desultory character, suggestive rather than educational, entertaining rather than instructive, serving an excellent purpose in drawing the members together, and, whether literary or scientific, pointing out objects of study and sources of intellectual gratification. Their influence, however, is too often ephemeral, and their suggestions should be followed by the more sustained and systematic study of the class-room. The library, also, is an indispensable feature, but the use of it being purely voluntary, the result of an acquired taste, its influence for intellectual advancement is of a mingled character. If the shelves be filled with what the coldly prudent call good books, they are likely to remain occupied; while if, on the other hand, the committee judiciously provide for the desire for light literature, the effect is rather the amusement than the improvement of the readers. Yet it is far better that a people should devote some of their leisure time to reading for amusement, to sympathise in the imaginary joys and sorrows of impossible heroes and heroines, with the probability of the greater ease of reading acquired by practice leading them to better works, than waste their hours of relaxation from toil in indulging worse tastes and acquiring worse habits. The choice of a library is one deserving much attention, and I should like to hear the opinions of some of your readers as to the character of modern literature, with reference to its fitness for popular perusal.

I am, &c.,

BARNETT BLAKE.

Leeds, 3rd September, 1860.

Proceedings of Institutions.

London Mechanics' Institution.—A meeting was held at this Institution, on Thursday evening, the 4th inst., for the distribution of the prizes and certificates obtained by the members at the last examination of the Society of Arts, and also of the prizes given by the Local board. Mr. Harry Chester, one of the vice-presidents of the Society of Arts, presided. He congratulated the Institution—the parent of all Mechanics' Institutions in England—and its local board of examiners, on the success which had attended their educational labours during the past year. He had to present the prizes and certificates to the candidates, both male and female, by whom that success was achieved; and in order that they might appreciate the significance of the act, he was anxious to make a few observations. The time was now passed for any contest on the question whether the people of this country ought to be educated; but he remembered that, 25 years ago, when he proposed to establish an Institution like the present, in the north of London, under the title of a Literary and Scientific Institution, the clergyman of the parish described it as an invention of the devil. That clergyman lived to see that what he feared would bring all sorts of evil to his parish did nothing but good, and he subsequently became a supporter of the Institution. Struggles were still, however, going on as to the mode

in which education should be provided for the people and the nature of that education; but while those questions were in debate, the good sense and earnest feeling of the country had been directed to practical measures. In no country had such extraordinary efforts been made for the education of children as in England during the last 20 or 25 years; but we had now arrived at a new phase of the subject, and had clearly seen that it was useless to attempt to educate people if we confined our efforts to the education of children. The most important part of the question of public education was the education, not of children, but of adults, and the period had now arrived when there could be no question as to the utility of institutions like the London Mechanics' Institution. Excellent as were our elementary schools, children were obliged to be taken away from them for the necessities of daily life when 10 or 12 years old, and it was absurd to suppose that they could get anything like education at that age. The result was an attempt to thrust too much knowledge into a child. The remedy for this over-teaching was, not to contract the education of the children of the humbler classes, but to extend the period over which it was carried on; but as they could not be kept at school after the age he had mentioned, the best course to pursue was to provide means and motives for the education of adults. Even the education given to children of the higher classes in our public schools would be of much less value than it is if it were not followed by instruction at the universities. The chairman then described the scheme which the Society of Arts had inaugurated and carried on for encouraging the education of adults by awarding prizes and certificates, and observed that he did not think the London Mechanics' Institution had been fairly dealt with by public opinion. It was too commonly said that it and all other mechanics' institutions had failed in their objects. He never admitted that this particular institution was a failure. No doubt it had not exactly answered the ideas and designs of its founder, Dr. Birkbeck, and of his friend, the great patriarch of education, Lord Brougham; but during its whole existence it had done an eminently useful work, and it was never more useful than at the present moment. The examinations of candidates for certificates by the Society of Arts were commenced in 1856, and in 1858 the Society called into operation an important part of the original scheme—viz., local educational boards to co-operate with the Society of Arts. The London Mechanics' Institution was one of the first to establish a local board, and during the last three years that board had borne an important part in the examinations. In the first year the only examination was in London, at the Society of Arts; in the second, there was an examination also at Huddersfield; in the third, there were examinations at 36 places; in the fourth, at 54; and, last year, at 63 different places in England, Ireland, Scotland, and Wales. The certificates awarded to candidates by the Society of Arts were not given on the principle of competition, but for absolute merit. On the other hand, the prizes were competed for, the candidates with the highest number of marks gaining the day. Mr. Chester then went over the list of the successful candidates, observing that a member of this Institution, Mr. William Scott, aged 26, an Inland Revenue officer, had carried off the first prize in chemistry as against all other candidates from all other parts of the United Kingdom, as well as a second prize in magnetism, electricity, and heat. Having complimented the Local Boards for the admirable manner in which they had sifted the candidates for examination, he stated that the Society of Arts had offered a prize for domestic economy, the candidates being young women, who would be called upon to answer questions as to the purchase of provisions, the price of dresses, attendance upon the sick, and other matters of a domestic nature, and suggested the advisability of the London Mechanics' Institution having a class for instruction in such subjects. Mr. T. A. Reed, the hon. secretary of the Local board, stated that in 1852, 12 members presented themselves to the board for examination, of whom 8 passed, and of those 8 six were successful and obtained between them from the Society of Arts 12 certificates; the Local Board receiving a prize of £4. In 1859 there were 11 candidates, 10 passed, and 9 of them were successful. In 1860 15 presented themselves, and 10 passed, all of whom were successful in every paper worked. He mentioned these facts not for the purpose of self-laudation, but with a view to present a stimulus to the members of the Institution who were disposed to seek such honours. The certificates and prizes of the Society of Arts were then distributed by the chairman as follows:—Mr. Morris, 2nd class, arithmetic; Mr. Aumonier, 2nd class, do.; Mr. Ravensworth, 3rd class, do.; Mr. Joseph, 1st class, arithmetic, 2nd class, book-keeping, and 3rd class, algebra; Mr. Shinn, 1st class, chemistry; Mr. Rundell, 2nd class, conic sections; Mr. Tisley, 2nd class, arithmetic and book-keeping, 3rd class, mechanics; Mr. Holloway, 1st class, history; Mr. Moore, 1st class, book-keeping, with 1st prize of £5. Mr. Scott, 1st class, chemistry, with 1st class prize of £5, and 1st class, electricity, with 2nd prize of £3. It was also stated that a prize of £4 had been obtained by the Local Board, and a prize of £5 by the Institution in respect of the candidate, Mr. W. Scott. The prizes awarded by the London Mechanics' Institution, consisting of books and maps, were received by the following candidates:—Mr. Simpson, arithmetic; Miss Shaw and Mr. Raisin, French; Mr. Williams, grammar; Mr. Worth, geography; Miss Wright and Mr. Cohen, writing; Mr. Saward, architectural drawing; Mr. Snowden, landscape drawing. On the conclusion of the ceremony the meeting was addressed by Mr. P. Graham and other gentlemen. A vote of thanks proposed by the secretary of the Institution to the Chairman, terminated the proceedings.

Salisbury Literary and Scientific Institution.—The tenth annual report for the year, commencing July 1st, 1859, states that during the past year the number of life, honorary, and ordinary members has averaged 250. A further numerical augmentation has also been caused by an arrangement admitting the city police force to the use of the library. The following lectures were delivered during the past year, viz.:—The Hon. and Rev. C. A. Harris, on "Gravitation; Mr. S. R. Atkins, on "The Chemistry of Common Life;" Henry Fawcett, Esq., Fellow of Trinity Hall, Cambridge, on "The New School of History;" Rev. James Fraser, Chancellor of Salisbury Cathedral, on "Dr. Johnson;" A concert, conducted by Mr. Kenningham; Rev. F. Ross Vallings, on "Sir John Franklin and the North-west Passage." These gentlemen all gave their services gratuitously, and have enabled an addition to be made to the library to the number of about 40 volumes, at the cost of about £8. A diminution of the number of lectures has been made, at the suggestion of a special committee, appointed for the purpose of considering the best manner of bringing the expenditure of the Institution within its income, which suggestion was adopted at the last annual meeting. The financial statement shows that the receipts have been £124 19s. 5½d., and there is a balance in favour of the Institution of £4 8s. 5½d.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 5th*, 1860.]

Dated 27th June, 1860.

1559. M. J. L. Latta, Ashton-Gourock, Renfrew, N.B.—Imp. in the treatment of various substances for the purpose of rendering the same non-inflammable.

Dated 27th August, 1860.

2057. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction of axle boxes and axle bearings. (A com.)

2068. J. Bingley, Leeds—Imp. in hydraulic presses, parts of which are also applicable to other purposes.

Dated 29th August, 1860.

2083. C. Iliffe, Birmingham—Imp. in the manufacture of metallic and non-metallic substances for expanding dresses, and other purposes.

Dated 30th August, 1860.

2096. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in the manufacture of railway chairs. (A com.)

Dated 1st September, 1860.

2118. S. Hargreaves, R. Holden, and J. Nuttall, Haslingden, Lancashire—An improved warping machine.

Dated 3rd September, 1860.

2128. T. Grimston, Clifford, Yorkshire—Imp. in machinery for balling threads, yarns, or twines, made from fibrous materials.

Dated 10th September, 1860.

2186. W. Wilkinson and H. T. Wright, Boston, Lincolnshire—Imp. in apparatus used when stacking straw and other agricultural produce.

Dated 11th September, 1860.

2194. J. Déneéchaud and J. Chapa, Bordeaux, France—An electric controller for indicating the relative position of trains on railways.

Dated 14th September, 1860.

2218. F. A. Calvert, Manchester—Imp. in steam engines and boilers, and in valves for steam and other fluids.
2222. J. Burrell, Norwich—Imp. in the manufacture of woven materials applicable as crinoline and other articles of ladies' dress.
2224. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for raising and lowering and weighing heavy bodies. (A com.)
2226. L. Turner, Leicester—Imp. in the manufacture of elastic fabrics.
2232. W. E. Gedge, 11, Wellington-street, Strand—Imp. in ornamenting glass with colored designs or pictures in imitation of stained or painted glass. (A com.)

Dated 15th September, 1860.

2236. W. Schnell, Strand—Imp. in the manufacture of lucifer matches.
2240. M. Burke, Gilbert-street, Liverpool—An improved spring sacking or foundation for a bed mattrass or other like article, especially adapted for ships' use, barracks, hospitals, and military camps, applicable also for domestic dwellings.
2242. G. F. Bradbury, Oldham, and J. J. King, Glasgow—Imp. in binding and folding guides in sewing machines.
2244. F. Seller, Paris—Imp. in compressing air or other gas which may be transferred by tubes for raising water, and for various other purposes.
2246. W. E. Gedge, 11, Wellington-street, Strand—Imp. in the manufacture of manure. (A com.)
2248. T. Barnett, Oldham—Imp. in high pressure steam-engines.
2250. W. E. Newton, 66, Chancery-lane—Imp. in safety locks. (A com.)

Dated 17th September, 1860.

2252. C. Stevens, 1B, Welbeck-street, Cavendish-square—A new medico-chirurgical bleeding instrument. (A com.)
2254. J. E. Betts, The Drapery, Northampton—An improved machine for cutting out clothing.
2256. F. Zysel, 28, Great Pearl-street, Shoreditch—Imp. in the construction of studs or fastenings for shirt fronts and other articles of dress.
2258. W. H. Teulon, Cooper's-row, Tower-hill—Imp. in brewing, and in apparatus employed therein. (A com.)
2260. W. E. Newton, 66, Chancery-lane—Imp. in lanterns. (A com.)
2262. G. Grout, Wood Green, Tottenham, Middlesex—Improved machinery for manufacturing elastic cord.

Dated 18th September, 1860.

2264. H. Stead and H. Gledhill, Halifax—Imp. in finishing textile fabrics, and in the means or apparatus employed therein.
2270. D. Miller, Glasgow—Imp. in the mode of constructing breakwaters, piers, quays, sea walls, and the submarine works of fortifications.

Dated 19th September, 1860.

2274. W. Holgate, Burnley, Lancashire—An improved beaming frame.
2276. F. A. Calvert, Manchester—Imp. in machinery and apparatus for opening, burring, cleaning, and carding cotton, and other fibrous materials, part of which is applicable to opening twisted yarns and woven fabrics.
2380. M. Sautter, 14, Boulvart Montmartre, Paris—Imp. in generating and applying steam as a motive power, and in apparatus employed for these purposes. (A com.)
2282. T. Greenwood, Leeds—An improved mode of and apparatus for manufacturing files.

Dated 20th September, 1860.

2285. A. W. Williamson, University College, and L. Perkins, Francis-street, Gray's inn-road—Imp. in surface condensers.
2287. T. Briggs, Salford—Certain imp. in the manufacture of oilcloth or oil-paper, to be employed for packing purposes, or for coating or covering surfaces, and in apparatus connected therewith.
2289. J. H. Taylor, Lea-terrace, Blackheath, Kent—Improved apparatus for lowering ships' boats, and disengaging same from the tackles.
2291. R. A. Brooman, 166, Fleet-street—Imp. in machinery for printing shawls and other fabrics. (A com.)
2293. G. Arnold and G. Arnold, Jun., Penton-place, Kennington, Surrey—Imp. in elastic skirts for distending ladies' dresses.
2295. T. Westhorp, Manor House, Poplar—Imp. in the manufacture of oakum.

Dated 21st September, 1860.

2299. T. Richardson, Newcastle-upon-Tyne—Imp. in the treatment of bones, and in the manufacture of paper.
2305. T. Martin, Manchester—An improved method of connecting and disconnecting pipes or tubes.
2307. J. Campbell, 44, Adelaide-road, Haverstock-hill—A chambered floating dry dock.
2309. A. V. Newton, 66, Chancery-lane—An improved mope of producing relief-printing plates, blocks, and cylinders. (A com.)

Dated 22nd September, 1860.

2311. J. H. Wells, Brooklyn, U.S.—Imp. in rocking chairs.
2313. T. Griffiths, Birmingham—A new or improved pulley for window or other blinds.
2315. J. J. Rowley, Rowthorne, Chesterfield, near Derbyshire—Imp. in machinery for cutting or clipping hedges.
2317. J. L. Budden, 48, Fenchurch-street—Imp. in the application of steam or highly rarefied gas, or other aeriform fluid to obtain motive power for propelling and other purposes. (A com.)

Dated 24th September, 1860.

2319. E. Gaskill, 10, Sermon-lane, Godliman-street, Doctors' Commons—The application of a traversing set-off sheet to gripper printing machines of all kinds.
2323. H. Batchelor, 34, Southampton buildings, Chancery-lane—Imp. in the apparatus and means employed for the production of geometric or ornamental figures or designs.

Dated 25th September, 1860.

2325. C. Kind, 50, George-grove, Holloway—Imp. in pianofortes.
2327. J. R. Porter, 47, Wood-street—Imp. in axles for railway carriages and other purposes. (A com.)
2329. E. Collier, Middleton-street, Clerkenwell—Imp. in respirators.
2331. R. Geoghegan, James-street Brewery, Dublin—Imp. in machinery or apparatus for expressing liquids from various substances.

Patents Sealed.

[*From Gazette, October 5th*, 1860.]

October 4th.

837. A. White.
868. W. Leuchars.
869. J. H. Fuller & W. Davidson.
870. V. Rola.
871. J. H. Wilson.
874. J. H. Johnson.
877. A. V. Newton.
879. H. Carter.
883. H. L. Hall.
886. J. Hamer.
887. H. Bridle.
889. T. Parker and G. Harrison.
891. T. Aveling.
896. E. Heywood.
899. J. Rigby & W. N. Norman.
900. J. Rankin.
905. T. H. P. Dennis.
909. T. Martin.
910. J. F. Hillel.
922. J. Platt.
938. L. M. Boulard.
961. J. H. Johnson.
963. Gustav Hansemann.
974. J. Fowler, jun., W. Worby, and D. Greig.
990. R. Roberts.
1008. J. Parkinson.
1048. W. Bate.
1057. W. Northern.
1089. H. T. Green and S. B. Wright.
1095. F. Preston.
1130. W. E. Newton.
1168. T. Wilson.
1184. W. E. Newton.
1275. R. H. Collier.
1313. J. H. Johnson.
1364. W. Taylor.
1406. M. Jacoby, J. Redgate, and J. Stones.
1447. J. Lancaster.
1631. W. F. Thomas.
1731. E. Loysel.
1793. W. E. Newton.
1794. Sir P. Fairbairn and J. Barrow.
1795. W. E. Taylor.
1807. A. V. Newton.
1837. J. Hamilton, jun.
1887. J. Rives.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 5th*, 1860.]

October 1st.

2552. J. Combe.
2556. J. T. Pitman.
2557. R. H. Hughes.

October 2nd.

2538. J. A. Molineaux and J. Nichols.

October 3rd.

2568. R. Romaine.
2635. W. A. Rooke.

[*From Gazette, October 2th*, 1860.]

October 4th.

2558. J. Parker.
2576. W. Mac Naught and W. Mac Naught.
2614. C. C. Alger.

October 5th.

2566. J. Warburton.
2574. T. Grubb.
2583. T. Massey and T. Savage.
2603. H. Edwards.
2633. G. Rhodes.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, October 5th*, 1860.]

October 3rd.

2261. P. R. Jackson.

[*From Gazette, October 9th*, 1860.]

October 4th.

2977. S. L. Worth and A. D. V. Canavan.

October 5th.

2295. J. H. Johnson.

October 6th.

2309. W. Potts.

Journal of the Society of Arts.

FRIDAY, OCTOBER 19, 1860.

COCOA—ITS CULTIVATION, MANUFACTURE, AND USES: ITS ADVANTAGES AND VALUE AS AN ARTICLE OF FOOD.

By J. A. Mann, F.S.S., M.R.A.S., &c.

(*Continued from page* 790.)

Cocoa must be placed as one among the many articles of luxury imported into this country in the present day which have come to be regarded as auxiliaries, if not necessaries, in our diet. In this category I would particularly place the beverages coffee and tea, for the general uses of the three are identical; yet there exists a strange disparity in the relative proportions of the extent to which they are consumed in the United Kingdom. The Table No. 1 will show that the quantity consumed* of each of the three articles, taking for our purpose annual averages of decennial periods, has been:—

	Tea.	Coffee.	Cocoa.
	lbs.	lbs.	lbs.
1820-9...	24,920,099	11,554,010	325,922
1830-9...	34,221,211	24,205,707	1,136,000
1840-9...	42,394,633	32,685,269	2,609,114
1850-9...	62,598,493	34,763,447	3,437,575

which shows the relative unimportance of the demand for cocoa as compared with that for tea and coffee; and we will further see, from the same table, that in the year just past (1859), the relative proportions were:—

67 per cent. 30 per cent. 3 per cent.

so that the quantity of cocoa consumed is only 1-25th of that of tea, 1-11th that of coffee, and 1-38th of the entire aggregate of the three articles. If we were, however, to disregard the proportions they bear to each other, and look only at their relative per cent. of increase, we should discover, by a comparison of the last decennial average with the first, that during the last thirty years the increase has been:—

153 per cent. 202 per cent. 957 per cent.

which would seem to indicate that relatively cocoa has gained public favour more than tea or coffee, but these figures show only the relative per centage of increase of each upon its own proportions; the actual increase in the quantity of each article consumed has been as follows:—

37,678,394 lbs. 23,209,437 lbs. 3,111,653 lbs.

The development first shown in the per centage of increase arises from the government duty imposed upon cocoa in the first period (the basis of induction) being exorbitant, and the demand for consumption consequently depressed. The reduction in the duty, and consequently of the market prices, as may be seen by a glance at the Table No. 4, has been greatest in the case of cocoa, and the per centage of increase has, therefore, been greatest in that.

The duties charged on cocoa, particularly in the manufactured state, until within the last few years, were very heavy, as may be seen from Table No. 4. Until 1823, the importation of chocolate, or cocoa paste, was prohibited, while cocoa husks, though allowed into Ireland at 20 per cent. *ad valorem*, were prohibited to be imported into Great Britain. In that year the former was admitted at £9 16s., the latter at £1 17s. 4d. per cwt. In 1825, a readjustment was attempted, and chocolate imported from foreign countries was charged with £24 5s. 4d. per cwt., which was continued down to 1838. Several alterations have since been effected, the greatest, however, in 1853, when cocoa from all parts was admitted at 9s. 4d., chocolate at 18s. 8d., and cocoa husks at 4s. 8d., which was, in 1855, reduced to 2s. per cwt.

A very cursory glance at the accompanying statistics will show the utter needlessness of such unwise impositions. When such prohibitive or protective duties as those under notice are imposed, one is led to expect that their removal would be followed by a sudden and overwhelming influx of the prohibited article; but, in this case, the eye searches in vain to detect any such development, while the mind is indelibly impressed with the short-sighted policy which prompted their imposition. None of those destructive results seem to have been produced which must have floated in the minds of our financiers; but, on the other hand, so long as the duties were exacted, our manufacturers were prevented competing with foreign countries: our consumers were forced to pay a higher price for the inferior article forced upon them, manufactured from our colonial produce, while even the producers themselves had no inducement to endeavour to improve their modes of cultivation, as their profits on the inferior qualities, with which the public were compelled to rest content, were greater than they could expect from any improvement. The results which followed the reduction of the duties on foreign chocolates really serve only to excite a smile. Even in the present day, when the rate of duty is about fair between chocolate and the raw material, the import of the former is only 36,000lbs. weight. Whether any further adjustment of the duties would be productive of any important development of the demand, or of revenue, we may hereafter discuss.

Few people out of the immediate trade would credit the value of the articles tea, coffee, and cocoa annually imported into this country alone. In the year 1859 it appears as follows*:—

	Gross Cost.	Government Duty.	Total cost.
	£	£	£
Tea	5,812,545	5,407,189	11,219,734
Coffee	1,955,543	431,359	2,386,902
Cocoa	150,684	15,732	166,416
Total cost of tea, coffee, and cocoa imported into the United Kingdom.....			£13,773,052

It may be said that cocoa is comparatively so unimportant that it requires no particular notice, but if it can be shown that the two articles, tea and coffee, costing the enormous sum of seven millions sterling, though pleasing to the palate, do not impart the sustenance to the

* It must, however, be observed, that the consumption of cocoa given in the table does not include the quantity taken for Government stores and the navy, which alone in quantity is nearly equal to half of that taken for home use; and that to ascertain the extent of the consumption of the manufactured article, we must double the quantity given to allow for the other matters with which it is diluted to the extent of 50 per cent. The first remark, however, applies also in a measure to tea and coffee, since they are likewise used to a considerable extent in the navy; while the importations of the article chicory, used to dilute the coffee exhibit a prodigious increase. Thus the imports of chicory have been:—

	lbs.
1857	10,468,528
1858	14,285,936
1859	29,893,808

Parliament has, however, now increased the duty on this article, which will, doubtless, tend to prevent the extension of consumption in this country.

* It must be observed, when perusing these figures, that the "gross cost" represents the value of the quantity *imported*, whilst the "government duty" is that charged upon the quantity *consumed*.

system to the extent which cocoa would do, if properly treated and employed, it will be conceded that the question is worthy of consideration;* and if we glance at the rapid strides made in the consumption of tea in this country, we may even find cause to believe that it is within the verge of possibility a rapid change may take place in their relative positions. Thus the progress of consumption in the case of tea was:—

	lbs.		lbs.
1725	370,323	1800	20,358,702
1750	2,568,338	1825	24,830,015
1775	5,648,188	1859	76,328,131

To unravel, if possible, the causes for the apparent disparity in the demand for cocoa, as compared with that for tea and coffee, and to illustrate their relative advantages, will then be the object of the following remarks.

Tea, coffee, and cocoa, are employed almost solely in the form of beverages made from the roasted leaves or berries, and it is in this light, therefore, we come to consider them. Their analysis will give the following results:—

One hundred parts or one pound weight of good black tea contains—

	parts.	oz.	grs.
Water	5·000	0	350
Thein	3·000	0	210
Casein or Cheese	15·000	2	175
Aromatic Oil	·750	0	052
Gum	18·000	2	385
Sugar	3·000	0	211
Fat	4·000	0	280
Tannic Acid	26·250	4	087
Fibre	20·000	3	087
Mineral matter	5·000	0	350

One hundred parts or one pound weight of raw coffee contains—

	parts.	oz.	grs.
Water	12·000	1	407
Caffeine	1·750	0	122
Casein or Cheese	13·000	2	035
Aromatic Oil	·002	0	001½
Sugar	6·500	1	017
Gum	9·000	1	192
Fat	12·000	1	402
Potash, with a peculiar acid	4·000	0	280
Woody Fibre	35·048	5	262
Mineral matter	6·700	1	031

One hundred parts or one pound weight of raw or unroast cocoa nibs contains—

	parts.	oz.	grs.
Water	5·000	0	350
Albumen	20·000	3	085
Theobromine	2·000	0	140
Butter	50·000	8	000
Woody Fibre	4·000	0	280
Gum	6·000	0	426
Starch	7·000	1	053
Red colouring matter	2·000	0	140
Mineral matter	4·000	0	280

These analyses, given by Dr. Lyon Playfair, in the catalogue to the Food Department of the South Kensington Museum, refer to the different substances in their green or unprepared state, and as such we will for the present compare them, premising, however, that no practical result can arise from this, until we come to consider them in the condition in which they usually enter the human stomach. Taking the analyses as they stand, but rejecting, as either non-nutritive or insoluble, the woody fibre in all, the tannic acid of the tea, and the colouring matter of the cocoa, but including the mineral matter as essentially necessary in nutrition, we find the following result:—

Tea.

Thein	3·000	18·000	"Flesh formers."
Casein	15·000		
Oil	·750	25·750	"Heat givers."
Gum	18·000		
Sugar	3·000		
Fat	4·000		
Mineral matter*	5·000	5·000	
Total nutritive matter		48·750	

Coffee.

Caffeine	1·750	14·750	"Flesh formers."
Casein	13·000		
Oil	·002	27,502	"Heat givers."
Sugar	6·500		
Gum	9·000		
Fat	12·000		
Mineral matter, potash and peculiar acid	10·700	10·700	
Total nutritive matter		52·952	

Cocoa.

Theobromine	2·000	22·000	"Flesh formers."
Albumen	20·000		
Butter	50·000	63·000	"Heat givers."
Gum	6·000		
Starch	7·000		
Mineral matter	4·000	4·000	
Total nutritive matter		89·000	

From this comparison then, we find cocoa contains much more nutritive matter than either tea or coffee, supposing that we were to employ the substances in the form in which they reach us, and even consume the whole of the coffee as the Arabs sometimes do, or eat our tea leaves (after the fashion in Russia), as well as drink their infusion. As universally employed in this country, however, it is only the infusions of the tea and coffee which are consumed, while on the other hand the whole of the cocoa is taken. No comparison will therefore prove of practical value which does not take this into account, and also allow for the change produced in the process of preparing the coffee and cocoa for the consumer's use.

The writer is indebted to Dr. Forbes Watson for the subjoined analyses, extracted from the materials for his elaborate work on food, preparing for the press, as well as for other observations under this head of the subject.

In order to make a pint of tea of the strength usually employed (using filtered Thames water), it is found that 83 grains, or about one-fifth of an ounce is required, while for the same quantity of coffee or cocoa one ounce must be employed. But the pint of tea so made is found to contain only 21·5 grains of solid matter as under:—

	Grains.
Nitrogenous substance	5·5
Gum, sugar, &c.	10·0
Mineral matter	6·0
	21·5

and as the pint of water employed to make the infusion itself contained 3·1 grains of mineral matter, the actual quantity of substance extracted from the 83 grains of tea amounted to 18·4 grains, or only twenty-two per cent. of that employed.

* That the real importance of the question may not be lost sight of, it is well to state that the amount paid by the consumers of tea, coffee, and cocoa in Europe and the United States is not less than £66,000,000 annually.

* A certain proportion of the mineral matter belongs to the 20 per cent. of fibre, and would, strictly considered, have to be deducted from this 5 per cent.; the same remark will apply in the case of coffee.

A pint of well-made coffee contains :—

	Grains.
Nitrogenous substance	22·0
Gum, sugar, &c.	51·6
Fat	1·5
Mineral matter	14·5
	89·6

so that from the ounce of (437·5 grains) coffee employed to make the pint we find that, allowing for the mineral matter in the water, only 86·5 grains, or twenty per cent. of the qnantity actually used passes into the system. In this respect, taking weight for weight, tea and coffee are therefore very similar.

Cocoa, unlike tea and coffee, is not taken in the form of an infusion, but as an emulsion, and has, therefore, the advantage of passing almost bodily into the stomach ; thus, a pint of cocoa, well-made from pure pounded cocoa nibs, will contain :—

	Grains.
Nitrogenous substance	67·8
Gum, sugar, starch, &c.	103·2
Fat	223·5
Mineral matter	15·7
	410·2

and allowing for the mineral matter in the water, the quantity of nutritious matter which passes into the system is 407·1 grains, or ninety-three per cent. of the entire weight (one ounce) of the cocoa used. Thus, it is clear, a pint of cocoa contains 2112 per cent. more of nutritious matter than the same quantity of tea, and 370 per cent. more than coffee.

But in determining the relative nutritive value of these three substances, there is still another consideration to be kept in view, for it may so happen that, small as the quantity of the tea or coffee actually taken into the system may be, it may nevertheless play a more important part than even cocoa in giving sustenance. For the sake of convenience, food substances have been divided into "flesh formers" and "heat givers;" the first embracing nitrogenous, the latter carbonous substances. These constituents are required for the supply of the elements in constant demand for building up or keeping in repair the tissues of the body, and must, moreover, be afforded in proportion to its individual necessities, or the system will droop and starvation ultimately ensue. As long as life endures, such processes, involving wear and tear, never cease to go on, but the rapidity with which such changes take place may be to a certain extent modified or restrained: and this property possessed by certain substances has led to a distinction between foods which play their part by yielding the actual material required for building up the tissues or keeping up the heat of the body, and those which practically accomplish the same object by diminishing the body's necessities for such materials, reducing, as it were the amount of friction constantly going on. Such food substances have been called "accessories," and their power of exercising such an effect would seem to depend on the existence of certain active principles. Thein, caffeine, and theobromine, are respectively the active principles of tea, coffee, and cocoa. The two first are essentially similar bodies, and the last is what is called homologous in composition with these, and supposed to possess similar properties. Experiments with theine and caffeine have proved that even when given in very minute quantities a considerably smaller amount of food has been required, and it has likewise been found that in households in which the use of tea has been discontinued the looked for economy did not result, the consumption of bread and meat having more than proportionately increased. Referring, then, to the analyses before given, we find that the proportion of these active ingredients existing in tea, coffee, and cocoa, are respectively 3, 1·75, and 2 per cent., and consequently that cocoa stands next to tea in even this repect, and considering that the infusion of the latter is not likely to have extracted the whole of the active principle, and that besides only 83 grains in all is employed, whereas 437·5 grains of cocoa are employed, we see that the pint of cocoa is certain to contain more both of this principle and of nutritive matter.

But on the faith of these figures, it may fairly be asked why is it, then, that the consumption of cocoa is comparatively so small ? And why is it that with few exceptions it disagrees with the system ? And this leads us to make a few remarks on nutrition.

It is not sufficient that the food taken into the human stomach should supply during digestion, in large quantity, some of the materials or principles necessary for the sustenance of the system, but it is necessary it should supply them also in proper proportion. It will not suffice that it consists largely of nitrogenous matter, or that fat and starch predominate, nor that it contains a larger than usual proportion of mineral constituents. It is the proper proportion of these elements. If either of them are defective it will not nourish, or if any of them are in excess certain harm to the system must result. It is, in short, the relative proportions in which they are combined, either by nature or man, that constitute the nutritive value of any substance taken as food.

To reduce the theory to practice and every-day life, we will discover that men fed on different kinds of food are acted on in different ways. Thus, men fed on rice alone become pot-bellied and emaciated ; fed on preparations of peas or beans, and blotches, bad sores, and disordered functions result. Nature has, however, furnished us with a few grains that will support the system so well, and for such a comparatively long period, that we are warranted in taking these as a standard by which to judge others. Taking wheat, we find that bread alone will for a while do what we have said. The proportion in which the essential elements in wheat are united is such as the human system finds to be right. In wheat the two chief constituents, the nitrogenous and carbonous, are combined in the proportion of 1 of the former to from 6 to 7 of the latter, and this accordingly may fairly be taken as the standard relation which ought to exist, or be made to exist, in other articles of diet intended to perform the same part, and experience has led man to form such combinations. Rice is supposed to feed a large portion of the human race (*i.e.*, in the Eastern world), but man cannot and does not live on rice alone. If he is a Hindoo he adds the peas or beans of the country until he has made the proportion between the nitrogenous and carbonous constituents reach the 1 to 6 or 7 standard, the same as in wheat. If he is a Mussulman, and has the money, he adds flesh and accomplishes the same. And taking other articles of diet, and supposing an Englishman the feeder, to fat pork, which, by itself, has too much carbonous matter, nature has suggested the addition of peas-pudding, which by itself has too much nitrogenous matter ; and for the same reason bacon and eggs is an excellent combination. With veal, which is poor in fat, we eat bacon ; and with fish melted butter. These instances may be multiplied *ad libitum*. It demonstrates that both the vegetable and animal kingdoms furnish the materials. Instinct leads man to combine them in wholesome proportions, and science, founded on experience, can accomplish the same.

In a great measure the elements which should be contained in the beverages consumed depends upon the other constituents of the diet of the consumer, whether the nitrogenous or carbonous preponderate, in either of which cases if the beverage is to perform the corrective part it would require to be regulated accordingly ; but we find that with few exceptions men raise the standard in the case of their principal diet, bread, to the standard of 8 or 9 carbonous to 1 of nitrogenous by the addition of butter. If cocoa or any other beverage is then to be taken, as an aliment supplying, *per se*, the necessary proportions of the elements required by the system, the standard would appear to be about 8 to 1. In the case of cocoa, it is relished and taken for a time by a large number of people

in this country, but the comparative smallness of the consumption as compared with tea and coffee, shows that there is some reason why, with all its inherent advantages, it does not receive the full meed of public favour, and this arises solely from the fact that constitutional instinct finds something wanting; that it does not agree with the majority of people is well known. It is pleasant, and we take to it kindly at first, but before long get tired of it. Cocoa alone is too fat, and soon displeases the stomach; it is not only too rich in carbonous matter, but too rich in fat as fat. Bring the constituent butter, in cocoa, to its equivalent starch value, and the proportion of carbonous to nitrogenous matter is found to be rather over the above standard, while the fat it contains, *per se*, affects the stomach; it is bilious But, while the pure cocoa itself naturally contains too small a quantity of nitrogenous matter and too much fat, the usual practice in the preparation of cocoas and chocolates is to reduce even that amount by the addition of starchy substances with the view of getting over the stomach's objections to the fat. Thus, the comparison of the analysis of cocoa nibs with that of the London cocoas and chocolate show the following facts:—

Average of the Analyses of	Moisture.	Nitrogenous matter.	Starch, Sugar, Gum, &c.	Fat or Oil.	Proportion of Carbonous to Nitrogenous.*	Mineral Matter.
	Per cent.	Per cent.	Per cent.	Per cent.		Per cent.
1 Sample pure mixed roasted cocoa nibs	5·000	14·400	29·900	47·400	10 C to 1 N	3·300†
4 samples chocolates	2·650	9·350	53·880	31·700	15·3 C to 1 N	2·400
8 samples cocoas ...	5·550	6·120	66·500	19·990	19·1 C to 1 N	1·840

But it is at once seen the starch does this without fulfilling the essential condition required. The palate and stomach, which soon reject the pure cocoa, are at first fairly pleased with the article thus prepared and starched, but the same constitutional instinct before long discovers that something is still defective; the cocoa can no longer be taken with advantage, or even relish; we tire of it, because it does not satisfy the innate wants of the system. Starchy matter is useful within certain limits. It is, however, a weak substance, which in this case adds bulk without fulfilling any really essential condition.

It must ever be kept in view, in considering this question, that even small as one ounce of cocoa may appear to be, still that weight, in the form of dry substance, forms a fair proportion of the total nutritive matter, minus water, taken into the system in the course of each twenty-four hours, and it is this fact which renders it so essential that its component constituents should be as near the dietetic standard as possible.

The qualities of cocoa which reach our market are those in which the largest quantity of fat is contained, and this for reasons we have already stated; but if the finer kinds of cocoa were obtained and employed even in their pure state, the beverage prepared from them would be essentially wholesome, if the other diet of the consumer were not too fat. But these inferior kinds could of themselves be rendered not only nutritious, but unquestionably wholesome and pleasing to the palate, if only a part of the butter were first expressed, but it is better to reduce the relation between the carbonous and nitrogenous, and thereby retain all the virtues of the cocoa, and render it the most highly nutritious of all beverages. In order to do this, however, it is clear that it is not starch alone which should be added, but some substance or substances rich in nitrogen. In practice, there is one way in which this is to a certain extent accomplished, and that is by the addition of milk. The dry substance of milk contains its essential constituents in proportion of about 4 to 1, and hence the addition of a considerable quantity of milk will assist in bringing the cocoa down to the standard of 8 to 1. But both economy and the palate oppose the addition of milk in quantity sufficient to effect the whole object. The flavour of cocoa must be retained, and milk in quantity sufficient to fulfil the desired end would drown that.

It has been proposed to effect this by the addition of substances rich in nitrogen, and lentils have been so employed, but only with partial success. The *Soja hispida*, a small bean (called "soy bean" and "Japan pea") which grows largely in the North of China and in Japan, and which is also used in India, has been shown by Dr. Watson to contain 5½ to 6½ per cent. of nitrogen, thus yielding 35 to 40 per cent of nitrogenous matter. It gives 5 per cent. of ash, and nearly 1 per cent. of phosphorous,* and were

* In order to obtain the proportion of carbonous to nitrogenous matter, the fat is multiplied by 2·5 to bring it to an equivalent starch value, the starch is then added, and the result so found divided by the nitrogenous matter.

† The mineral matter in the pure cocoa nibs is thus composed:—

	Per cent.	Per lb. Grains.
Iron (peroxide)	·021	1·47
Potash	·054	37·45
Soda	·902	63·11
Lime	·188	13·16
Magnesia	·408	28·56
Chlorine	·049	3·40
Phosphoric acid*	·956	66·92
Sulphuric acid	·239	16·73
Silica	·540	3·78
	3·357	234·58

* A portion of this phosphoric acid exists in combination with the nitrogenous matter.

* The analysis of the two varieties of the soja, by Mr. F. A. Manning, give the following results:—

YELLOW VARIETY.	Per cent. on moist.	Per lb. on moist. ozs.	grs.
Moisture	12·000	1	403
Nitrogenous matter*	36·089	5	340
Fatty matter	18·075	2	392
Starch, &c.	29·762	4	337
Potash	1·716	0	119
Soda	0·068	0	5
Sesquioxide of iron	0·039	0	3
Lime	0·218	0	15
Magnesia	0·354	0	25
Phosphoric acid	1·061	0	74
Sulphuric acid	0·241	0	17
Chlorine	Trace	—	
Sand, &c.	0·150	0	11
	99.773	16	000
			— 9
*Nitrogen in nitrogenous matter	5·73	401 grs.	
Sulphur in ditto	0·137	10 grs.	

GREEN VARIETY.	Per cent. on moist.	Per lb. on moist. ozs.	grs.
Moisture	12·000	1	403
Nitrogenous matter*	38·919	6	98
Fatty matter	16·966	2	315
Starch, &c.	28·215	4	224
Potash	1·731	0	121
Soda	0·026	0	2
Sesquioxide of iron	0·034	0	3
Lime	0·237	0	17
Magnesia	0·355	0	25
Phosphoric acid	1·162	0	81
Sulphuric acid	0·240	0	17
Chlorine	Trace	—	
Sand, &c.	0·114	0	7
	99·999	16	000
*Nitrogen in nitrogenous matter	6·180	434 grs.	
Sulphur in ditto	0·191	14 grs.	

the theory that assigns nutritive value in proportion to the amount of nitrogen correct, it would, by itself, be the most nourishing substance yet discovered. It is, however, far too rich in nitrogen to be given alone, but for the purpose of bringing substances too poor in nitrogenous matter to the standard, it is perhaps the most powerful in existence. It has naturally not more of the pea taste than any other of the tribe, and when dried at a temperature from 230° to 240°, it loses it almost entirely, and is capable of being mixed with the cocoa in requisite quantity without interfering with its flavour. The proportion between the carbonous and nitrogenous matter in the soja is as 1·45 to 1. It is found to contain from 14 to 20 per cent. of oil, and this multiplied by 2½, to bring it to the equivalent starch power, gives the above relation; it may be deemed advisable to express the oil, in which case the relation would then become nearly one to one, and a less quantity consequently answer our purpose. It would be substituted for the starch now employed by the cocoa manufacturers, probably in about the same proportion, but this would depend upon the nature of the cocoa employed. It would fulfil the purpose for which starch is at present ostensibly used, that is to lower the proportion of fat and give body to the compound, while it would, at the same time, bring the required carbonous and nitrogenous elements into their proper proportion. The flavour of the beverage would not be interfered with, and the taste, considered mawkish by some, would be probably improved.

There is no doubt that there are extenuating circumstances, in so far as regards the conduct of the manufacturers in diluting the cocoa with starch, since it effects one great object very cheaply; and as economy must be the basis of all commercial success, it is important to inquire what change, in this respect, the proposed substitute is destined to effect. On this point our information is rather meagre and defective; there is, however, every reason to believe that the cost of the soy bean will certainly not exceed £12 per ton, or say 1½d. per lb. And it may be stated that there is some reason to believe that it may be cultivated in those parts of Europe favoured with drier seasons. As it is a shrub bearing large crops, if such prove really to be the case, the cost will doubtless be much less, and its great use in other matters of food would render its cultivation probably of great extent.

The manufacture of cocoa is at present carried on by several persons and firms, and among the more respectable are several of the Society of Friends. But a great many of the best puffed kinds in the market are shockingly diluted, some of them containing as much as twenty-three parts of carbonous matter to one of nitrogenous; the quantity of starch which is added is very great, and the system soon tires of such senseless stuff. At the present time no aliment is more largely adulterated than cocoa, and I am even assured of the fact that, amongst other substances, large quantities of rice, heated and maggoty from the voyage, have been occasionally ground up and employed. It is a pity that an article of such worth as a nutritive substance should be thus shamefully neglected; but it arises in great part from ignorance, since it is probable there is little difference in the cost of converting it into one of the best foods for man, and concocting the stuff now palmed upon the people.

Tea costs in China, put on board the vessel, 11d. per pound; coffee, in Ceylon, 7d.; and cocoa, in Trinidad, 5d. per pound. The duties are respectively 1s. 5d., 3d., and 1d., per pound, making the total 2s. 4d., 10d., and 6d. per pound respectively, without considering or allowing for all the many charges and expenses incurred between the place of production and their delivery in a proper form to the consumer. In the case of the two latter, there is a considerable wastage or loss of weight in the process of manufacture, but making proper allowances for this, they should be sold to the consumer, after allowing for all expenses, at about 3s., 1s. 2d., and 9d. per pound respectively, whereas they are sold, mixed tea of good quality at 3s. 6d., coffee at 1s. 4d., and cocoa nibs at 1s. per pound.

To prepare one pint of a satisfactory drinkable beverage, we require to employ, as I have already said, one ounce of cocoa, one ounce of coffee, and about one-fifth of an ounce of tea; it is therefore clear that—

One pint of tea will cost 0·52d. or = ½d., while it will contain 18·40 grs. of nutritive matter.
One pint of coffee will cost 1·00d. or = 1d., while it will contain 86·50 grs. of nutritive matter.
One pint of cocoa will cost 0·75d. or = ¾d., while it will contain 407·10 grs. of nutritive matter.

From these figures we see that the consumer, disregarding the relative nutritive power of the three articles, tea, coffee, and cocoa, would, as regards cost, select tea as meeting his wants more cheaply than either of the others, but we must remember that the cheap cocoas are now sold at 40 per cent. less than the price we have taken, and because these do not meet the wants of the system, we have taken the price of pure cocoa nibs, at the same time not doubting that a cocoa combining the qualities we have shown as essential, can be sold at a profit at a price equally as cheap as the cheapest of the compounds at present sold to the consumer; and if we look simply at the proportion of nutritive matter in the dry material, disregarding all the other elements in the question in favour of cocoa, we cannot fail to remark the benefits it is capable of affording.

The flavour of cocoa already has its admirers, and it s certain that when once the difficulty is seen in its true light, and the means by which it may be corrected adopted, it must, with its inherent advantages, largely increase in public favour. If we need any evidence that there are those who would under these circumstances at once transfer their allegiance to the theobroma, it will be found in the fact that scarcely any around us but will reply to the question that they have tried it and found, after a certain period of time, differing according to their habit of body and scale of dietary, that it would not agree with them; it is to be hoped that the cocoa manufacturers will adopt a system of preparation more in accordance with vital laws, and thus render the article a blessing to the people; and we hope before long to see a poor man's cocoa which will yield a tolerably fair proportion of the muscle-giving power demanded by daily toil.

It will have become evident from these remarks that it is to the poor and hard-working man that cocoa can yield the greatest boon. Formerly it was considered one of the greatest luxuries, but as an article capable of cheap and extensive production, it has recently undergone a marked alteration as to the channels in which it is consumed; indeed, the extended consumption has arisen rather from its in a measure superseding coffee as a cheaper beverage; and for this reason the high prices ruling for the last few years have materially curtailed the extent of consumption, since it may be said that the larger proportion of the demand in the present day is for cheap cocoas.

A great part of the question of an extension of the sphere of consumption hinges on the course pursued by the manufacturers, especially in the one item of cost, for a taste once acquired, and more particularly one so deep rooted as that for the beverages tea and coffee, will not be readily effaced, on the score of the healthful advantages pertaining to an article hitherto looked upon merely as an adjunct to the breakfast and tea and not particularly as an aliment. It is very certain that with such high prices as those now ruling, the advance will not be so great as the immense advantages warrant. The article must ever be largely dependent upon the manufacturer for its success, since, unlike tea and coffee, when it arrives in this country it has to undergo the entire process of manufacture. In Port d'Espagne, in Trinidad, there is a model chocolate manufactory on a small scale (that of Messrs. Cruger and Leotaud), some of the chocolate from which reaches this market; but the temperature is there too high to admit of the

manufacture of those kinds which are required to keep; the temperature for this purpose should not exceed 60 deg., and the chocolates of the best quality are even here made in cold weather.

(*To be continued.*)

THE WRECK REGISTER AND CHART OF 1859.

The *Wreck Register and Chart* for 1859 have been published by the Board of Trade, and they chronicle the fearful, and, in the present instance, unprecedented effects, both on life and property, of the terrific storms of the preceding twelve months in the seas and on the shores of the United Kingdom. Truly these statistics may seem of a dry and uninviting character, but they are of the utmost national importance, for they tell with unmistakeable accuracy that 3,977 shipwrecked persons were placed last year in imminent danger on our coasts, of whom 1,645 unfortunately met with a watery grave, and that the value of the property destroyed was upwards of a million and a half sterling. The lives thus sacrificed and property destroyed on the coasts of the British Isles represent a state of things within one short year which is without a parallel in the maritime annals of the kingdom.

To realize, however, the desolating scene at one view, the *Wreck Chart* must be consulted. It will be observed that in some spots, such as the whole of the east coast, where 621 wrecks took place last year, near projecting headlands and the sites of lighthouses, the disasters have been most numerous, just as though such localities had a special attraction for vessels. To survey the map it would seem as though all the ships of the world had been attracted to our shores as by some magnetic mountain, and then shattered helplessly upon them.

When it is remembered, however, that England is the centre of the commercial world, that hither are attracted the mercantile navies of all nations as well as of our own; that last year alone the number of vessels which entered inwards and cleared outwards, including their repeated voyages from the different ports of Great Britain, was 300,580, representing a tonnage of 31,712,500, and probably having more than a million of people on board; that it is not an unfrequent occurrence to see 400 or 500 vessels at one time coming down the east coast, and equally as many at the mouth of the Thames and Mersey, when this is considered, all this enormous shipping and number of men which crowd, day after day, the narrow channels, skirted as they are by dangerous rocks, headlands, and sandbanks, it is not a matter of surprise that so many lamentable catastrophes should occur year after year among them. However, last year was one of the most disastrous on record to ships on our coasts, as many as 1,416 wrecks having occurred, with the loss of, as has been said before, 1,645 poor creatures.

In analysing the causes of these shipwrecks, it appears by the *Wreck Registry* that the increase of these disasters is mainly to be traced to the very heavy storms of October 25 and 26, and of October 31 and November 1 and 2 last. In the former gale there were 133 total wrecks and 90 casualties, resulting in serious damage, and 798 lives were lost. This number, however, includes the loss of 446 lives in the *Royal Charter*, which will always be remembered as one of the most melancholy shipwrecks that ever occurred on British shores.

During the gale of November 1 and 2 there were 27 total wrecks and 27 casualties resulting in partial damage, and there was a loss of 51 lives. Besides these, 424 lives were lost at one time in the *Pomona* on the 28th of April, and 56 in the *Blervie Castle*, on or about the 20th of December.

Although the work of destruction, as thus officially recorded, is fearful to contemplate, yet it must be remembered that had it not been for the services of the lifeboats of the National Lifeboat Institution, the rocket and mortar apparatus of the Board of Trade, and other means, it would have been much more disastrous in its consequences. It is somewhat singular that while the number of casualties to British ships trading to, from, or between places in the United Kingdom has greatly increased—viz., from 927 in 1858 to 1,187 in 1859—the casualties to foreign ships similarly employed have decreased from 209 to 188. It surely cannot be creditable to British seamen that foreigners should beat them in safely navigating ships in British waters.

Again, it appears that in one voyage out of every 175 voyages made by British ships employed in the oversea trade, a casualty has happened, while in only one voyage out of 335 has a casualty happened to a foreign ship similarly employed. This unfavourable contrast would be still more strikingly illustrated if the per centages of casualties compared with voyages made by vessels in ballast in our coasting trade were given; but, unfortunately, this register is silent on that important point, as no record is kept of coasting voyages made by British ships in ballast. Some of the most distressing and fatal wrecks are often occurring among our coasters in ballast.

In the classification of the casualties according to the cargoes of the ships, it appears that the ships which have suffered most are as follows, viz., laden colliers, 506 in 1859 against 377 in 1858; light colliers, 71 against 41; ore ships, 130 against 101; and ships with passengers and a general cargo, 42 against 14.

It will be observed that our ill-built colliers continue to maintain their fatal pre-eminence for their frequency of wrecks on the east coast. When overtaken by a storm off Flamborough Head, no shelter is afforded them until they reach Yarmouth Roads, where, alas! too frequently the bodies of their unhappy crews are found floating on the out-lying sandbanks. No facts can speak louder than this simple record of the absolute necessity that exists that measures should be taken as early as practicable to improve our natural harbours of refuge on the east coast and elsewhere.

The services of lifeboats are also most frequently called into use on the east coast of the United Kingdom. Who that has seen the Lowestoft, Pakefield, Southwold, and other boats in connection with the National Lifeboat Institution put off during the past few months in the very fury of the storm, has watched their successful fight with the elements, and has seen the same boats return laden with human life, has not felt a deep emotion such as one cannot but experience when witnessing some heroic and self-denying act?

The whole of the wrecks are divided clearly into classes, according to their rig and tonnage; and it appears from the register that those which have suffered most are as follows—viz., schooners, 491; brigs, 292; sloops, 127; and barks, 123; that the number of casualties to vessels between 100 and 300 tons is 493; between 50 and 100 tons, 455; and below 50 tons, 306; while the number to vessels from 300 tons to 1,200 tons and upwards is only 160.

It was among these numerous wrecks which occurred often during fearful storms that the lifeboat was busily engaged. It is a long list of noble services, and a few of them will be enough to show what strong claims the National Lifeboat Institution has on the public gratitude. Here is April 15.—Goodwin Sands—terrible name of ill-omen to sailors;—wind W.N.W.; sloop *Liberal*, of Wisbeach, 1 man saved by the Walmer lifeboat. Sept. 17 and 18.—Misner Haven; wind N. and W., strong gale; brig *Lucinde*, of Memel, 11 men saved by the Southwold lifeboat. Feb. 28.—Jack's Hole Bank; brig *Louise*, of Genoa, ship assisted by the crew of the Padstow lifeboat. March 8.—Doom Bar Sands—a hideously suggestive designation—brig *Gonsalve*, of Nantes, 7 men saved by the Padstow lifeboat. Nov. 1.—Holm Sands; wind S., heavy gale; steamer *Shamrock*, of Dublin, 14 men saved by the Lowestoft lifeboat. Nov. 2.—Whitburn; blowing a hurricane; schooner *Anton*, of Denmark, 6 men saved by the Whitburn lifeboat. Nov. 26.—Redcar; wind S.E., heavy gale; brig *Fortuna*, of Memel, 11 men saved by the Red-

car lifeboat. Dec. 30.—Barmouth; wind from the S.W., blowing a gale; ship *Britannia*, of Bath, United States, 14 men saved by the Barmouth lifeboat. Dec. 21.—Lytham; weather stormy; the brigantine *Hannah Jane*, of London, 7 men saved by the Lytham lifeboat; and so the record goes on through a long list, enumerating services of the most humane and sterling character in words and figures as simple as an ordinary entry in a merchant's ledger.

Old age tells on ships as it does on human beings, and the ship that was once able to weather the fierce gale bends under the influence of advancing years and rotten timbers. The *Register* states that the greatest number of casualties have happened to ships between 14 and 20 years old, next between 20 and 30, and then to comparatively new ships, or ships between three and seven years of age. It also happens that 64 were upwards of 50 years old, three of this number being between 80 and 90, one between 90 and 100, and one above 100 years old.

A comparison of the wrecks that have occurred during the past two years on the coasts and in the seas of the British isles, gives the following result:—

On the east coast are 621 against 514 in 1828; on the south coast, 136 against 89; and on the west coast, 466 against 304. On the Isle of Man six wrecks took place in 1858, but in 1859 they had increased to 28. This is a point where the Commissioners on Harbours strongly recommended the erection of a Harbour of Refuge. The Castletown lifeboat, belonging to the National Lifeboat Institution, has several times been instrumental during the past year in saving life from wrecks off that island.

The wind which has been most disastrous to shipping during 1859 was the S.W. wind; this was also the case during 1858. The casualties during the S.W. winds were, in 1858, 110; and in 1859, 166. Next comes the W.S.W., which shows 104 casualties in 1859, against 65 in 1858. Then follow the S.S.W., the N.E., the W., and the W.N.W., which show a marked prevalence as compared with the preceding year.

From the force of the wind when each casualty happened, it appears that a marked increase has taken place in those which happened during force 11 (or "storm")—viz., 88 against 57 in 1858; and at force 12 (or "hurricane"), 87 against 11.

Knowledge and ignorance hold also an unequal strife in these alarming records, for it shows that the number of ships to which casualties happened, commanded by masters possessing certificates of competency, was 217 against 344 commanded by masters holding certificates of service only, and 597 commanded by masters not required by law to have certificates. It is only reasonable to expect that every one who professes to navigate a vessel should give some proof of his ability to perform so important a work.

It is computed that the loss of property caused by wrecks and casualties on the coasts of the United Kingdom during the year 1859 was, in cargoes, about £893,000, and in ships, £870,000, being a total loss of nearly £2,000,000.

An analysis of the 1,416 wrecks gives the following results:—

In 1859 the wrecks and strandings involving total loss amounted to 527 against 354 in 1858, and those involving partial loss to 540 against 515 in 1858; the total number of strandings, &c., being 1,067 against 869 in 1858; 116 of these happened in the daytime, between 6 a.m. and 6 p.m., against 76 in the daytime in 1858; and 233 happened in the night, between 6 p.m. and 6 a.m., against 225 in the night in 1858; only 89 happened between April and September inclusive, and 260 collisions happened between October and March inclusive.

It appears that, exclusive of passengers, there were 10,538 persons on board these 1,416 wrecks, and of these 3,977 were actually imperilled, and 2,332 have been saved from a watery grave by lifeboats, the rocket and mortar apparatus, ships' own boats, and other craft; the remainder, 1,645, having unhappily been drowned. This is the largest number on record that have perished from wrecks in one year on the coasts of the British Isles. It should, however, be remembered that 226 of the unfortunate creatures who were thus sacrificed belonged to the *Royal Charter*, the emigrant ship *Pomona*, and the *Blervie Castle*.

Of course, more lives have been saved by ordinary boats than by the lifeboats of the National Lifeboat Institution and other bodies, fishing smacks and other craft being much oftener at hand when disasters happen; nor, indeed, are the services of the boats in question called into requisition when it safe for other kind of vesssels to approach a wreck. To despairing mariners in the shattered hulk, however, grinding upon some rocky barrier, or sinking into some treacherous quicksand, these boats are lifeboats indeed. For instance, on the 30th of January last the ship *Ann Mitchell*, of Glasgow, was wrecked on Arklow Banks. Several fishing smacks attempted in vain to approach her. The steamer *Ruby*, bound for Bristol, lay-to for five hours, with the laudable view of succouring the crew; but the sea was so very heavy that neither smacks nor steamers could even come within hail of the wreck. The Arklow lifeboat, belonging to the National Institution, made her appearance. She nobly ran through the heavy breakers, and succeeded in taking off the whole nine men from the wreck.

While the services of the boats of the National Lifeboat Institution are thus recorded, full justice must be done to the marine department of the Board of Trade in the same cause of humanity. From the Mercantile Marine Fund that department has expended, in support of lifeboats, the rocket and mortar apparatus, and rewards for saving life, nearly £4,600 during the past year.

There are altogether 158 lifeboats on the coast of the United Kingdom; about 100 of these are under the management of the National Lifeboat Institution, and are manned and inspected in conformity with its regulations. They were manned last year, on occasion of service and of quarterly exercise by about 5,000 persons. With the exception of three persons who perished from the extreme coldness of the weather and the water by the upsetting of a lifeboat, not a single accident happened to either the boats or their brave crews.

During 36 years of existence the National Lifeboat Institution has expended on lifeboat establishments nearly £40,000, and has voted 82 gold and 658 silver medals for distinguished services, besides pecuniary grants, amounting to almost £14,000; while during the same period it has granted rewards for preserving, by its lifeboats and other means, no less that 11,601 of our fellow-creatures from a watery grave.

Home Correspondence.

DRAWING CLASSES.

Sir,—Now that the examinations in drawing have, I am glad to find, been resumed by the Society of Arts, I beg to offer, through your *Journal*, a few remarks resulting from experience, for the benefit of those Institutions which may be desirous of establishing drawing classes in their connection. We have had in the Slough Institution a drawing class about seven years, which has been the most successful class belonging to us, and which has been, beyond all expectation, most beneficial to the members belonging to it. Other Institutions in the neighbourhood have endeavoured to establish drawing classes with similar hopes, but after a few months they came to nothing; why, will be explained presently.

I will give you some of the principles upon which we proceed, as they probably may be useful to those who have not a clear notion how to begin and how to conduct the classes they wish to establish. We are able to meet only twice a week, in the evening, from a quarter past 8 to a quarter to 10, Wednesday and Friday. On the

Wednesday evening the junior class is open for beginners, who are first conducted through a course of practical geometry; when this is gone through once, it is again repeated once a fortnight, whilst the intermediate evening is devoted to a course of ground-plan perspective. The times for admitting fresh members are in February and September, at the re-commencement of the geometrical course. When any members of this class feel themselves sufficiently qualified to compete for promotion to the freehand class, they are placed by themselves, to construct the polygons from a triangle to a duodecagon, without any assistance; should they accomplish this they are then admitted into the freehand class, to draw from copies, and can attend on the Friday evening also, as well as the Wednesday, when the members of both classes meet. After they are sufficiently advanced in freehand from copies, they then compete to draw from casts and objects, by making an outline from a copy one-third larger than the original. By being particular that all these drawings should be faithfully done, and their promotion made an object of ambition, an interest is created which tends very materially to keep up the class and give confidence to the members.

This is the foundation upon which we proceed, and upon it we direct the attention of the pupils in their drawing to those objects which are of importance to them in their several vocations. The class is composed of men and apprentices in all mechanical trades, carpenters, blacksmiths, stonemasons, &c., &c. Each is free, after admission to the senior class, to take up that style of drawing most advantageous to himself. Thus, whilst some are being conducted through the first step in practical geometry by one of the senior members under my superintendence, and who draws each problem on a black board, giving at the same time the necessary explanation, others are busily engaged from copies, casts, drawing plans and elevations of buildings, making and tinting working plans and sections, ornaments, modelling, and anything else which they feel it is necessary for them to know. At stated times volunteers from the senior class are conducted through courses of lineal perspective, orthographic and geometric projection, construction of scales, use of instruments, with short dissertations upon the principles of design, &c.

By this mode of conducting the class, and restricting it to mechanical drawing in all its branches, we have produced results which have been in many cases really surprising. For several years we have sent up some volunteers for examination at Kensington Gore, the success of which has been very encouraging. This year we sent up ten, and seven gained prizes; last year eight, and five were successful; the year before six, and five were successful; other years also with similar results. Besides this, cases of private individual success could be mentioned equally pleasing; promotion to appointments where wages and other advantages have been doubled in consequence of their ability to draw and plan. One instance I will give out of numbers that might be mentioned:—A carpenter belonging to the class was at work at a building some distance from London, where the architect resided. This gentleman had neglected to send down some working plans of the staircases and other parts of the building. The men were suddenly at a stand-still for want of the plans, and expected to be so a day or two, until they could get them. The carpenter just mentioned stepped forward, and offered to set the men to work again in two or three hours, if he could be provided with paper and instruments; these were at hand, and he drew the necessary plans within the time, and all went on again; this young man did all the plans for that master afterwards. It would occupy too much of your space to relate a fraction of the number of similar cases, or I would most willingly.

I attribute the cause of our success to confining the study of drawing to the daily requirements of the members. I believe the failure which I have already mentioned of the classes in the Institutions about us, to be in consequence of introducing a kind of drawing for which there was no sympathy amongst the members. One case I know was where the gentleman who undertook to teach them began at once by copying prints in pen and ink, and never attempted anything else. Of course, it could not possibly succeed: it would only prove to the class that they knew nothing about drawing, and from this method could learn nothing; consequently, it disgusted them with it. And here I beg most earnestly to recommend those who wish to promote drawing in their institutions, not on any account to introduce a fanciful kind of drawing, fit only for amusement. Landscape has not yet been introduced into the Slough class, nor is it intended; and everything else is excluded which might draw the attention of the pupils from the useful and essential to the pretty and amusing; unless it were so, the intention of the class would be lost, and, consequently, it would soon cease to be a class. Mechanical drawing, not artistic, is the object of our study.

The above hints I beg to submit to the promoters of drawing in Mechanics' Institutions, offering at the same time to give any further information to anyone who may require it, by addressing a line to me.

I am, &c.,
JAMES CHAPMAN.

Upton-grove, Slough.

Proceedings of Institutions.

Sussex-hall Evening Classes.—A *soirée* of this Institution was held on Wednesday evening, the 10th inst., under the patronage of the Right Hon. the Lord Mayor and Sheriffs, with the view of raising a fund for the further embellishment of the theatre and class-rooms. The list of stewards who had consented to act on the occasion included the names of the Duke of Argyll, the Earl of Harrowby, the Lord Bishop of London, Vice Chancellor Sir William P. Wood; Revs. J. C. Gelling, M.A., C. H. Hardingham, M.A., T. Hugo, M.A., F.S.A., &c., John Jessop, M.A., J. W. Laughlin, M.A., M. W. Lusignan, M.A., George H. M'Gill, M.A., John Patteson, M.A., and R. Wheler Bush, M.A.; C. Buxton, Esq., M.P., R. Hanbury, jun., Esq., M.P., W. Tite, Esq., M.P., Aldermen Copeland and Mechi, Harry Chester, Esq., C. Wentworth Dilke, Esq., Captain Baumgarten, 7th Hussars, Captain Lovell, 10th Hussars. The doors were opened about seven o'clock, and up to eight o'clock the juvenile band of the Foundling Hospital performed a variety of airs in the gallery of the theatre. The Lord Mayor having been detained beyond the hour fixed (eight o'clock), the Rev. Charles Mackenzie requested Mr. Harry Chester to address the meeting. Mr. Chester, in a short speech, alluded to the progress of the movement, which had originated with the Society of Arts, Manufactures, and Commerce, in reference to competitive examinations. He dwelt specially on the various schemes which had been devised for the better education of the humbler classes, and observed that there was much that was objectionable as to the primary schools; the system was faulty, because the time alloted for the attainment of a certain amount of education was too limited, and he considered the period should be extended. Happily the necessity of affording facilities for the better instruction of adults had been proved, and hence had arisen the establishment of evening classes. The Metropolitan Evening Classes were in union with the Society of Arts. The Society of Arts had established a system of competitive examination, conducted by a committee of examiners appointed by that society, which he begged to state was not merely the Society of Arts, but the Society for the Promotion of Arts, Manufactures, and Commerce. In the early part of this movement, the examinations were confined to London, but now these committees were in operation in 63 places in England, Ireland, Scotland, and Wales. Thus great facilities were thrown in

the way of young men who were anxious to distinguish themselves. The Lord Mayor then took the chair, and having apologised for being detained, the business of the evening was proceeded with, by his lordship distributing the prizes and certificates awarded by the Society of Arts in the following order :—Prizemen : £5 each and certificates (first class) — William Robert Clark, German ; William Vaughan, arithmetic. Certificates (first class)—Albert Bannister, English history ; Joseph M. Carpenter, literature; Alfred B. Clementson, arithmetic ; Alfred George Gillingham, book-keeping ; George C. Leslie, arithmetic, and third-class geography ; John B. Moorshead, arithmetic ; Geo. Vaugham, arithmetic ; (second class)—Benjamin Fisher, arithmetic, and third-class book-keeping ; James L. Harding, arithmetic and French ; Henry Hoskins, algebra ; Henry Ash Israel, arithmetic ; William N. B. Moorshead, arithmetic ; Thomas Smith, arithmetic and third-class book-keeping. Third-class certificates to Richard Henry Dart, French ; Joseph Harvey, German ; Robert George Nash, Latin and Roman history ; Walter Henry Shaw, English history. The Rev. C. Mackenzie then moved a vote of thanks to the Society of Arts, and warmly eulogised the successful efforts made by that institution to forward the cause of education. In doing so the rev. gentleman adverted to the origin and progress of these evening classes, which had originated at Crosby Hall, which might be said to have been really their *Alma Mater*. He was strongly of opinion that these evening classes should be self-supporting, but unfortunately they were not so. When young men were called upon to contribute for the enlargement of the accommodation, or for beautifying the theatre, the complaint was that they never knew the end of the expense, and under these circumstances the committee were compelled to ask for aid in carrying out these objects. Having recapitulated the circumstances under which these classes were formed, and the vast assistance which had been given by the Society of Arts, the rev. gentleman concluded by moving a vote of thanks to the Society of Arts. The Rev. Mr. Lusignan seconded the motion, which was carried by acclamation. Mr. Harry Chester, having been called upon, returned thanks. Mr. G. Clark, who was formerly a student at Crosby Hall, who had passed the A.A. examination at Oxford, had gained prizes of the Society of Arts, and who had obtained an appointment in the East India House, moved the thanks of the company to the Lord Mayor and sheriffs. The Rev. Henry Christmas seconded the motion, which was carried. The Lord Mayor returned thanks on behalf of himself and sheriffs. The remainder of the evening was devoted to a concert under the direction of Mr. T. C. Reynolds.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 12th*, 1860.]

Dated 2nd August, 1860.

1864. J. Ryde, 27, Queen-street, Cheapside—An imp. in apparatus applicable to turn tables, swing bridges, cranes, and other machinery acting on a pivot. (A com.)

Dated 23rd August, 1860.

2024. J. Corbett and R. Smith, 15, Elizabeth-terrace, Spencer-road, Hornsey New Town, Stoke Newington, Middlesex—An improved portable circular crane, applicable also as a fire escape.

Dated 29th August, 1860.

2086. E. Deane, Arthur-street East, London-bridge—Imp. in apparatus for facilitating culinary roasting.

Dated 4th September, 1860.

2132. H. J. Standly, 9, Pall-mall East, Westminster—Imp. in the production of gas for illumination and other purposes, and the utilization of the products arising therefrom.

Dated 7th September, 1860.

2158. B. Nicoll, 42, Regent-street, London—An improved method of treating needles, and needles used in sewing and other machines, applicable also to those parts of such machines that hold the needles.

2162. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved impermeable oil varnish. (A com.)

2170. E. Deane, Arthur-street East, London-bridge—An improved rotary cooking apparatus.

Dated 8th September, 1860.

2174. F. Yates, Parliament-street—Imp. in apparatus for and in the mode of manufacturing iron, steel, and other metals and substances, gaseous and solid, fuel being thereto applied as the heating, reducing, cementing, and oxidizing agents.

2180. J. Wood, West Smithfield—Imp. in stereotyping apparatus.

Dated 10th September, 1860.

2185. W. E. Robson, 4, Adam's-court, Old Broad-street—The application of an improved elastic material for springs or cushions on the chairs of railways and tram roads, or in any other position, to prevent the friction caused by the working of iron on iron or other metal substances.

Dated 11th September, 1860.

2190. G. Wellman, Lowell, U. S.—Imp. in carding engines, for carding cotton and other fibrous materials.

2198. G. L. P. Coopman, Constantine (Algeria)—New means and processes of tanning hides and skins by which a graduated impermeability of leathers is obtained.

Dated 12th September, 1860.

2200. B. Baillie, 7, Henry-street, Cumberland Market, Middlesex—An improved rifle range.

Dated 13th September, 1860.

2208. J. Wright, 42, Bridge-street, Blackfriars—An imp. or imps. in the construction of boots and shoes. (A com.)

Dated 14th September, 1860.

2230. J. P. Dusterwald, Ixelles, near Brussels, Belgium—An improved forcing pump for raising beer and other liquids.

2234. N. R. Hill, Northfleet, Kent—Improved apparatus for winding up clocks or timekeepers.

Dated 15th September, 1860.

2238. A. Tronchon, 4, South-street, Finsbury—Imp. in constructing iron and cast-iron dwelling-houses.

Dated 17th September, 1860.

2259. J. Hay, Salford, near Manchester—Imp. in machinery or apparatus for making gas burners.

Dated 18th September, 1860.

2266. E. J. Hughes, 123, Chancery-lane—Imp. in brewing malt liquors, and in apparatus employed therein. (A com.)

2268. W. Cullis, 4, High street, Homerton, Hackney—Imp. in stoppering or closing bottles, jars, and other like vessels.

2272. R. Reece, Llandilo, Carmarthen—Imp. in treating lignite and certain bituminous mineral substances, so as to obtain products therefrom.

Dated 19th September, 1860.

2278. R. Crawford, Beith, Ayr, N. B.—Imp. in apparatus for conveying communications from one place to another.

Dated 20th September, 1860.

2286. J. Oldham, Derby—An imp. in machinery for pulping turnips and other roots.

2292. J. Cash and J. Cash, jun., Coventry—An imp. in the manufacture of frillings to be applied to wearing apparel.

2294. J. Cocker, Liverpool—An improved construction of packing case.

2296. T. Richardson, Newcastle-upon-Tyne, and M. Prentice, Stourmarket, Suffolk—Imp. in treating phosphoric matters, and in obtaining products therefrom.

2298. R. Mushet, Coleford, Gloucestershire—The manufacture of a new or improved metallic alloy.

Dated 21st September, 1860.

2300. D. Murray, Norwich—Imp. in means or apparatus used in weaving.

2301. C. B. Rogers, 13, East-street, Red Lion-square—An improved floor skate. (A com.)

2306. H. E. Skinner and W. H. Miller, Shadwell, Middlesex—Imp. in cranes and other lifting apparatus.

2308. W. E. Newton, 66, Chancery-lane—Imp. in rotary engines and rotary pumps. (A com.)

Dated 22nd September, 1860.

2310. T. Fallows, Farnworth, near Bolton-le-Moors, Lancashire, and R. Wild, Bolton le-Moors—Imp. in fasteners for window sashes.

2314. R. Ash and J. L. Petit, Birmingham—Imp. in metallic pens and penholders.

2316. J. H. Tuck, Great George-street, Westminster—Imp. in air pumps, and in machinery for actuating the same.

2318. E. B. B. Barker, Bayswater, Middlesex—Imp. in apparatus for raising or forcing water or other fluids.

Dated 24th September, 1860.

2320. G. Parsons, 1, Duke street, Finsbury—Certain imp. in breaks for railway carriages.

2321. J. Hine, Clerkenwell—Imp. in markers for billiards, cricket whist, or other games of skill or chance, a modification of which is also applicable for indicating years, months, days, and dates.

2322. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for wringing and washing clothes, and similar articles. (A com.)

Dated 25th September, 1860.

2324. J. Vavasseur, 28, Gravel-lane, Southwark—Imp. in machinery for rolling or polishing leather.

2326. J. Haworth, Thorncliffe, Old Trafford, Manchester—Imp. in tramways for streets and ordinary roads, and in carriages for running thereon.

2328. J. B. Mannix, London—An improved wheel to be used for carriages or other purposes.

2330. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of certain kinds of soap.

Dated 26th September, 1860.

2333. T. S. Truss, 53, Gracechurch-street—Imp. in apparatus for the traction and propulsion of ships, boats, and other nautical vessels.

2334. W. Hollis, 6, Railway Arches, Victoria Station, Sheffield—An improved composition for steel moulders.

2335. W. Hargreaves, Crawshawbooth, near Rawstentall, Lancashire—Imp. in machinery or apparatus for washing woven fabrics.

2337. C. Burn, Delahay-street, Westminster—An improved tram-rail for street railways.

2339. W. Boulton, Burslem, Staffordshire—An imp. in the construction of potter's drying stoves and workshops, and in apparatus for preparing the clay for the moulds used by the potter, so as to render the process of drying more effectual.

2340. J. McCrossan, Glasgow—Imp. in sewing machines. (A com.)

2341. W. Macnab, Greenock—Imp. in steam engines and boilers.

Dated 27th September, 1860.

2343. W. F. Brown, Westgate-street, and W. Jeffery, Eastgate-street, Gloucester—A more convenient and effectual method of attaching and securing brooches and such like articles, and for improved fastenings to be used therewith, and for other purposes.

2344. T. Brookes and T. Adams, Birmingham—An imp. or imps. in the manufacture of the joints of brooches and other similar dress fastenings.

2345. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Improved processes for dyeing or printing with certain products of aniline on cotton, and other textile matters of vegetable origin. (A com.)

2347. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in forging and rolling metals, applicable to the manufacture of wheels, spades, shovels, axles, buffers, and other articles of wrought iron. (A com.)

2348. M. Jacoby and J. Stones, Nottingham—Imp. in the manufacture of bobbin-net or twist-lace, in bobbin-net or twist-lace machines.

2349. W. Hodgkinson, New Lenton, Nottinghamshire—Imp. in machinery or apparatus in the manufacture of figured laces made on bobbin-net machines.

2350. J. Winram, Liverpool—Imp. in machinery for the manufacture of casks and other like vessels of capacity.

Dated 28th September, 1860.

2351. W. A. Martin and J. Purdie, Old Barge House Wharf, Upper Ground-street, Surrey—An improved method of mounting and giving motion to fire-bars.

2353. H. Gilbee, 4, South-street, Finsbury—An improved medicament to prevent and cure venereal diseases. (A com.)

2355. G. H. Birkbeck, 34, Southampton-buildings, Chancery-lane—Imp in electro magnetic apparatus. (A com.)

2357. J. A. Callander, Springfield-house, near Ryde, Isle of Wight—An improved method of hanging doors.

Dated 29th September, 1860.

2359. W. Green, Dod-street, Victoria-road, Limehouse—Imp. in refining or treating sugar and molasses.

2361. A. Delesalle, Lille, France—Means and apparatuses used in steam engines for expelling out of the cylinders the condensed water, and to employ this water for the alimentation of boilers.

2363. A. Warner, Threadneedle-street—Imp. in the manufacture of iron, steel, copper, lead, tin, zinc, and their alloys, and in the manufacture of coke.

Dated 1st October, 1860.

2367. E. Steane, Commercial-place, Brixton—Imp. in apparatus by the use of which the dropping or guttering of candles is prevented.

2369. J. J. Field, Holloway-place, Holloway—Imp. in condensing the vapours arising from fluids evaporating in closed vessels, which invention is also applicable to the condensation of the vapours of volatile fluids during the process of distillation and for improvements in apparatus to be employed for the purpose.

2371. M. Henry, 84, Fleet-street—An addition to or improvement in gas meters. (A com.)

Dated 2nd October, 1860.

2373. R. Hellard, North-street, Taunton, Somersetshire—Imp. in reaping and mowing machines.

2375. J. Bullough and J. Walmsley, Buxenden, near Accrington, Lancashire—Imp. in looms.

2377. B. H. F. Macnamara, Great Yarmouth—Imp. in the construction of floating breakwaters adapted for the facile and economic formation of harbours of refuge and other such purposes.

2379. W. G. Roberts, Nottingham—Imp. in machinery or apparatus in the manufacture of fabrics made on warp machines.

2381. P. Gardner and A. Lindsay, Stirling, N. B.—Imp. in knives for reaping machines.

2385. J. Brokenshire, Bowmanville, Durham, Canada West—Imp. in pumps.

2387. G. E. Taylor, Oatlands Mill, Leeds—Imp. in apparatus used when boiling cloth.

Dated 3rd October, 1860.

2389. T. Johnson, 9, Leicester-square—An improved tobacco pipe.

Inventions with Complete Specifications Filed.

2413. T. M. Richardson, Maine, U. S.—A new and useful or improved steering apparatus for navigable vessels.—5th October, 1860.

2444. W. Snell, 13, Clement's-inn, Strand—An improved machine for making horse-shoe nails. (A com.)—9th October, 1860.

Patents Sealed.

[*From Gazette, October 12th*, 1860.]

October 11th.

903. R. Atkinson.
912. C. Newbold.
913. J. Webb.
914. M. Drukker.
917. J. Bushell, W. Bushell, S. Bushell, J. Bushell, and D. Bushell.
918. H. Smith.
921. O. Vandenburgh.
924. A. Bamlett.
926. A. Mitchell, J. Mitchell, and B. Emmerson.
927. J. W. Crossley and J. Crossley.
932. E. J. Hughes.
933. J. J. L. Bremond and L. Z. Thuilliez.
934. J. Notman.
939. A. Jones.
940. J. Petrie.
943. Sir J. S. Lillie.
949. T. Burstall.
951. T. Walker.
952. W. Smith.
954. D. G. Fitzgerald and G. Bate.
957. W. Clark.
962. J. Patterson.
966. S. Cheetham.
967. W. Bridgett.
971. J. Shaw and J. Cook.
981. S. Wheatley and A. Milnes.
1041. R. Seager.
1045. J. Clark and W. Cross.
1078. R. L. Berwick.
1084. J. Grantham.
1134. J. H. Johnson.
1182. E. Lord.
1207. A. V. Newton.
1318. E. Dufossé.
1456. E. Sparkhall.
1560. J. Mackintosh.
1570. W. Richards.
1888. E. U. Thompson.
2021. E. A. Dana.
2049. F. G. Migeot de Baran.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 12th*, 1860.]

October 8th.

2585. G. Scott.
2589. J. Harland.
2601. R. Porter and J. Porter.
2625. J. F. Swinburn.

[*From Gazette, October 16th*, 1860.]

October 12th.

2626. J. H. Johnson.
2628. F. H. Holmes.

October 13th.

2630. T. Restell.
2646. G. Scarr and J. Pollard.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, October 12th*, 1860.]

October 8th.

2331. J. H. Nalder and J. T. Knapp.

October 9th.

2375. C. Coates.

October 10th.

2412. G. Collier.

[*From Gazette, October 16th*, 1860.]

October 13th.

2355. J. Elce.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Registry.	Date of Registration.	Title.	Proprietors' Name.	Address.
4293	Sept. 27	Porte Monnaie	Thomas Drayton	1, Holford-square, Pentonville, N.
4294	Oct. 2	Improved Sack Lifting or Raising Barrow.	William Newzam Nicholson.	Newark-upon-Trent.
4295	,, 4	Railway Whistle and Carriage Key	Gower and Adley	Calcutta.
4296	,, 6	A Plate to be fixed to the Heels of Boots and Shoes, to be called the Revolving Metallic Heel Plate	John Meccormack	8, Caroline-place, Mecklenburgh-square, W.C.
4297	,, 16	The Volunteer's Canteen or Refreshment Case	George Gibson Bussey	Dunn's-passage, 485, New Oxford-street, W.C.

Journal of the Society of Arts.

FRIDAY, OCTOBER 26, 1860.

COCOA—ITS CULTIVATION, MANUFACTURE, AND USES: ITS ADVANTAGES AND VALUE AS AN ARTICLE OF FOOD.

By J. A. Mann, F.S.S., M.R.A.S., &c.

(*Concluded from page* 800.)

The London market price of raw cocoa (Grenada), which is sufficiently remunerative to induce an extension of the cultivation, is 45s. per cwt. in bond, and this is equal to paying the planter 3¾d. per pound, which is the most he has ever received in any one year. The preposterously high prices to which cocoa has attained in the last few years, owing to a rather deficient supply at the time of an increasing demand, must greatly prevent the development so much to be desired. A comparison of the prices of 1854 and April, 1860, will sufficiently demonstrate the great fluctuations to which I allude, thus:—

	1854. Per cwt.	1860.* Per cwt.
Trinidad red ...	35s. to 40s.	80s. to 101s.
,, gray...	31s. ,, 34s.	75s. ,, 79s.
Grenada	29s. ,, 33s.	64s. ,, 74s.
Para	29s. ,, 30s.	63s. ,, 67s.
Bahia	26s. ,, 28s.	50s. ,, 52s.
Guayaquil	33s. ,, 35s.	71s. ,, 73s.

The prices indicate extremes equally to be avoided; those of 1854 were too low to pay the producer, while those of this year are far too high, paying the producer handsome profits at the expense of the consumer, and this, notwithstanding the alacrity with which our demands have been met; thus the features of demand and supply in the interim appear to have been:—

	Import.	Export.	Consumption.	Taken for Stores and Navy.	Stock.
	lbs.	lbs.	lbs.	lbs.	lbs.
1854	5,258,367	1,573,077	4,452,529	1,641,375	2,169,155†
1855	7,376,053	1,470,725	4,383,023	1,859,638	1,831,822†
1856	7,343,475	4,935,262	3,634,135	197,586	408,314
1857	7,256,045	2,464,961	2,647,470	1,216,288	1,180,761
1858	10,338,404	3,568,642	2,860,034	1,071,898	4,059,263
1859	6,006,759	2,819,248	3,013,858	1,660,111	2,122,927

These figures, with those in the several tables, are obligingly furnished from the Department of H.M.'s Inspector-General of Imports and Exports, and the Statistical Department of the Board of Trade.

The process of manufacture of cocoa or chocolate, though tedious, is not very difficult; the cocoa seeds having been picked of all extraneous matter, or mouldy, worm eaten, or defective seeds, are gently roasted over a fire, in a revolving metal cylinder, having small holes at the end, to allow of the escape of any vapour generated, the motion keeping the cocoa gently moved in order that it may be evenly heated throughout; when the aroma is well developed the roasting is finished, and the husks or skins will have become brittle and freed from the cocoa nib; they are then put into a machine or kibling mill, where they are bruised or pounded, so as to break off the husks, from which they are separated by the blast of a fan; the broken seeds are now carried to the pressure rollers, between which they are crushed and pounded, the rollers being formed of double cylinders, and retained at the proper heat, by means of steam injected between them; thus far, whatever may be the ultimate kind of cocoa or chocolate intended to be manufactured, the process is always the same; from these the cocoa runs in a paste, all the fat having become perfectly soft by the heat and pressure applied; at this stage, whatever ingredients are to be incorporated with it are added, it is put with them into a machine, where, by the trituration of the revolving roller, in a tight fitting case, it is thoroughly pounded and incorporated; the operation is then finished, the paste is weighed out, put into moulds, where it dries hard as it cools; it is then packed in paper and tin-foil, or otherwise prepared, when it is ready for the market.

We have already shown that cocoa alone is detrimental to health, from the amount of fat which it contains, and that it must be mixed with other substances to adapt it to the palate and the system. Thus it is no recommendation that you purchase the pure chocolate and cocoa unless you have the means, and are prepared to employ it in the proper way, and unfortunately there is little more inducement to buy the compounds now generally sold; nevertheless, some are decidedly preferable to others. The numberless kinds of cocoas and chocolates in the market would employ far too much space to recount here. They range from the plain roasted nibs, at 1s. per lb., through all the gradations of flaked, rock, roll, soluble, homœopathic, and dietetic cocoas, and soluble, Spanish, French, health, cream, and Vanilla chocolates, up to the delectable extra superfine caraque triple vanille, at 4s. per lb.

In the Great Exhibition of 1851, there was exhibited by a M. A. E. Lemolt, a sample of a substance called "Cho'ca," being a preparation of coffee and chocolate blended, sufficiently agreeable to the palate to be wholesome and pleasant, but it is not likely to please in this country sufficiently to render it a compound in any extended demand.

While cocoa is thus employed, it has, of course, also the independent advantage of yielding a large quantity of the fatty oil, called butter of cocoa. This is of the consistence of tallow, and of a white colour, melting only at 122 deg. Fahr. It contains a large quantity of stearine, and is, therefore, solid at the ordinary temperature of the atmosphere. It is of a mild, agreeable taste, and does not readily turn rancid. It may be obtained by boiling, but more usually and readily by exposing the beans to pressure in bags after they have been steamed; from 6 to 7 ounces of butter may be thus readily obtained from a pound of cocoa. It has a reddish tinge when first expressed, but becomes white by boiling with water. Though now but little used, it is valuable in the preparation of pharmaceutical compounds, and from its comparative hardness it is well adapted to the purposes for which other oils are used if it could be grown sufficiently cheap; and as for dietetic reasons it is of advantage that the fat should be to a certain extent removed from the cocoa when it is employed as food, it might become possible advantageously to turn it to account, and then leave the cocoa in such a condition that the simple addition of a little arrowroot or starch to impart smoothness would be all that would be necessary, but while making the remark it appears very evident that on the score of cheapness it is not a plan likely to be adopted. The butter of cocoa with soda makes an excellent soap of good emollient qualities, and of great service in the toilet. The inferior kinds of West India, which abound in fat, were formerly used in France to a considerable extent for the sake of expressing the oil, but the many oleaginous substances of late discovered have rendered this unprofitable.

The loss of weight in the process of roasting and separating the husks or skins is about twenty-four per cent., of which the husks form 12 per cent. These are very largely consumed in Ireland, where almost all the husks from the 3,000,000 lbs. of cocoa consumed, or 360,000 lbs. besides the

* The prices of August 1857 were even 20 per cent. higher than those now given.

† The stocks of cocoa given for 1854-5 are estimated.

700,000 lbs., shown by table No. 2 to be imported, are consumed. They make by boiling a fairly agreeable and wholesome food, yielding half their weight of soluble matter of a mucilaginous nature, which furnishes a tolerable nutriment. They can, however, be purchased of most grocers here at about 3d. per lb. One strange fact is shown in regard to them by a glance at the same table, that while other countries purchase of us a considerable quantity of the raw material imported into the United Kingdom, they do not purchase but a very few pounds of these husks, which we, on the other hand, import in considerable quantities for our poor people.

The trade in foreign chocolates, we shall see by Table No. 2, is very insignificant; but as we have already said, legislative enactments have prevented any development in this direction.

The manufacture of British chocolates and cocoas for export is now increasing, the exports during the last four years have been:—

	lbs.	Computed Real Value.
1855	84,874	£3,205
1856	122,931	4,807
1857	118,956	5,943
1858	200,752	9,071

We have now presented, and it is to be hoped fairly, the principal features in regard to the uses of, and our trade in, this useful article. We have shown the advantages and drawbacks in the case of cocoa as compared with tea and coffee, and, admitting the premises, it is likely enough that ere long a great change will take place in the relative positions of the three articles. At present cocoa cultivators in the West Indies labour under the disadvantage of having to pay their labourers 1s. and 1s. 6d. per day, while coffee planters (in the East Indies) can obtain more satisfactory labour at 4d. per day; this must sooner or later be more equitably balanced, and so aid the advance of the cultivation of the former, and it is not that

Table No. 1, Showing the Relative Progress in the Import, Export, and Consumption* of Tea, Coffee, and Cocoa (Exclusive of "Cocoa, Husks, and Shells," and "Chocolate and Cocoa Paste") in the United Kingdom, since 1820.

YEARS.	IMPORTED.			CONSUMED.			RE-EXPORTED.		
	Tea.	Coffee.	Cocoa.	Tea.	Coffee.	Cocoa.	Tea.	Coffee.	Cocoa.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1820	30,147,994	48,841,626	2,397,083	22,452,050	7,103,409	276,321	NO RETURNS.	44,440,869	1,855,031
1821	30,731,105	45,237,869	2,350,105	22,892,913	7,593,001	283,735		41,635,956	1,499,891
1822	27,362,766	44,003,124	2,551,376	23,911,884	7,669,351	267,495		35,825,535	2,800,462
1823	29,046,885	45,053,373	1,435,239	23,762,470	8,454,920	286,657		30,025,691	750,183
1824	31,681,977	50,674,249	2,761,629	23,784,838	8,262,943	318,941		39,517,736	798,057
1825	29,345,699	52,597,518	3,274,375	24,830,015	11,082,970	347,251		27,392,389	1,547,738
1826	29,840,401	42,017,103	2,227,563	25,238,067	13,203,323	344,776		31,894,278	1,742,469
1827	39,746,237	47,938,047	4,615,732	26,043,223	15,566,376	385,793	255,083	29,475,870	3,166,089
1828	32,678,767	41,069,731	1,637,000	26,790,336	17,127,633	354,407	259,659	23,785,980	1,478,537
1829	30,544,404	39,071,215	3,209,933	29,495,199	19,476,180	393,847	251,971	23,023,410	1,674,613
1830	31,897,745	40,952,163	2,065,416	30,047,079	22,691,522	425,382	242,954	20,087,994	1,383,894
1831	31,648,926	43,007,828	3,483,118	29,997,055	22,740,627	502,806	236,359	22,485,474	1,531,131
1832	31,709,016	50,225,939	2,971,019	31,548,381	22,952,527	1,150,193	266,399	25,719,742	1,798,264
1833	32,057,832	34,426,109	4,608,718	31,829,620	22,741,984	1,268,287	254,460	15,349,578	2,351,877
1834	33,643,980	41,865,111	2,984,894	34,969,651	23,785,095	1,173,795	1,181,005	15,250,480	2,205,316
1835	44,360,550	28,398,493	2,118,756	36,574,004	23,295,046	1,084,170	2,158,029	13,346,537	2,481,133
1836	49,307,701	34,054,837	2,788,224	49,142,236	24,947,690	1,130,168	4,269,863	10,681,758	332,587
1837	36,973,981	36,412,514	2,853,000	30,625,206	26,346,961	1,416,613	4,716,248	8,060,975	933,276
1838	40,413,714	39,932,279	4,096,409	32,351,593	25,765,673	1,601,787	2,577,877	11,293,290	639,287
1839	38,158,009	41,003,316	1,654,666	35,127,287	26,789,945	1,606,800	3,318,912	12,762,587	486,905
1840	28,021,882	70,250,766	3,499,746	32,252,628	28,664,341	2,041,678	2,383,384	12,707,414	865,022
1841	30,787,796	43,317,762	5,014,681	36,675,667	28,370,857	1,928,847	4,490,363	14,274,096	471,019
1842	40,742,128	41,444,414	3,172,255	37,355,911	28,519,646	2,246,473	5,710,127	9,505,634	635,125
1843	46,612,737	38,942,469	3,795,531	40,293,393	29,979,404	2,547,934	4,584,141	12,683,443	568,470
1844	53,147,078	46,523,188	3,731,256	41,363,770	31,352,382	2,589,977	4,828,985	6,305,982	1,267,194
1845	51,056,979	50,377,915	4,907,679	44,193,433	34,293,190	2,579,497	4,055,589	19,229,621	158,716
1846	54,767,142	51,813,651	2,800,893	46,740,344	36,754,578	2,951,206	3,533,668	11,739,999	683,616
1847	55,624,946	55,354,044	5,716,375	46,314,821	37,441,373	3,079,198	4,718,138	13,358,802	411,421
1848	47,774,755	57,053,450	6,442,986	48,734,789	37,077,546	2,919,591	3,551,528	24,088,477	1,604,813
1849	53,459,469	63,315,787	7,805,335	50,021,576	34,399,374	3,206,746	4,845,617	34,852,083	3,398,155
1850	50,512,384	50,803,152	4,478,252	51,172,302	31,166,358	3,080,641	5,015,629	12,169,752	1,443,363
1851	71,466,421	53,110,660	6,773,960	53,949,059	32,504,545	2,978,344	4,524,599	22,712,859	1,543,456
1852	66,360,535	54,935,510	6,269,434	54,713,034	34,978,432	3,328,527	6,134,743	12,937,552	1,925,966
1853	70,735,135	55,634,733	8,283,694	58,834,087	36,983,122	3,997,198	4,836,009	26,656,892	2,736,827
1854	85,792,032	66,500,358	5,258,367	61,953,041	37,350,924	4,452,529	8,655,955	32,589,117	1,573,077
1845	83,259,657	64,061,479	7,376,053	63,429,286	35,764,564	4,383,023	13,626,507	28,766,528	1,470,725
1856	86,200,414	56,992,116	7,343,475	63,278,212	34,995,944	3,634,135	5,718,764	27,602,836	4,935,262
1857	64,493,989	58,892,726	7,256,045	69,132,101	34,353,123	2,647,470	8,707,571	15,782,710	2,464,961
1858	75,432,535	60,697,265	10,338,404	73,195,685	35,208,932	2,860,034	7,249,270	28,761,314	3,568,642
1859	75,077,452	65,353,029	6,006,759	76,328,131	34,328,526	3,013,858	6,418,794	29,586,054	2,819,248

* The quantities given as consumed are exclusive of those taken into the Government Stores, or for the use of the Navy.

Table No. 2, Showing the Quantity of Cocoa, Husks or Shells, and Chocolate or Cocoa Paste Imported into, Re-Exported from, and Consumed in, the United Kingdom since 1820.

YEARS.	IMPORTED.				RE-EXPORTED.				CONSUMED.			
	Cocoa.	Husks and Shells.	Chocolate or Cocoa Paste.	Total.	Cocoa.	Husks and Shells.	Chocolate or Cocoa Paste.	Total.	Cocoa.	Husks and Shells.	Chocolate or Cocoa Paste.	Total.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1820	2,397,083	461,947	14	2,859,044	1,855,031	...	...	1,855,031	276,321	461,947	14	738,282
1821	2,350,105	485,933	33	2,836,071	1,499,891	...	...	1 499,891	283,735	485,933	22	769,690
1822	2,551,376	320,610	5	2,871,991	2,800,462	...	...	2,800,462	267,495	320,610	5	588,110
1823	1,435,239	385,621	116	1,820,976	750,183	1,444	...	751,627	286,657	329,556	98	616,311
1824	2,761,629	295,992	1,866	3,059,487	798,057	192	...	798,249	318,941	307,251	1,114	627,306
1825	3,274,375	335,693	1,094	3,611,162	1,547,738	...	277	1,548,015	347,251	367,268	991	715,510
1826	2,227,563	519,037	1,807	2,748,407	1,742,469	...	210	1,742,679	344,776	435,776	1,512	782,064
1827	4,615,732	463,145	2,345	5,081,222	3,166,089	...	1,032	3,167,121	385,793	413,988	1,995	801,776
1828	1,637,000	340,716	1,957	1,979,673	1,478,537	...	106	1,478,643	354,407	295,996	1,902	652,305
1829	3,209,933	237,399	1,782	3,449,114	1,674,613	...	211	1,674,824	393,847	244,139	1,728	639,714
1830	2,065,416	348,636	1,685	2,415,737	1,383,894	5,057	283	1,389,234	425,382	340,088	1,324	766,794
1831	3,483,118	282,000	1,316	3,766,434	1,351,131	...	37	1,531,168	502,806	343,781	1,257	847,844
1832	2,971,819	349,504	1,835	3,322,358	1,798,264	91	361	1,798,716	1,150,193	392,878	1,475	1,544,546
1833	4,608,718	515,688	2,024	5,126,430	2,351,877	...	117	2,351,994	1,268,287	449,168	1,930	1,719,385
1834	2,984,894	404,039	3,602	3,392,535	2,205,316	...	1,985	2,207,301	1,173,795	443,786	1,663	1,619,244
1835	2,118,756	273,401	2,906	2,395,063	2,481,133	1,374	640	2,483,147	1,084,170	368,222	2,037	1,454,429
1836	2,788,224	425,648	3,928	3,217,800	332,587	16,800	1,798	351,185	1,130,168	364,144	2,160	1,496,472
1837	2,853,000	511,757	2,398	3,367,155	933,276	...	219	933,495	1,416,613	481,170	2,009	1,899,792
1838	4,096,409	384,842	2,314	4,483,565	639,287	...	506	639,793	1,601,787	421,548	1,805	2,025,140
1839	1,654,666	609,399	2,722	2,266,787	486,905	...	596	487,501	1,606,800	513,157	2,178	2,122,135
1840	3,499,746	692,091	2,535	4,194,372	865,022	...	453	865,475	2,041,678	753,580	2,067	2,797,325
1841	5,014,681	598,172	1,653	5,614,506	471,019	6,720	80	477,819	1,928,847	566,278	1,523	2,496,648
1842	3,172,255	839,770	9,322	4,021,347	635,125	9,837	82	645,044	2,246,473	640,057	7,522	2,894,052
1843	3,795,531	476,772	23,742	4,296,045	568,470	...	4,853	573,323	2,547,934	504,638	10,760	3,063,332
1844	3,731,256	790,706	9,902	4,531,864	1,267,194	5,340	589	1,273,123	2,589,977	759,784	16,542	3,366,303
1845	4,907,679	337,778	15,405	5,260,862	158,716	...	1,621	160,337	2,579,497	614,869	14,215	3,208,581
1846	2,800,893	973,853	9,196	3,783,942	683,616	15	727	684,358	2,951,206	1,140,171	7,765	4,099,142
1847	5,716,375	1,500,251	23,403	7,240,029	411,421	198	2,946	414,565	3,079,198	1,439,165	20,646	4,539,009
1848	6,442,986	1,208,282	13,016	7,664,284	1,604,813	...	1,532	1,606,345	2,919,591	971,666	12,294	3,903,551
1849	7,805,335	507,726	15,773	8,328,834	3,398,155	3,696	530	3,402,381	3,206,746	712,502	16,364	3,935,612
1850	4,478,252	631,898	13,239	5,123,389	1,443,363	...	951	1,444,314	3,080,641	675,465	12,581	3,768,687
1851	6,773,960	602,846	16,881	7,393,687	1,543,456	5,155	2,440	1,551,051	2,978,344	640,303	14,134	3,632,781
1852	6,269,434	795,070	23,594	7,088,098	1,925,966	...	4,323	1,930,289	3,328,527	734,290	18,079	4,080,896
1853	8,283,694	413,207	29,082	8,725,983	2,736,827	...	3,142	2,739,969	3,997,198	707,142	15,128	4,719,468
1854	5,258,367	422,360	16,772	5,697,499	1,573,077	6,180	6,230	1,585,487	4,452,529	609,694	14,339	5,076,562
1855	7,376,053	506,128	25,657	7,907,838	1,470,725	18,040	2,232	1,490,997	4,383,023	1,116,304	23,344	5,522,671
1856	7,343,475	826,112	34,007	8,203,594	4,935,262	33,547	5,703	4,974,512	3,634,135	963,984	27,138	4,625,257
1857	7,256,045	828,688	30,242	8,114,975	2,464,961	...	8,740	2,473,701	2,647,470	983,136	28,639	3,659,245
1858	10,338,404	792,060	36,064	11,166,528	3,568,642	361	2,574	3,571,577	2,860,034	968,912	29,393	3,858,339
1859	6,006,759	981,792	25,904	7,014,455	2,819,248	224	3,819	2,823,291	3,013,858	1,137,584	25,330	4,176,772

Table No. 3, Showing the Quantity of Cocoa Imported into the United Kingdom Annually, Distinguishing that from the British Possessions, and Foreign Parts, since 1831.

Years.	BRITISH POSSESSIONS.										FOREIGN COUNTRIES.							Grand Total Imports.
	Trinidad.	Grenada.	Barbados.†	St. Lucia.	St. Vincent.	Dominica.	All other B. W. India Islands.	Demerara and Berbice.	Other British Colonies.	Total.	Brazil.	Chili.	Ecuador.	New Grenada.	Venezuela.	Other * Foreign Countries.	Total.	
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1831	1 057,990	368,882	2,554	42,380	6,043	7,414	6,684	...	...	1,491,947	1,716,614	37,130		206,234		31,193	1,991,171	3,483,118
1832	415,039	196,195	2,468	...	242	...	4,049	97	...	618,090	2,198,709	75,445		10,197		68,578	2,352,929	2,971,019
1833	1,760,258	312,446	8,403	28,622	2,713	8,808	2,355	2,051	...	2,125,656	2,402,803	...		...		80,259	2,483,062	4,008,718
1834	999,816	349,367	72	...	4,279	4,767	1,938	86	401	1,360,726	1,591,600	16,061		110		16,397	1,624,168	2,984,894
1835	160,617	276,359	77	...	272	685	1,311	126	...	439,447	1,678,769	103		108		329	1,679,309	2,118,756
1836	1,292,595	307,236	4	5,036	1,350	279	4,208	1,121	...	1,611,829	183,526	...		859,521		133,348	1,176,395	2,788,224
1837	1,461,976	351,613	7,155	10,686	2,525	1,896	10,772	522	...	1,847,145	356,458	...		344,659		304,738	1,005,855	2,853,000
1838	1,678,913	428,626	2,652	16,225	3,191	1,054	20,976	...	...	2,149,637	201,780	396,290		1,053,626		295,076	1,946,772	4,096,409
1839	629,945	327,497	6	35	760	1,127	213	58	...	955,641	186,465	...		375,184		133,376	695,025	1,654,666
1840	2,007,494	239,680	31,016	51,479	6,442	2,366	3,448	2,376	48	2,374,349	67,382	22,059		1,035,956		...	1,125,397	3,499,746
1841	2,493,302	372,008	...	49,086	1,758	4,014	1	129	7	2,920,305	269,794	...		1,802,547		22,035	2,094,376	5,014,681
1842	2,183,798	280,679	35,054	8,637	1,736	667	8,642	98	...	2,499,311	185,756	...		441,059		46,129	672,944	3,172,255
1843	1,099,975	296,269	18,476	2,818	55,867	4,614	18,929	4,178	12	1,501,138	1,033,388	28		1,229,487		31,510	2,294,393	3,795,531
1844	2,526,702	544,253	2	17,242	8,316	1,746	11,099	10,209	201	3,119,770	580,501	...		15,796		15,189	611,486	3,731,256
1845	2,960,215	342,092	6,422	30,979	6,150	5,444	...	...	...	3,351,602	1,543,196	...		5,639		7,242	1,556,077	4,907,679
1846	1,370,691	353,663	40	2,010	3,630	6,782	2,143	...	...	1,738,959	997,186	...	...	950	3,100	60,698	1,061,934	2,800,893
1847	2,584,514	299,802	35,923	15,428	73,187	17,672	...	...	2,086	3,028,612	1,013,971	95,702	725,997	741	1,619	849,733	2,687,763	5,716,375
1848	2,077,474	464,703	19,006	16,917	11,955	12,247	63	113	7	2,602,485	1,265,605	1,289,890	1,169,347	34,035	878	80,719	3,840,501	6,442,986
1849	2,715,604	424,743	56	7,928	3,959	6,892	1	...	...	3,159,183	1,391,162	1,059,000	2,144,811	..	488	50,691	4,646,152	7,805,335
1850	1,345,284	609,954	3,222	1,372	8,642	19,071	194	21	837	1,988,597	1,204,572	1,231,773	...	...	4,438	48,872	2,489,655	4,478,252
1851	3,812,361	419,309	30,435	15,986	42,572	7,823	4,798	15,020	747	4,349,051	1,949,666	70,665	324,532	2,763	1,405	75,878	2,424,909	6,773,960
1852	3,293,626	604,299	17,722	9,428	5,287	6,232	...	1,857	2,106	3,940,657	2,244,713	...	...	179	8,191	75,794	2,328,877	6,269,434
1853	4,305,411	583,783	58,610	21,455	9,880	11,977	...	2,143	...	4,993,259	2,114,400	293,907	506,233	18,790	...	357,105	3,290,435	8,283,694
1854	2,042,617	607,887	77,894	5,913	14,034	...	1,261	43	177	2,749,826	1,367,051	...	186,939	...	...	954,551	2,508,541	5,258,367
1855	3,874,716	783,417	39,411	63,906	20,489	12,461	64	...	107	4,794,571	656,273	...	1,802,347	...	...	122,962	2,581,482	7,376,053
1856	3,274,466	796,499	119,670	111,291	13,587	37,284	10	23	...	4,352,830	349,808	396,194	1,762,742	...	...	481,901	2,990,645	7,343,475
1857	2,613,605	949,865	33,301	193,831	19,214	36,634	635	55,036	10	3,932,131	925,689	125,958	968,513	...	...	1,303,754	3,323,914	7,256,045
1858	2,905,795	1,249,544	5,372	130,197	17,006	82,480	22,751	55,522	299	4,468,966	776,363	156,565	3,849,230	342,038	...	745,242	5,869,438	10,338,404
1859	3,133,739	833,079	14,632	110,775	4,221	107,832	6,907	...	...	4,211,185	1,027,614	...	...	73,599	91	694,270	1,795,574	6,006,759

* The quantities shown as impor ted from "Other Foreign Countries" are principally made up of indirect Imports from Continental Europe.

† The quantities shown as Imported from "Barbados" are principally the produce of Grenada and St. Vincent.

Table No. 4, Showing the Annual Average Prices in London of Cocoa, Tea, and Coffee: the Rates of Duty Imposed, and Amount of Revenue Collected upon Each, since 1820.

Years.	Cocoa. Price. Per cwt.	Cocoa. Price. Per lb.	Cocoa. Rate of Duty. British.	Cocoa. Rate of Duty. Foreign.	Cocoa. Rate of Duty. Cocoa Husks.	Cocoa. Rate of Duty. Chocolate and Cocoa Paste.	Cocoa. Amount of Revenue.	Tea. Price. Per cwt.	Tea. Price. Per lb.	Tea. Rate of Duty.	Tea. Excise Levy.	Tea. Amount of Revenue.	Coffee. Price. Per cwt.	Coffee. Price. Per lb.	Coffee. Rate of Duty. British.	Coffee. Rate of Duty. Foreign.	Coffee. Amount of Revenue.
	s. d.	s. d.	per lb.	per lb.	per lb.	Per lb.	£	s. d.	s. d.			£	s. d.	s. d.	per lb.	per lb.	£
1820	...	...	E.I. 1s. 6d. other 1s.	E.I. 1s. 6d. other 2s. 6d.	Prohibited in Great Britain, but admitted into Ireland at 20 per cent. ad. val.	Prohibited.	14,339	...	...	Duties repealed.		3,484,226	...	...	E.I. 1s. 6d., other 1s.	E.I. 1s. 6d. other 2s. 6d.	342,828
1821	...	...	... ...			...	15,140	...	...			3,707,270	...	...	... ...	... ...	384,283
1822	...	...	... ...	...		...	14,031	...	...	...		3,941,484	..	...	... ...	... ...	387,342
1823	...	...	... ...	...	4d.	1s. 9d.	15,521	...	...	...		3,848,122	...	...	... ...	... ...	428,613
1824	220 0	1 11½	... ...	...	...	...	21,077	616 0	5 6	...	96 per cent. when under 2s. per lb., 100 per cent. when over that	3,865,477	232 0	2 0¾	... ...	... ...	420,988
1825	205 0	1 10	E.I. 9d., other 6d.	E.I. 9d., other 1s. 3d.	2d.	B. P. 1s. 9d.; Foreign, 4s. 4d.	14,295	616 0	5 6	Bohea 1s. 6d. Congou, Twankey, &c., 2s. 2d. Souchong Hyson, &c., 3s.		4,031,018	158 0	1 5	E.I. 9d., other 6d.	E.I. 9d., other 1s. 3d.	315,809
1826	172 3	1 6½	... ...		...		12,387	616 0	5 6			3,738,042	156 0	1 4¾	... ...	... ...	336,570
1827	133 6	1 2¼	... ...	...	...	...	13,237	532 0	4 9			3,705,588	151 0	1 4	... ...	... ...	399,690
1828	126 6	1 1½	... ...	...	...	...	11,556	532 0	4 9			3,177,179	136 0	1 2½	... ...	... ...	440,245
1829	119 6	1 0¾	.. ...	...	...	...	11,943	522 8	4 8			3,321,722	132 0	1 2	... ...	... ..	484,975
1830	89 0	0 9½	... ...	...	...	...	13,622	494 8	4 5			3,387,097	134 0	1 2½	... ...	... ...	579,363
1831	114 0	1 0¼	... ...	...	...	...	15,329	504 0	4 6			3,344,918	134 0	1 2¼	... ...	... ...	583,751
1832	82 6	0 8¾	All kinds 2d.	All kinds 6d.	1d.	B.P. 4d., For. 4s. 4d.	16,902	504 0	4 6			3,509 835	156 0	1 4¾	... ...	... ...	589,858
1833	77 11	0 8¼	...	...	...	...	12,026	504 0	4 6			3,444,102	140 0	1 3	... ...	... ...	591,241
1834	67 6	0 7½	...	...	...	...	11,779	504 0	4 6		Repealed.	3,589,361	168 0	1 6	... ...	... ...	614,434
1835	65 0	0 7	...	...	...	...	10,692	504 0	4 6		...	3,832,427	181 0	1 7½	E.I. 6d., other 6d.	E.I. 9d., other 1s. 3d.	652,124
1836	68 6	0 7½	...	..	...	...	11,165	448 0	4 0	All 2s. 1d.	...	4,674,535	145 0	1 3½	... ...	... ...	691,616
1837	68 6	0 7½	...	...	...	...	13,922	448 0	4 0	...	...	3,223,840	138 6	1 3	... ...	... ...	696,645
1838	68 0	0 7¼	...	...	...	...	15,285	448 0	4 0	...	...	3,362,635	153 0	1 4½	E.I. 1s., other 6d.	E.I. 9d., other 1s. 3d.	685,082
1839	64 6	0 7	...	...	...	B.P. 4d., For. 1s. 4d.	15,703	448 0	4 0	...	...	3,658,803	162 0	1 5½	... ...	... ...	779,115
1840	64 6	0 7	...	...	...	...	20,944	560 0	5 0	...	...	3,472,864	158 6	1 5	... ...	... ...	921,551
1841	69 6	0 7½	...	...	...	...	19,596	560 0	5 0	...	...	3,973,668	148 6	1 4	... ...	... ...	887,747
1842	59 6	0 6½	All kinds 1d.	All kinds 4d.	B. P. ½d., other 1d.	B.P. 2d., For. 6d.	16,437	560 0	5 0	...	...	4,088,957	121 4	1 1	All kinds 4d.	All kinds 8d.	768,886
1843	44 0	0 4¾	...	...	...	...	13,621	448 0	4 0	...	...	4,407,642	105 10	0 11½	...	...	697,376
1844	54 6	0 5¾	All kinds 1d.	All kinds 2d.	...	...	15,172	392 0	3 6	...	...	4,524,193	157 4	1 5	...	All kinds 6d.	681,616
1845	54 0	0 5¾	...	...	...	...	14,387	448 0	4 0	...	...	4,833,353	154 4	1 4½	...	...	717,871
1846	55 0	0 6	...	...	...	...	18,276	392 0	3 6	...	...	5,112,005	144 10	1 3½	...	...	756,838
1847	57 0	0 6	...	...	...	...	21,421	392 0	3 6	...	...	5,066,494	135 4	1 2½	...	...	746,436
1848	57 0	0 6	...	...	...	...	18,329	392 0	3 6	...	...	5,329,992	136 0	1 2½	...	...	709,632
1849	53 6	0 5¾	...	...	...	...	20,101	392 0	3 6	...	...	5,471,422	123 0	1 1	...	...	642,520
1850	57 2	0 6	All kinds $1\frac{1}{10}$d.	All $2\frac{1}{10}$d.	B.P. $2\frac{21}{40}$d. other $1\frac{1}{20}$d	B.P. $2\frac{1}{10}$d., For. $6\frac{3}{10}$d.	19,317	392 0	3 6	2s. 2½d.	...	5,596,961	98 0	0 10½	Raw 4½d., Roasted 5d.	Raw $6\frac{3}{10}$d. Roasted 8d.	565,659
1851	60 1	0 6⅛	...	...	...	...	18,911	392 0	3 6	...	...	5,900,625	81 0	0 8¾	... 3d. ... 6d.	... 3d. ... 6d.	444,670
1852	53 9	0 5¾	...	...	...	...	18,943	392 0	3 6	...	...	5,984,172	79 0	0 8½	... ...	... ...	437,229
1853	56 9	0 6	All kinds 1d.	All inds 1d.	All kinds ½d.	All kinds 2d.	19,947	392 0	3 6	1s. 10d.	...	5,686,193	93 0	0 10	All kinds 4d.	All kinds 4d.	462,397
1854	49 3	0 5½	...	...	...	...	20,408	350 0	3 1½	...	...	4,781,899	93 0	0 10	...	...	467,018
1855	47 1	0 5	...	...	2s. per cwt.	...	20,188	336 0	3 0	1s. 9d.	...	5,312,197	96 0	0 10¼	Raw 4d., Roasted 5d.	Raw 4d., Roasted 5d.	546,264
1856	76 0	0 8¼	...	...	...	...	16,765	336 0	3 0	...	...	5,538,242	98 0	0 10½	... ...	... ...	584,517
1857	88 0	0 9½	...	...	...	...	12,671	333 8	2 11¾	1s. 5d.	...	5,060,032	93 0	0 10	Raw 3d., Roasted 4d.	Raw 3d., Roasted 4d.	454,727
1858	68 3	0 7¼	...	...	...	...	13,906	322 0	2 10½	...	...	5,186,170	87 0	0 9¼	... ...	... ...	440,475
1859	59 9	0 6¾	...	...	...	...	15,732	329 0	2 11¼	...	...	5,407,189	94 0	0 10	... ...	... ...	431,359

The prices given are of "Raw Grenada Cocoa" delivered to Greenwich Hospital—of "Congou Tea," also delivered to Greenwich Hospital—and of "Fine Raw Jamaica Coffee" in the London Market, with the Duties in every case included.

I have more sympathy with the cocoa than the coffee planters, but believing as I do that cocoa is a more valuable and nutritious food, I would gladly see it take more firm root, and be more generally consumed, particularly by the working or waged classes in this country, as well as placed within the reach of the poor.

The Statistical Tables appended to the paper will furnish the data from which the progress of the trade may be regarded more in detail:—

Table No. 1 shows the quantity of tea, coffee, and cocoa, annually imported, exported, and consumed in the United Kingdom since 1820.

Table No. 2 furnishes in detail the quantity of cocoa, husks and shells, and chocolate and cocoa paste, annually imported, re-exported, and consumed in the United Kingdom, since 1820.

Table No. 3 shows the quantities of cocoa annually imported into the United Kingdom from each of the producing countries since 1831;

And Table No. 4 shows the annual average price of tea, coffee, and cocoa; the rates and duty imposed, and revenue collected on each since 1820.

THE TRADE IN CHEAP CLOCKS—GERMAN AND AMERICAN.

The Dutch were the pioneers in cheap clock-making; their phlegmatic disposition appears to have harmonised admirably with a manufacture the principle requisite in which was care and attention. To them we are indebted for the timber clock, with that marvellous appendage the cuckoo, which issued forth exactly at the hour, and uttered its cry in number of times corresponding to the hour. Five scores of tons weight of German clocks are imported into this country annually. They are brought from Germany into France by the Strasburg Railway, and are shipped at Havre, being conveyed across the channel by the South-Western Steam Packet Company's boats to Southampton. In 1858, the total number imported was 228,417 under the value of 12s. 6d. each, and 19,211 above that value.

Of the former (the low-priced ones), 102,937 came from the United States, and 660 of the higher priced ones. The rest were received chiefly from Holland and France. The aggregate value of these clocks was £134,483. These imports were for sale here, and exclusive of those shipped to foreign ports.

The American metal clocks have, with their stamped wheels, taken the shine most effectually out of those formed from timber. Clock-making has, in truth, dwindled down from an art to a manufacture; the pride of the workman is prostrated before the machine; pinion wire is drawn, the teeth of the wheels are rounded, the side plates perforated by machinery; in truth, everything is so reduced to a manufacture that the minimum of price is counterbalanced by the same amount of skill. Even at home a respectable clock movement may be purchased for 20s.

Forty-five years ago a plain man, of few words but great mechanical ingenuity, purchased an old grist mill in Plymouth, at the south-eastern extremity of Litchfield county, Connecticut, and converted it into a wooden clock factory. Wooden clocks had indeed been made long before that time. They were, however, few in number and sold at enormous prices. It was even said that the parts of some of those which were first made were cut out with the penknife. Thirty years ago, Chauncey Jerome, of Plymouth, a young man of enterprise, engaged in the business. It is said by some that he made his first clock by the hand. The price of clocks had indeed somewhat fallen before he commenced business, but only a little way. It was reserved for this gentleman to reduce it to three or four dollars. Mr. Jerome removed from Plymouth to Bristol nearly 30 years ago, where he remained till nine years ago, when he removed to New Haven, where he still resides. The entire number of operatives now dependent upon his (Mr. Jerome's) enterprise is something more than 260; to whom about 10,000 dollars are paid monthly. Looking at a single clock, it would seem that not a very large quantity of material would be necessary to the manufacture of many thousands of them. Yet a million and a half feet of pine lumber, more than a third of a million of mahogany and rose wood veneers, two hundred thousand pounds of rolled and cast brass, two hundred barrels of glue, and a hundred more of varnish, two thousands boxes of glass, three hundred casks of nails, and other necessary materials in proportion, will give some idea of the immense business done by this single establishment.

A further estimate of the extent to which clock making is carried on in the State of Connecticut, may be formed from the fact that, in the town of Bristol alone, a capital of 300,000 dols. is invested in the manufacture of clocks. The number of this description of time-pieces annually finished is 150,000. 100,000 samples of inside work, in addition, are turned out, and sent to other factories for completion; that is, to be supplied with cases and other external embellishments. Between 300 and 400 hands are employed in the different establishments, besides a large number of females, who do the ornamental part of the work, such as painting, &c. Other flourishing factories exist in various parts of the State, equally worthy of notice, particularly at Terryville, Plymouth, and Litchfield. In Connecticut good time-pieces, with brass works, made by machinery, are sold for sixty cents. wholesale, and for one dollar retail. Mr. Jerome, at Newhaven, can turn out 800 per day.

In the early part of the present century this species of time-keeper was first introduced in America. Rapidly superseding the tall Dutch and English clocks, not more by their cheapness than by their greater beauty and convenience, they soon penetrated the remotest settlements of the South and West, astonishing all by their cheapness, and charming all by their beauty and accuracy of performance. It is but a few years since American clocks first attracted the attention of merchants and shippers as articles of export to foreign countries, yet, now large quantities are regularly exported to the British North American Provinces, to Europe, to South America, the East and West Indies, to Australia, to Constantinople, and the various ports of the Mediterranean, to the Cape of Good Hope, to China, &c. In the year 1857, 1,000 packages of clocks, valued at £2,000, was imported into Hamburg from the United States. In short, they are now sold in nearly all the great markets of the world, wherever commercial enterprise carries the constantly increasing manufactures of the United States. Every newly settled region, and every new market opened to American commerce, are sure to create fresh demands for clocks of every description. There has been for the last year or two a constantly increasing foreign demand for these articles.

The large and rapidly increasing manufacture of this article in America is evident from the following additional statistics of the trade to those already given:—In Connecticut there are seven manufactories, employing 1,300 persons, and producing annually 800,000 wooden clocks; in Bristol, 14 manufactories with 400 persons, making 200,000 clocks; Plymouth has three manufactories, with 175 workmen, turning out 75,000 clocks; at Ausonio are two manufactories, with 140 persons employed, who make annually 102,000 clocks; at Winshotrad, one manufactory, with 40 persons, 30,000 clocks; at Southampton, two manufactories, with 45 workmen, producing 40,000 clocks, and, lastly, at Newhaven there are three manufactories employing 400 persons, and making 370,000 clocks, so that in the seven above-mentioned places, there are 32 manufactories, employing 2,500 workmen, and producing 1,617,000 wooden clocks.

Mr. Whitworth, in his Report on American Manufactures, observes:—"The celebrity attained by New Eng-

land in the manufacture of clocks, gave a peculiar interest to a visit to one of the oldest manufactories of Connecticut; 250 men were employed, and the clocks made at the rate of 600 per day, and at a price varying from one dollar to ten dollars, the average price being ten dollars. The frames of the clocks are stamped out of sheet brass, and all the holes are punched simultaneously by a series of punches fixed at the required distances. The wheels also are stamped out of sheet brass, and a round bedding is raised by a press round their rims, for the purpose of giving them lateral strength. They are cut by a machine having three horizontal axes, carrying each a cutter placed about four inches apart. The first cutter is simply a saw, and the second rounds off the teeth. In cutting an escapement wheel, the first cutter is made to cut each tooth entirely round, and then either the second or third axis with its cutter is used for finishing. The pulleys on the three axes are driven by one driving pulley with three straps working over and in contact with each other. The plates forming the clock faces, and other discs, are cut by circular shears. The beaded rims intended to go round the clock faces, varying in size from fifteen inches downwards, are stamped in concentric rings out of a disc, and then made of the required form by means of dies and a stamping press. The ogee form given to the wooden framing of the common clock, is formed by a revolving cutter of the required shape, making 7,000 revolutions per minute, over which the piece of wood is passed by hand—the requisite pressure downwards being given at the same time. Each clock passes through about sixty different hands; more than one-half of the clocks manufactured are exported to England, and of these a large portion are re-exported to other markets."

It is worthy of remark that the superiority obtained in this particular manufacture is not owing to any local advantages; on the contrary, labour and material are more expensive than in the countries to which the exports are made; it is to be ascribed solely to the enterprise and energy of the manufacturer, and his judicious employment of machinery.

There is one quality of American clocks for which they are entitled to greater credit than is generally known, and that is the small weights or moving force which they require, showing that there is much less power wasted by friction and the motion of the train than in most other clocks. The small amount of motion is caused by the tightness of the wheels, and the small friction is accounted for by the use of lantern pinions, which (when driven by the wheels) have much less friction than leaved pinions of such low numbers, are less liable to be clogged with dust, and are also less affected by the wheel-teeth being inaccurately cut, as they generally are in clocks of much greater pretensions than these.

The manufacture has been transferred by degrees from the mountains of Wurtemburg to the plains of America by the numerous emigrants annually leaving Germany, and it must be confessed that they make them now in America—probably from the greater facilities afforded them in the choice of the wood and other materials—in a much more creditable and workmanlike manner than they were done in their native country.

The Americans, in former years, used to send a large quantity of these wooden clocks to England for exportation to Australia and other British colonies, but now the Germans in the States are able not only to beat them out of that field, but to compete successfully with their own German countrymen in the home market of their fatherland.

The clocks made in the Black Forest have long been known and appreciated, as much for their cheapness as for their excellent construction, in every country where clocks are made use of. This trade employed in 1855 no less than 1,570 master workmen, and three times that number of common workmen. This industry owes its flourishing condition to a well-regulated division of labour and to the honesty and perseverance of those children of the forest, who, in all parts of the globe, are engaged in selling the handiwork of their ingenious and laborious compatriots. The districts of Neustadt, Tuyberg, and Homburg, are the principal seats of this trade; and the cause which renders it so valuable to those engaged in it, is the little capital which is required in consequence of the well organised state of the commerce. The total annual value of the clocks sold exceeds £1,000,000.

The Government, on its part, has established a model school for clock making at Furtwargen, under the control of a special overseer.

With all their ingenuity and industry the Chinese appear to employ themselves but little in the art of clock-making; and it may be safely declared, that Geneva turns out more time-keepers in a year than are produced in the whole of the Celestial Empire. In the large city of Nankin, there are not more than 40 clock-makers; Su-chew has thirty, and Ning-po not more than seven; while, until recently, the value of the clocks and watches imported into China from Europe amounted to about half a million dollars yearly. It is said that the number of clocks really manufactured in the country in a twelvemonth does not exceed 1,500—a fact the more remarkable when contrasted with the state of the case in other countries. The watch and clock makers in London, including those who manufacture portions of the mechanism only, amount to more than 1,500; and, as is well-known, the enterprising horologists of New England make and export clocks every year by tens of thousands. These latter, with that keen spirit of trade which characterises them, have lately been turning their attention to China as a profitable market for their handicraft; and a request was despatched some time since from the United States' Patent Office, to such American citizens as were resident in the flowery land, for any information that might promise to benefit the branch of industry in question.

From one of the replies which this "request" elicited, we gather that the Chinese have always been too deficient in their acquaintance with astronomy and mathematics to construct proper sun-dials; and that their knowledge of these instruments was obtained from Europeans; while hour glasses are known only as a contrivance "employed in Western countries to measure time." Many Celestial gentlemen make it a *sine qua non* to carry two watches; among these, specimens of very ancient workmanship are sometimes met with, as rotund as "Nuremberg eggs," and the wearers are too often anxious to make the pair go well together. The trouble they gave in consequence, in former days, to some of the Jesuit Fathers who were skilled in clock-making, will be found mentioned in the *Lettres Edifiantes et Curieuses.*

A Chinese day comprises twelve periods, each equivalent to two hours, and they are represented by twelve characters on the clock-face, being those used also to designate the months. 'The first in the list (meaning Son) is employed at the commencement of every cycle, and to the first of every period of twelve years, and also to the commencement of the civil day—at eleven P.M.—comprehending the period between this and one A.M. The month which is signified by this term is not the first of the Chinese year, but singularly enough coincides with January. Each of the twelve hours is divided into eight *kih*, corresponding to quarter-hours. This diurnal division of time does not appear to have been in use in the time of Confucius, as mention is made in the spring and autumn annals of the *ten* hours of the day.'

The writer whose remarks we quote, recommends his countrymen, in manufacturing clocks for the Chinese, to adopt the clock-face commonly used in China with some improvements, one of which would be to surround the twelve 'horary characters' with a ring of numerals from one to twenty-four, every alternate one of which would be opposite the half hour of our time, and to continue the use of the four signs which now stand near the centre of the face to indicate midnight, dawn, noon, and evening. The pendulum is to vibrate seconds; the minute-hand to

make half a revolution at every sixty seconds; and the hour-hand is to go but once round the face in the whole diurnal period. As the result of this arrangement—'At one o'clock P.M., our reckoning, the hour-hand will be half-way between the large character at the top and the next one to the right; and the minute-hand having made half a revolution, will point perpendicularly downwards, and the clock strike one. At the expiration of another of our hours, a whole Chinese hour will have expired, when the former hand will have reached the first large character to the right, and the latter will be directed to the zenith—the clock striking two.' The minute-hand is, therefore, to make twelve revolutions in the twenty-four hours.

The clocks are to be constructed with lines and weights, as those with springs are not liked in China; and as a Celestial always likes to see what he is buying, it is suggested that the works be made as visible as possible, and of good quality, to avoid the loss that would be sure to follow attempts to palm off clocks made to sell merely. To gratify the Chinese wish for utility, the lower part of the door is to contain a looking-glass, or if not this, something very ornamental; and inside, instructions in the native character for fixing, winding, regulating, &c. Such clocks as are here described can be manufactured in Connecticut for two dollars and a half each; and as they can be sold in China at from five to six dollars each, we may shortly expect to see a great and profitable trade in American-time keepers between the two countries.

P. L. S.

WARMINSTER CONFERENCE ON ADULT EDUCATION.

The three next numbers of this journal will contain a copious report of the Dean of Chichester's speech, and of the papers read, at the Conference of the Southern Counties Adult Education Society, at Warminster, on the 2nd and 3rd inst.

Proceedings of Institutions.

Glasgow Athenæum.—The public opening of the Class Session took place in the large hall of the Institution, October 18, Sheriff Strathern in the chair. On the platform were Principal Barclay, Councillor Binnie, James Craig, Esq., of Middleton, M. Provan, Esq., and the directors and teachers of the Institution. Mr. Provan read the report. It stated that the total number of persons who presented themselves at the preliminary examination by the Glasgow Board was 40; of these 39 passed. Three did not come forward at the final examination, leaving 36 who did, and 31 received 42 certificates. One gained the 1st prize of £5 in English history; and in respect of this, £5 was awarded to the Athenæum. There were 9 first-class, 14 second-class, and 19 third-class certificates. It will be observed that eight students have carried off no fewer than nineteen certificates. One of the candidates has obtained two first-class and one second-class certificate—an amount of honours which, it is believed, has not been won by any of the students in the United Kingdom. The ratio of successful students, compared with the whole number attending the Athenæum classes, has been ascertained to be the highest of any of the Glasgow Institutions—not only so, but the subjects for which these certificates have been awarded, comprise a greater variety than has been exhibited by any other local institution. Mr. Provan added that Glasgow had attained a position in this scheme which had attracted attention at head-quarters. To Principal Barclay and Dr. Hetherington the Athenæum had been very much indebted for the assistance they had rendered it.—Sheriff Strathern said the effect of the ever-progressive condition of the country had been to drag education along with it; and the state of society would have been singular if improvement in education had not been conspicuous as in any other human pursuit. It was satisfactory to know, that the progress of recent legislation had rendered it in a great degree compulsory on workmen in more than one industrial calling, to acquire some learning by making it the condition of employment. It was not many years ago that the generality of agricultural labourers, and very many city artisans, were unable to write even their names; less generally, but still to a considerable extent, they were unable to read. This state of matters was not found to so great an extent, perhaps, in Scotland as in the sister kingdoms; for the parochial school system with the Scotch distinguished their peasantry, and from among them rose philosophers, divines, lawyers, and poets of the very first rank. Yet that much ignorance prevailed was a fact attributable, in all likelihood, as much to the distraction in public affairs, caused by long foreign wars, as from apathy on the part of the people themselves. But the working man was privileged to enjoy the intellectual pleasures of learning—he can appreciate the privations of his ignorant predecessors, who were shut out from so many real delights. The altered and improved condition of the working classes was especially remarkable during the Russian war. Our soldiery, recruited from these very classes, to their honour be it told, in the letters which they themselves wrote and despatched from camp, gave, in many instances, indications of a sound education. But how different the soldiery of the Peninsula! Early enlisted, thrown immediately among the vast swarm of combatants in Spain, with the neglected opportunities of acquiring education in boyhood passed away—few of these gallant men who so long and gloriously maintained their country's honour, were able, without assistance, to hold communication with distant friends. The regimental schoolmaster, or some comrade having exceptional advantages, was appealed to to pen the letter so much prized by loved ones at home. Seldom, however, could the genuine expressions of the heart find vent in the borrowed pen, and so the bitter thought, that opportunity had never occurred or was lost, might arise to trouble the brave soul, who sought to recount his exploits or to confess his sorrows to the willing eyes of longing relations. In Glasgow, which during the past year had become so prominent in raising an unequalled mass of citizen soldiers, the bulk of whom were workmen, it was his privilege as a magistrate to administer the oath of allegiance to several artisan companies. The oath was signed by nearly all the men—the exception was a volunteer who could not; and he (the Sheriff) remembered well one company, comprising upwards of a hundred men, who subscribed the oath without any exception. It was incidents such as those which furnished practical tests of the progress of education. But if there was one circumstance more remarkable than another in showing what he now advanced, it was the pleasing and most important one, that from the labouring classes, places of trust, of management, of superintendence—requiring intelligence, integrity, and education—are being filled. Our public works and factories would furnish abundant evidence of the fact, and the growing thirst among the working classes for education and information still further attested it. The advent of cheap literature, about 25 years ago, might have paved the way for this desirable consummation, but he was persuaded its realisation had been mainly attributable to the establishment of mechanics' and other similar institutes throughout the country. Nor did this important phase in the character of the working population stand alone. Among the industrious of the middle ranks has a similar transitional improvement been noted. The youth of the country, destined for commercial life, had been stimulated to stretch beyond the acquisition of mere rudimentary mercantile rules, and sought a higher and still more intellectual flight in the prosecution of their studies. The metropolitan Society of Arts had done much, especially of late years, to encourage and foster this turn in commercial training, but

the immediate cause he believed to be the facilities furnished by the numerous educational establishments and societies with which our large cities abounded. Nowhere had this happened more strikingly than in Glasgow; nor more successfully than in the Glasgow Athenæum. The thirteenth session of this Institution had opened, and from the first it took sure ground for maintaining its prosperity. Formed at a time when no institute precisely like it existed in Glasgow, it offered opportunities for the middle-class youth to obtain solid instruction and agreeable relaxation. Nor did the prospectus limit the student to accomplishments merely of a business kind; there were placed within his reach elegant and elevating studies—from the hours devoted to graver, he had the means of turning to politer branches of education. From the profundity of mathematical demonstration, he might divert the mind to music, engage in literary controversy, or the quiet of the reading room or library. Possessing so much resource, the fault could never be charged to the Institution, but to the public, if it was not largely supported and its influence more widely spread. The reports of the past years showed the continuing usefulness of the Athenæum; its annual meetings had been honoured and dignified by the eminent and influential of the city; and the noble and great of the land had been numbered among the lecturers. It was one of the very few institutions in Scotland which formed an alliance with the Society of Arts of London. From that connection much good had already arisen, and the programme for the present session, containing also the results of the last, left no room to doubt the permanency of its benefits. The system of examinations prescribed guaranteed the value of its training; no student could pass if he was superficially taught, and the number who had achieved distinction during the past session incontestibly established the solid character of the tuition and the skill of the teachers. The competitive plan for stimulating study had been most successfully followed by the Society of Arts, and the prizes and certificates which it distributed were not earned by the slothful or careless. Such testimonials were the honourable tributes to assiduous study, and could be purchased by that toil which alone could bring knowledge. These considerations gave worth to such certificates, intrinsically, for to a dunce they had no value,—but to the industrious and zealous such certificates were above estimate. The success of the Athenæum in the last session had been very marked indeed, the success of the Scotch students generally had been very great. About 500 certificates in all had been awarded to students in England, Ireland, and Scotland. Of these, 110 had been assigned to Scotch, and the remainder to English and Irish students. Having regard to the population of the kingdoms, the proportion coming to this side of the Border was very great; but when it was seen that the 110 certificates had been won by students from the Athenæum, Mechanics' Institution, and the Glasgow Institution in Glasgow, and one society in Aberdeen, it would be seen how distinguished had been the success. The Athenæum and Mechanics' Institute in Glasgow had carried off two-thirds of the whole. The Society of Arts, besides the honorary certificates, distributed £60 in £5 prizes, and of this sum students in the three Glasgow societies had won six, or exactly one-half. The remaining prizes had been awarded to English students. It was creditable to the Athenæum that one of her students had been signalised, not only for gaining one of the money prizes, but he had also earned separate honorary certificates. These successes had entitled the Athenæum itself to a prize. Such was the result of the late competition, and the Athenæum had reason to be proud of her position. To those who had struggled and had not succeeded he said "Persevere; be assured, if you do, you will arrive at honours as well as those who are now to receive their rewards. Never yield to discouragement; be industrious. That is the secret of after triumph. Remember the hopeful motto, '*Et mea messis erit.*'" Let the successful bear their honours meekly, and remember this, that it is a sure indication of a great mind that he is not elated overmuch with victory, nor depressed overmuch with defeat." The prizes were then distributed to the successful students, after which, Mr. John Clark, one of the students, presented Mr. Provan, in the name of the pupils and of the teachers, with a handsome ring, as a recognition of the labours he had been called on to undergo in his capacity of Secretary to the Local Board.—Mr. Richardson also followed up Mr. Clark's observations.—Mr. Provan having suitably acknowledged the gift,—Principal Barclay, in a few remarks, moved that the Athenæum classes were deserving of the support of the commercial young men of Glasgow.—Mr. Rait seconded the motion, which was carried unanimously.—A vote of thanks to the Chairman terminated the proceedings.

MEETINGS FOR THE ENSUING WEEK.

Mon.....Medical, 8½. Dr. H. Hyde Salter, "On the Nature and Cause of the Respiratory Murmur."
Thurs....Linnæan, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 19th*, 1860.]

Dated 31st July, 1860.

1854. A. Dixon, Birmingham—Imp. in knife-cleaning machines.

Dated 13th September, 1860.

2210. A. Ransford, Manchester—Imp. in galleries or supports for gas shades.

Dated 20th September, 1860.

2288. R. Kunstmann, Manchester—An improved apparatus for lubricating the frictional surfaces of machinery. (A com.)

Dated 22nd September, 1860.

2312. J. Tomlinson, Nottingham—Imp. in fire engines.

Dated 26th September, 1860.

2336. C. Burn, Delahay-street, Westminster—Imp. in the tram-rails of street railways, to prevent horses slipping thereon.
2338. F. W. Daehne, Swansea—Imp. in extracting copper from ores.

Dated 27th September, 1860.

2346 J. J. O. Taylor, 12, Mark-lane—An improved composition for vessels, furnaces, and other apparatus to be exposed to the operation of great heat, and the effect of fluxes, and the like.

Dated 28th September, 1860.

2352. A. F. Sheppard, 38, Moorgate-street—An improved method of and apparatus for plate printing. (A com.)
2354. J. Aspell, Middleton, Lancashire, E. Booth and J. Hurst, Tonge, near Middleton—A certain imp. in power-looms for weaving.

Dated 29th September, 1860.

2358. C. Green, Winnington, near Norwich, Chestershire—Imp. in the manufacture of salt.
2360. J. Roberts, Upnor, Kent—An improved mode of and apparatus for harvesting corn and other crops, and ventilating granaries.
2362. H. Offergeld, Eilendorf, near Aix-la-Chapelle—Imp. in drums and apparatus connected therewith, for giving motion to shafts.
2364. T. Robinson, St. Helen's, Lancashire—Imp. in machinery for packing soda ash and other matters or substances in casks and other vessels.
2365. R. Mushet, Coleford, Gloucestershire—An imp. in the manufacture of cast steel.

Dated 1st October, 1860.

2366. J. Clark, W. Pollock, and J. White, Paisley—Improved apparatus for spinning and twisting.
2368. G. Hulme, Rochdale—An imp. or imps. in the process of carding wool, cotton, silk, or other fibrous materials, and in machinery or apparatus applicable to that purpose.
2370. C. H. Hurst, Victoria-terrace, Royal-road, Kennington, H. Horsey, and G. Baker, Bridge-street, Southwark—Imp. in syphon and other taps or cocks employed for drawing off liquids.

Dated 2nd October, 1860.

2374. J. Parker, 6, Litford-road, Camberwell, Surrey—Imp. in propelling vessels by the buoyant power of steam, hot air, and vapour in combination, in rising through water.
2376. R. Whittam, Accrington, Lancashire—Imp. in pentagraph machines used for engraving metal rollers and cylinders employed in printing calicoes and other surfaces.
2378. J. T. Robinson, Bradford—Imp. in screw gill apparatus for combing wool and other fibrous materials.
2382. H. C. Rush, Spencer-road, Putney, Surrey—Imp. in fences for railway platforms.

2384. Major G. Rhodes, Albemarle-street, and J. Syme, Bishopsgate-street—Imp. in tent frames, and in rendering coverings for tent frames, and other textile fabrics, and fibres, and surfaces waterproof.
2386. J. L. Norton, 38, Belle Sauvage-yard—Imp. in apparatus used in tentering, or stretching and drying fabrics.
2388. C. Mather, Salford—Imp. in machinery for shearing and singeing fabrics.

Dated 3rd October, 1860.

2390. J. Bower and D. F. Bower, Hunslet, Yorkshire—An imp. in the manufacture of iron and cast steel.
2391. R. James, Faversham, Kent—Imp. in reaping and mowing machines.
2392. A. W. Williamson, University College, Middlesex, and L. Perkins, Francis-street, Gray's-inn-road—Imp. in steam engines.
2393. J. H. Riddell, 155, Cheapside—Imp. in boilers.
2395. R. J. Cole, 11, Pembridge-gardens, Bayswater—Imp. in ornamenting the windows of public and private vehicles.
2396. A. I. Mahon, Dublin—Imp. in screw propellers, applicable also for raising and forcing water and other liquids, and obtaining motive power from the same.
2397. J. W. Greaves, Port Madoc, Carnarvon—Imp. in slate dressing machines.
2398. W. E. Newton, 66, Chancery-lane—Imp. in lamps for burning oils, and other hydro-carbons containing an excess of carbon. (A com.)
2399. J. Robinson, Rochdale—Imp. in machinery, commonly called log frames, for sawing timber.

Dated 4th October, 1860.

2401. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in the manufacture or extraction and application of colouring matters from the products of the distillation of coal tar. (A com.)
2403. L. P. Reynaud, Paris—An improved buckle.
2405. M. Jones, Lidlington-place, Camden Town—Imp. in rifles and other fire-arms, whereby to insure greater accuracy in the use of the sights.
2407. J. Morris, Clapham, Surrey—Imp. in holdfasts and guide pulleys for the cords of Venetian blinds for windows.

Dated 5th October, 1860.

2409. C. Callebaut, 4, South-street, Finsbury—Imp. in sewing machines.
2411. W. MacNaught, Manchester—Certain imp. in steam-engines.
2415. T. Rickett, Castle Foundry, Buckingham—Imp. in locomotive engines for common roads.

Dated 6th October, 1860.

2417. R. M. Hands, Coventry—Imp. in dressing or giving lustre to silks, ribbons, and other fabrics, also to threads and yarns.
2419. W. B. Caulfield, 24, Cole Harbour, Blackwall—Slinging and raising sunken or stranded vessels.
2421. W. E. Newton, 66, Chancery-lane—Imp. in knitting machinery, and in the mode of operating the same. (A com.)
2423. J. Platt, Oldham—Imp. in machinery or apparatus for forging or shaping cranks on bars of metal.
2425. W. Yates, Bromley, Middlesex—Imp. in steam-boiler and other furnaces, and in apparatus connected therewith.

Dated 8th October, 1860.

2427. M. Paris, Hill Side, Wimbledon, Surrey—Imp. in fire-arms.
2429. D. Cope, Liverpool—Imp. in drums, kegs, casks, and like packages, and in machinery or apparatus employed in the manufacture of the same.
2431. G. H. Underwood, Manchester—Imp. in finishing and stiffening textile fabrics.
2433. J. A. Knight, 4, Symond's-inn, Chancery-lane—An improved lathe for ribbon looms. (A com.)
2435. W. E. Newton, 66, Chancery-lane—Certain imp. in springs for railroad cars, locomotives, and carriages. (A com.)
2439. W. Clark, 53, Chancery-lane—Imp. in cleaning or separating gutta-percha from extraneous matters, and in apparatus for the same. (A com.)
2441. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in railways or tramways, and in carriage wheels to be used thereon. (A com.)
2443. W. Hood, Glasgow—Imp. in ladies' trowsers, drawers, or other under clothing.

Dated 9th October, 1860.

2445. J. Edge, Bolton-le-Moors, Lancashire—Certain imp. in steam engines.
2447. G. Price, Wolverhampton—An imp. in the manufacture or construction of metallic armour for vessels of war, land defences, shields of ordnance, mantellets, &c.
2449. G. Price, Wolverhampton—An imp. in metallic targets.
2451. R. Anderson, Liverpool—Imp. in apparatus for economizing and regulating the flow and passage of fluids for flushing water-closets.
2453. R. Hands and R. M. Hands, Coventry—Imp. in lustering, stretching, and finishing silks, and other yarns or threads. (A com.)
2455. J. Stockley, Newcastle-on-Tyne—Imp. in apparatus for grinding, smoothening, and polishing plate glass.
2457. G. Bonelli, Milan, Sardinia—Imp. in electric conductors and apparatus for transmitting telegraphic despatches.
2459. A. Granger, 308, High Holborn—A better and cheaper kind of embossing press, for embossing or stamping paper, linen, or other articles.

Dated 10th October, 1860.

2461. T. Barnett, Beverley, Yorkshire—Imp. in machinery for drying grain, roots, and seeds, and for roasting coffee, cocoa, chicory, malt, and other vegetable substances.
2465. D. G. FitzGerald, Cambridge-street, Middlesex—Imp. in breech-loading fire-arms.
2467. A. Maxfield, Nottingham—Imp. in the construction of water closets and urinals, together with flushing apparatus connected therewith, which said flushing apparatus is also applicable to the watering of gardens, the cleansing of windows, or for other purposes.
2469. G. T. Bousfield, Loughborough-park, Brixton—An eraser and pencil sharpener. (A com.)
2471. T. Whitby, Millbank-street, and W. Dempsey, Great George-street, Westminster—Imp. in applying springs to railway trucks, and to railway and other carriages.

Invention with Complete Specification Filed.

2480. L. H. Rousseau, 29, Boulevart St. Martin, Paris—Certain imp. in steam engines.—11th October, 1860.

Patents Sealed.

[*From Gazette, October 19th*, 1860.]

October 17th.

744. J. S. Bell.
980. B. Lauth.
985. J. Dale and H. Caro.
988. C. F. Sebille.
994. H. A. Silver & J. Barwick.
995. W. Lukyn, sen.
996. A. Denny & E. M. Denny.
999. T. A. Hedley, and G. H. C. Hedley.
1002. J. Lewtas.
1003. E. Peyton and W. F. Batho.
1004. W. Buckwell.
1005. W. Buckwell.
1010. J. A. Philippe.
1015. A. Ritchie.
1017. E. Hillam & R. R. Wilson.
1019. E. Wilkins.
1022. E. Gatwood.
1025. E. E. Albrecht.
1027. W. Clark.
1028. J. W. Ford.
1035. C. Minasi.
1037. G. J. Parker.
1038. J. Mason, jun.
1040. X. Tarte and W. Toovey.
1101. A. Bain.
1135. J. Corbett.
1155. R. B. Boyman.
1711. W. F. Henson.
1861. J. Jackson.
1981. A. Fryer.
1991. R. Mole and F. M. Mole.
2019. H. M. Clarke.

[*From Gazette, October 23rd*, 1860.]

October 23rd.

1024. J. Stafford and B. Stafford.
1033. T. A. Claeys.
1042. J. G. West.
1051. G. F. Train.
1052. W. Buckwell.
1053. J. H. Johnson.
1056. W. J. Harvey.
1059. L. A'Aubréville.
1061. P. Thorn.
1062. G. Ager.
1063. J. Nichols.
1064. J. Bullough.
1067. H. S. Roser.
1075. T. Molineux.
1076. J. Green.
1085. G. Masure.
1093. J. H. Bennett.
1114. M. Henry.
1122. E. Hardon and J. Lee.
1124. J. Grimond.
1138. W. Evans.
1163. W. E. Newton.
1185. W. E. Newton.
1225. J. D. Dunnicliff and S. Bates.
1226. W. Geeves.
1232. A. R. Turner.
1237. W. E. Newton.
1238. W. E. Newton.
1265. J. H. Johnson.
1289. W. E. Newton.
1316. H. Moule and J. Bannehr.
2336. W. E. Newton.
1348. C. Clay.
1418. W. Spence.
1496. E. B. Webb.
1528. D. Dawson.
1995. G. Nimmo.
2011. J. Neal.
2032. W. Spence.
2089. P. Fairbairn.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 19th*, 1860.]

October 15th.

2649. J. Wright.
2651. J. Bernard.
2652. L. Arbel.
2659. J. Eastwood.
2706. A. V. Newton.

October 16th.

2662. W. Osborne.

October 17th.

2672. H. Wimball.
2673. E. Cockey, H. Cockey, and F. C. Cockey.
2695. T. Hamilton & J. Hamilton.

[*From Gazette, October 23rd*, 1860.]

October 18th.

2664. L. De Christoforis.
1667. V. Pean.

October 19th.

2684. C. Tooth and W. W. Wynne.

October 20th.

2731. A. West.
2803. C. Clay.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, October 19th*, 1860.]

October 16th.

2388. G. F. Chantrell.

[*From Gazette, October 23rd*, 1860.]

October 18th.

2399. G. L. Stocks.
2409. J. Norton.

October 20th.

2455. T. Summerfield.
2476. P. B. O'Neill.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 2, 1860.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

INTERNATIONAL EXHIBITION OF 1862.

The following additions have been made to the List of Guarantors and of the sums guaranteed since the announcement in the *Journal* for October 5 :—

*** *The name marked with an asterisk is that of a Member of the Society of Arts.*

NAMES.	AMOUNT.	REPRESENTING THE OBJECTS OF THE SOCIETY—ARTS, MANUFACTURES, AND COMMERCE.
Amount last advertised	£365,200	
*William Ladd, 11 and 12, Beak-street, Regent-street, W.	100	Commerce.
Robert Lang, Redland, Bristol	100	Arts.
Joseph White, Irishtown House, Clonmel, Ireland	100	Arts.
Robert Tubbs, 62, Harley-street, Cavendish-square, W.	100	Arts.
George Price, Cleveland Safe and Lock Works, Wolverhampton	100	Manufactures.
Charles G. Maclea, J.P., 17, Blenheim-terrace, Leeds, in addition to £100 already subscribed	100	Manufactures.
Total	£365,800	

BY ORDER, P. LE NEVE FOSTER, *Secretary.*

WARMINSTER CONFERENCE ON ADULT EDUCATION.

A Conference of the Southern Counties Adult Education Society was held at Warminster, on the 2nd and 3rd October, presided over by the Very Rev. W. F. Hook, D.D., Dean of Chichester. At the opening meeting the President said:—

I cannot open the proceedings without expressing my deep sense of the honour conferred upon me in being appointed to preside over this meeting. I am aware that I am not exactly qualified for the position. Having had some experience among my noble friends the operatives of Yorkshire, I might be of some service at a meeting in a manufacturing district, but I feel out of place in a society which carries on its proceedings chiefly among agriculturists. However, there are some general principles which are applicable to all institutions of this sort. This is a society for adult education; that is, it assists those who desire to educate themselves. In primary schools we impart education, and have often to bring it to bear on unwilling minds. With respect to adults, all that we can do is to assist those who desire to educate themselves. We can open the well of water; we cannot make them drink, but we can exhort them so to do. We have not sufficiently attended to these secondary schools—to adult education. We have brought all our force to bear upon the primary and national schools—we have, perhaps, over-educated there. I believe this is the impression of persons who have had experience, that in our primary schools we have been aiming at too much, and that we must go back to the good old English system, which still prevails in our public schools, of teaching a little, but teaching that little accurately and well. We must prepare the soil for seed hereafter to be sown, and I think we shall soon come to the opinion that in our primary schools we should teach the children reading, writing, and arithmetic, and confine ourselves to these. In Mechanics' and similar Institutions, I have known young persons who knew a number of other things, but could read, and write, and spell very imperfectly. I think it our business and duty to throw our force, not entirely, but much more than hitherto, into these institutions for adult education. And,

first of all, we must attend to their literary departments. We must make them attractive. We must persuade young persons to read. I am a great advocate for light literature. Get a person to read at the Mechanics' Institution, and he will go on reading; but first get him into the way of it. Likewise in respect to newspapers. This is an age when everybody wishes to read the newspaper, and you must provide them with papers. They will read, perhaps, first of all, their own party papers, or those of which you do not approve, but in time will go on to read other papers. It is so in light literature. Let a man read Sir Walter Scott's novels, and they will lead him on to history. From inferior newspapers they will go on to read the *Times*. If people read that paper they will not always be with it in the conclusions which it draws—but they will not read it without being improved, because the articles are written by men of great information, well-versed in political economy, history, and general literature. We must also find amusement for young people. Dramatic readings, concerts, and things of that sort are very attractive. There is great difficulty in getting young people away from places of amusement of which you do not approve, and it can only be done by offering them some counter-attraction. Another point to which we must direct our special attention is the scientific education of the people. In these adult Institutions we are very deficient in this respect, and the general complaint is that this is not sufficiently attended to. When we look round on the state of society, we find that in the upper and middle classes if a young man between 18 and 25 has been what is called a "fast man," he can retrace his steps; his friends and family are ready to welcome him home, and he is enabled to redeem his character; whereas in the humbler classes of life, where the same sort of men exist, a fast man is brought under the law, he is put into prison, and has no means of redeeming his character. One of the greatest blessings in this respect is the Reformatory Schools. But there is another thing which must be attended to. Our business is to enable our friends, the members of this society, when they have children able to distinguish themselves by their genius and their talents, and to benefit society, to have those talents and that genius exercised. It is for the good of the country as well as for the good of individuals. We cannot expect in Institutions of this sort that we shall have very many persons giving their attention to scientific pursuits, but we can give them the opportunity. We must give aid and assistance to persons like Dr. Kitto; if you read his life, you will see the hardships he had to undergo in order to obtain his instruction. But we must go still further with respect to our scientific education. We shall never have these Institutions on a proper footing till we have paid masters and professors. Government might establish first-class professors in all our large towns, who would be able to impart instruction, and they could have a large number of persons under them quite capable of carrying on the instruction. For instance, there are the masters now trained at our schools—we are employing engines of 24-horse power to pick up pins; these persons are quite prepared to become instructors, and to be really useful in such institutions as these. It is most important that we should establish, in connection with all these Institutions, good libraries. This society, I am happy to say, directs its attention to book-hawking. In a large Institution in the North they have rotary libraries, which are sent out to the different parishes and districts, where they are kept a month or six weeks, and then passed on to others. This is a point to which our attention must be directed. When we speak of adult education, we do not mean merely the instruction received at institutions such as this. The man must educate himself, bring out his mind and all his moral faculties, and the consequence is we must attend to his moral training as well as to his literary and scientific improvement and advancement. The very first thing we must do is to inculcate, as far as we possibly can, habits of prudence. Once get a man to save, and you are sure of him. We have temperance societies, but they must not supersede the provident societies. When once you have persuaded a man to act with prudence, and to save money, you have done an immense good. I am myself—I am happy and proud to say it—an Odd Fellow, and a member of several other societies. Some people set themselves against these societies, but they originated with the working classes, and they are connected with their welfare. I have worked with them for a great number of years, and as far as the Odd Fellows' societies are concerned, they are the best organised bodies in the country. In Wiltshire you have established an excellent Provident Society, which has spread over the whole county. They are following your example in Yorkshire. Of course there is a great objection to teetotal societies, on account of their being so intolerant. Of the amount of good done by them anybody who has lived amongst the working classes is quite aware. You protest against the intolerance, but you admit the advantage of them. Improvidence and intemperance almost always go together. I will only conclude by remarking that this society is entirely and purely a secular society, or else we should not be all here now advocating it. A secular society is of great advantage, because you have connected with it all classes of persons, and persons of all shades of opinion. But it is most important that you should preserve your character as a secular society. He who has been converted by the grace of God feels and knows that his business is to propagate the Gospel. He will do so, he cannot help it; he will endeavour to propagate the truth, the whole truth, and nothing but the truth, as it is in the Lord Jesus Christ. Now when once we come to that point, of course there must be great difference of opinion. All that we can say is—In this Society we agree to differ; let us assist one another, and let us keep our differences perfectly distinct. When we meet for the purpose of secular education, let us devote our whole force to that one subject, leaving religious education to those whose business it is to conduct the religious education of our families, and who will give that religious education which they deem to be founded on the truth of God.

The Hon. and Rev. S. Best, one of the Hon. Secretaries, then read the report. It stated that there are 150 institutions and night schools in union with this society, 20 of which have come into union since the last report. The schools aided have increased from 24 to 53, and the gratuities from £52 6s. 9d. to £98 6s. 11d. Nearly 300 lectures have been gratuitously delivered upon scientific or literary subjects.

The Rev. Prebendary Fane moved that the report be circulated as widely as possible. It was true, as the excellent chairman had said, that we had been educating the children in our national schools to a height which really put them completely out of the educational level. We had been straining too much at one point and too little at the other. The great difficulty was how to carry education to those who, from early neglect or other causes, had received no education at all. What was the working man to do when he came home at night, unless there was some place to which he could resort to spend an intellectual evening? He hardly knew how to express the admiration he felt for the gentleman who had read the report. It was owing to his strong, powerful, and working mind that the society thrived as it did. Great good had been done by the society, and by God's blessing he hoped much more would be done.

Mr. John Ravenhill seconded the resolution, and it was carried unanimously.

The Rev. Thos. Bacon was happy to say that they had a lecture list in preparation for the coming year, which contained the names of 58 gentlemen who had given their services gratuitously as lecturers. He earnestly invited gentlemen who had talents for lecturing to add their names to his list. He hoped all who intended to give lectures in connection with the society would avail themselves

of the large selection of diagrams which were placed at their disposal.

The Archdeacon of Winchester moved the re-election of the committee and officers. The three great requisites of a committee were—a fair measure of concordance amongst its members, some hard workers, and plenty of zeal. These requisites their committee possessed, and they could not do better than re-elect them.

The Rev. Prebendary Smart seconded the resolution, and it was carried unanimously.

The Chairman then presented the rewards to the successful competitors. The results of the examinations showed that to 87 candidates awards had been made. Medals were awarded to the following voluntary teachers: Mr. Eyres, Wilton, Class in Institute, 5 certificates, 2nd degree, silver medal; Walter Fergus, M.D., Marlborough, School, 5 certificates, 3rd degree, silver medal; Mr. H. P. Dixon, Marlborough, School, bronze medal; Mr. W. G. Davis, Heytesbury, Classes of Reading-room, bronze medal; Mr. T. Wilce, Heytesbury, Classes of Reading-room, bronze medal; Rev. G. Waddington, Tytherley, School, bronze medal; Mr. W. Wylie, Winchester, Music Class in Institute, bronze medal; Mr. W. Henstridge, South Newton, School, bronze medal.

Mr. Harry Chester expressed the great interest he had taken in this society. He had long been of opinion that the education of adults was the masterpart of the whole subject of the education of the people. The conviction was gradually spreading throughout the country that we must increase to a very large extent our means of adult education. Children were in our hands but a very short time, and we attempted to teach them a great deal more than it was possible for them to learn. He was not one who thought that instruction in elementary schools should be confined to reading, writing, and arithmetic; they would then become more monotonous and tiresome than they were at present. He thought the programme of the society for the ensuing year was well devised. He was glad that pupil and certificated teachers were to be admitted to examination, and hoped a large number of them would avail themselves of the opportunity. He trusted that the Southern Counties Society's candidates would be successful next year in the Society of Arts Examinations. That Society's list of subjects of examination had been increased by the addition of mining and metallurgy, freehand drawing and mechanical drawing, and domestic economy. In the last subject, which was designed principally, but not exclusively, for females, the Dean of Hereford was Examiner.

The Chairman said he did not wish to confine the children in elementary schools entirely to reading, writing, and arithmetic, because he considered that the most important part of their education was religious education. When he said the children should be taught to read correctly, he meant they should be taught to read intelligibly; their instruction should be of the most practical kind. In elementary schools we should give as correct information as was possible. The chairman then read some extracts from a book entitled "Light, more Light," written by a working man in Yorkshire, on the education of the lower classes.

The Rev. T. Bacon then made a statement in connection with a communication he had received from the Secretary of the Royal Agricultural Society, in reply to a letter he had sent him, asking for some information respecting works on agriculture suitable for the lads and young men in his parish. That gentleman in reply stated that he was sorry that he did not know of any elementary books for the purpose which he had mentioned, but that he could obtain them from Mr. Ridgway, of Piccadilly.

The Rev. Prebendary Fane said he wished some of the medical and legal gentlemen of the town and neighbourhood could be induced to assist the institution by delivering lectures.

The Rev. H. Gunn (Independent) said that the restrictions which pupil teachers would be under at the examinations were mentioned but not explained; and that none might be prevented from attending the examination it was desirable that some light should be thrown upon it.

The Hon. and Rev. S. Best, in reply to the last speaker, explained that the pupil teachers might be examined and take certificates, but could not compete for prizes.

Mr. John Warren made some observations. He earnestly desired that education should be carried on morally, religiously, and intellectually.

The meeting then adjourned.

The dinner took place at the Town-hall. The chair was taken by Lord H. Thynne, M.P.

At seven o'clock the society met in four sections for the reading of papers under the following heads:—

Section 1.—Night-schools, their Formation, Management, Extension, &c.

Section 2.—Town and Village Institutions: their Wants, Practical Working, and Results.

Section 3.—Education as it Affects the Working Man's Home—The Working Man's Home as it Affects Education.

Section 4.—Societies having an Influence on the Advancement of Education.

On Wednesday there was a general discussion of the papers read in the various sections on the previous evening. The Very Rev. the Dean of Chichester presided. A summary of the different papers read was brought up by the various chairmen.

The substance of these papers is given below:—

Section No. 1.—Night Schools.—Their Formation—Management—Extension, &c.

Chairman, the Rev. J. E. Philipps, Vicar of Warminster.
Secretary, the Rev. T. H. Tooke.

1. The first paper was read by the Hon. and Rev. Samuel Best, from the MS. of Mr. W. C. Keckman, of Empshot, Hants. It related the experience of that gentleman's evening school. He attributed its success, in great measure, to its being held alternately once a week in his own dining-room and presence; and twice a week in a cottage under "round frock" superintendence. If always held in his own house he thought there would be too much restraint; if always in the cottage, too little discipline. He obtained excellent results from devoting half an hour weekly to conversation with the whole party of scholars. His object was, by sharp questions and answers, on very familiar and homely subjects, to habituate the villagers both to answer when spoken to, and to look at the person speaking; and he succeeded by this method beyond his expectations.

2.—Management of Night Schools. By the Rev. Lester Lester, of Swanage, Dorset.

The Swanage Night School was opened in the winter of 1857–8. It was renewed in the winter 1858–9—re-opened in September, 1859; and re-modelled in the beginning of 1860. In 1857–8–9, the instruction was confined to reading, writing, and arithmetic. In 1857–8, the payment was 1½d. a week for three nights' teaching and one night's use of the room for reading. In 1858–9 the payment was 2d. weekly for four nights' teaching. The first year the teaching was by volunteers; the attendance good, mainly by big lads. The expenses were cleared. In the second year the teaching was by volunteers, and the attendance very good, up to Christmas. After Christmas the teaching was by a certificated master, aided by volunteers; the bigger lads nearly all dropped off—the expenses not cleared. In the autumn and winter of 1859–60, the teaching was first by a certificated master and volunteers; and then by a certificated master alone. The attendance was so bad that (first) no volunteers were required to aid the certificated master, and (then) he was obliged to be dismissed. The moral drawn from this experience was that voluntary teachers are preferred by the bigger lads, that the boys require a regular master, and that the two classes must be

kept apart and separately treated. At the beginning of the present year, Mr. Lester says that the following new plan was commenced at Swanage:—They called together the big lads, and explained to them that those institutions were likely to flourish which grew up naturally, as it were, among a body of men, by their own act, not those which were presented to them cut and dried by others. They were advised to form among themselves an association which should provide for their instruction, without being a school. A sketch of such an association was put before them for consideration; and a promise of voluntary teaching was made to them. The idea took with them, and they soon agreed on an improved sketch of the association. "Beyond giving the instruction, and superintending the examinations," says Mr. Lester, "we have nothing to do with it. They receive their own subscriptions; pay their own expenses; admit and expel their own members. The president and committee are chosen from among themselves. This has been at work this spring, with what success you may judge from the fact that Swanage gained three certificates, and an extra prize, at the May Examinations of the Adult Education Society." The following are the amended rules:—

I. The Swanage Adult Association has been formed among some of the young men of Swanage.

II. Its object is to enable those are already possess some knowledge of the elementary subjects of education, to keep up that knowledge, and improve it.

III. To this end, instruction will be given by voluntary teachers, who have promised their assistance during the winter.

IV. The place of meeting is the National School-room: the time Monday, Tuesday, Thursday, Friday, from 7 to 9.

V. The subjects proposed to be taken during the present winter are these:—Reading, Writing on paper, Dictation and Spelling, Arithmetic, including Mensuration, Gospel History, the Geography and History of England.

1. The Association is managed by a President and Committee, elected annually from and by the members.

2. Any person wishing to join the Association, is requested to give his name to the President, who will propose him to the members, and they, by show of hands, will declare whether they will receive him amongst themselves.

3. A person wishing to join the Association is expected to have some knowledge of reading and writing, and must be over 16 years of age.

4. The subscription is twopence weekly from each member, paid every Monday, in advance. The money arising from the subscription will be expended by the Committee in light, firing, books, &c., for the Association.

5. Members are expected to attend regularly, as the instruction is given after a fixed plan. Any member intending to be absent more than a fortnight, is requested to give notice to the President; or else he will, at the end of that time, be considered as having left the Society, and must be again elected in case he desires to rejoin it.

6. Members are expected to be orderly and attentive. Any member misbehaving himself will be requested by the President, or by a Committeeman if the President be absent, to leave the room, and on a repetition of the offence will be requested to leave the Association.

3.—Organising Masters. By the Rev. J. H. Carnegie, of Cranbourne, Dorset.

The greatest impediment of evening schools is the difficulty of finding qualified and trained teachers. In large towns, the certificated master of the boys' day school may have the help of a probationer or assistant master, instead of two pupil teachers, in which case he is allowed by the Committee of Council to be absent from the day-school in the afternoon, and to teach in the night school. This advantage, however, is out of the reach of rural parishes, in which there is only a mixed school taught by a mistress. Under these circumstances, either there is no night school; or the incumbent himself is obliged to act as a night schoolmaster; or he appoints some person who may be willing to undertake the office, but is unqualified for the work, and deficient in the method and power of teaching. The success of a night school depends greatly upon the skill and tact of the teacher. To induce plough-boys and apprentices to attend regularly, the school must be attractive to them. The school-room must be properly warmed and lighted, and provided with books and apparatus; the scholars should be divided into classes, according to their acquirements. Good order and discipline must be maintained, but great tact is required that this may be done, not harshly and repulsively, but kindly and judiciously, and with due allowance for the habits and feelings of the scholars. Those who are unable to read ought to be taught after the most approved methods; and the reading lessons of the more advanced scholars ought to be illustrated by diagrams, and made amusing and attractive by interesting anecdotes. Arithmetic ought to be taught not in a dry and mechanical manner, but so that the scholars may thoroughly understand "the reasons why," and their intellectual powers may be exercised. Very few villages have a master qualified to teach in this way, and in very few the payments of the scholars and other funds for the support of the night school are sufficient to secure a trained teacher. Organising masters might be advantageously employed by the Society. All schools in union, whose managers might desire this help, might be formed into convenient groups, and each group might be placed under the charge of an organising master, who would reside in the centre of his district. He would organise classes, draw up time-tables, instruct the local teachers in the best modes of teaching, and give them every other assistance in his power. He might aid the local teachers in their own studies, and give lectures. The remuneration of these organising masters will be difficult. Each school benefited by them should contribute. Those evening schools which are adjuncts of day schools receiving annual grants from the Committee of Council, are entitled, under the minute of the 26th of July, 1858, to a capitation grant of five or six shillings for every night scholar attending 50 nights in a year, and this source of income might be available. When the funds of the Southern Counties Adult Education Society increase, as may be expected, the Society might devote a certain sum to this object. If the organising masters were certificated under the Committee of Council, that Committee might possibly allow them the annual augmentation on their certificates. During the summer, when the evening schools are closed, they might find employment in teaching drawing or some branch of science; or the managers of day schools might be glad to avail themselves of their help in the work of school organisation. The appointment of organising masters should rest with the Society's Committee, as this would be a guarantee that no unqualified persons would be appointed. These masters should not be allowed to interfere with the religious instruction of the schools, except with the express sanction of the incumbent or other managers. The organising masters have been adopted in the East Lancashire Union of Mechanics' Institutes with great success. The National Board of Education in Ireland appointed, in 1856, a certain number of organising masters and mistresses. To show the benefits arising from their services, the 23rd Report states that one of the worst town schools in connection with the Board has become, since its organisation, distinguished for the neatness and completeness of its arrangements, and the general excellence of the order, discipline, and methods of teaching pursued in it.

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4. How are we to have a Night School? By the Hon. and Rev. S. Best, of Abbott's Ann, Hants.

The Night School is now a part of the parochial system. Our educating power is incomplete without it. The child

is taken from us at eight or nine years of age, and there is no hope for him but in the night school. I pass over difficulties, drowsiness, inattention, &c. I believe in them but as creations of those who know not how to interest the child, who insist on teaching him what he does not want to know, and will not teach him what he wants to know; who teach abstract truths which he cannot apply, and refuse to teach practical truths which would aid him every day in his labours, and in his leisure. Make his studies interesting to him, and the drowsiness and inattention will vanish. Change of toil is relaxation, and especially change from manual to intellectual labour in the night scholar. Dismissing these difficulties, let us look to those of finance. The real difficulty is in providing for the different classes to be taught. The man of neglected education, and the boy more advanced, cannot be jumbled together in the same school. It is naturally distasteful to the senior, and he will not come. The senior and the backward boy may be brought together, and the senior, under a judicious teacher, will be a valuable aid in maintaining order. The teaching of such a class is elementary, and does not require great attainments. Any young man who has passed through the day school with credit is equal to the post, reading, writing, and arithmetic in its first rules being generally the extent of his requirements. Such a young man, taking a night school under his charge, may derive much assistance from Daniell's copy books, Bishop Short's arithmetic, and the various reading books published by the Irish Commissioners of Education, by the National and Christian Knowledge Societies, teaching to read and at the same time conveying information and amusement. How is his salary to be met? Suppose there are ten scholars and (I know that they are able to pay) that they each pay 4d. a week, for four nights of two hours each. I will suppose that 3s. a week, or in all for 26 weeks £3 18s. 0d. is raised by subscription; that 5 out of the ten scholars attend 80 hours, for whom our Society pays one shilling each, that 2 of the ten earn our 3rd class certificates, and entitle the teacher to 10s. The school having been open 208 hours (4 nights a week for 8 hours for 26 weeks) at 2d. an hour, further entitles him to £1 14s. 8d. The receipts then stand thus:—

10 Scholars at 4d., 26 weeks...	£4	6	8
Subscriptions, 3d. a week, 26 weeks...	3	18	0
5 scholars, 1s. each	0	5	0
2 Certificates	0	10	0
208 hours at 2d.	1	14	8
	£10	14	4

or for 26 weeks, 8s. a week with 6s. 4d. over. There will be some deduction for lights and fuel; but this total is in addition to the daily earnings of the teacher, which it will consequently raise into a respectable livelihood. I have stated this in low numbers, having in view a country parish school. With increase of numbers comes of course facility in carrying out such an arrangement. This has contemplated the one class only to whom I have referred. With respect to those who have passed up out of our day schools tolerably educated, there is a provision made by Committee of Council for the instruction of pupil teachers. To them in extra hours the master is bound to give instruction, and it is little additional labour to instruct 2 or 10 other lads with them, while it will afford him a satisfaction in continuing and finishing off those whom he has educated, and whose presence forming a larger class will both give spirit to his teaching, and excite interest and emulation in those taught. In these remarks I contemplate masters instead of mistresses, who are seldom able to cope with a night school of boys, although admirable instances of this have been quoted. What is done in the boy's night schools by masters may, of course, be done by mistresses for girls, and I hope the public attention may be drawn to the maintenance of night schools for girls. In three instances, Wilton, Romsey, and Warminster, (and probably there are many more) for the winter six months there is a night school for boys, and for the summer six months there is a school for girls.

5.—How to Secure Elementary Instruction. By Sir Stafford Northcote, Bart., M.P.

The point to which I wish to call attention, and which I think of great importance to the cause of education, is the necessity of placing some check on the tendency of our present system to educate a small proportion of children highly, and to leave a large proportion almost uneducated. We have been busying ourselves with the improvements of our educational machinery at a great expense, which will soon become a serious difficulty in the House of Commons, and we have been forcing on our masters and pupil teachers by extraordinary stimulants, till we find that the real difficulty is in getting children for them to teach. Then comes an outcry against the apathy of parents, complaints that children are taken too early from school, and we devise prize schemes and other attractions to keep them longer; but these schemes all tend to the fostering of the few superior children without a corresponding attention to the many inferior. The same evil is making itself felt in other departments of our educational system, as for instance in some of the middle class schools, whose masters are devoting all their energies to force forward those lads who are likely to do them credit at the University examinations, and are neglecting the unpromising mass of ordinary scholars.

What I believe to be the true remedy is something of the nature of Mr. Adderley's Bill of last session, requiring the employers of labour to satisfy themselves, before engaging a child of (say) nine years old, that he has learned to read and write, or else to undertake to allow him a certain amount of schooling, if there be a school within reach, until he can read and write. There are many practical difficulties in the way of the adoption of such a plan, and the country is probably not yet ripe for it, but I am anxious to ventilate it a little, and to collect opinions both as to its principle and as to the mode in which it could be worked out. The advantages of it would be, that the parent would feel the importance of schooling, and co-operate with the master in making the child attend regularly, which is a great object; it would also make the master careful to educate all his scholars, instead of the most promising only, since the disgrace of failures would have to be set off against the credit of successes; whereas now the master gains credit for his successful scholars, but loses none by those who are unsuccessful; and it would go far towards ensuring to every child the rudiments at least of a good education, and thus making education really general. It is objected that reading and writing are not education, which is of course true; but they are an important part of it; and, in every well-conducted school, the education of a child in sound religious and useful knowledge, and the formation of good habits and the inculcation of good principles, ought to proceed *pari passu* with instruction in these elements of learning. Let the State assist, as at present, the religious bodies which take charge of education, but let the assistance be proportioned, not to the high acquirements of the few, but to the moderate acquirements of the many. Why should not the capitation grants, for instance, be made to depend upon the number of children who can read, write and cipher, instead of upon the number in attendance? I would graduate the scale of the grant according to the acquirements of the children. It would give the inspector more trouble, but would make his inspection more valuable, and would, I think, save the public a good deal of wasted money, which might be employed in strengthening the inspectors' department.

I should very much like to have the opinion of practical people, both as to the feasibility of legislation in favour of reading and writing, and as to its probable effect upon education generally.

Note by the Hon. and Rev. S. Best on the foregoing Paper.

If the elementary knowledge of reading, writing, and arithmetic be given in day-schools, however imperfectly, the education may be carried on in the night schools. One of their greatest difficulties is having to give elementary knowledge of writing and arithmetic to adults. If, therefore, the payments of the Committee of Council could be made to stimulate the laying of these elementary bases of education, though the details of such a plan as Sir Stafford Northcote refers to might present difficulties, it would be of the greatest possible consequence, and should receive our best attention. It would be a very great point gained in our night schools if we could receive our scholars from the day school, having in all cases acquired the elementary knowledge here referred to. Much time, labour, and embarrassment would be saved to us, and a more reasonable hope might be entertained of the satisfactory result of our labours.

6.—Evening Schools. By the Rev. F. V. Thornton, of Chilton.

The day school in towns can do little for the education of the working classes, while in the country the education of boys depends on the evening school. Many have found that the better the day school the sooner the boy leaves it for labour, and without the evening school there is no hope of retaining the small knowledge acquired in the day school, nor of obtaining any effective intellectual training. But, while all admit the advantages and necessity of evening schools, there is less agreement as to the objects to be aimed at in them, and the manner in which those objects are to be attained. This arises in part from the different circumstances under which such schools have arisen, and the necessity of doing not that which appeared absolutely best, but which was possible at that time; and in part from the changes in the school itself after it has been at work for a few years. On the opening of an evening school it is filled by men old enough to feel the disadvantages of their want of education; and the ignorance of these men leads those who are interested in the school to believe that it ought to exist for them. Of these men, however, some give up in despair of learning, some from inability to spare the time, some as having learned all they desire to know; and so the school languishes from the diminution of numbers, and is given up, or the numbers increase, but the age of the pupils undergoes a change. Instead of men, boys, and at last little boys, fill the benches; and the few who remain of the earlier pupils cease to attend, on the ground, perhaps, of the noise and confusion arising from the presence of the young learners for whom no separate provision has been made. In some cases the adults have been suffered to leave the school from the impossibility of shutting the door to the boys; in others the adults have been retained by the exclusion of the boys, and this course has been apparently and unintentionally sanctioned by the Government in its minute of June, 1858, as it had been by the original rule of the Southern Counties Adult Educational Society. The full remedy of retaining both in different rooms is possible only where there is much space, and where many teachers can be secured. But everywhere experience has taught us that the normal condition of an evening school is, that it should contain those who have just left the day school; and this is the class for whom our arrangements should primarily be made. It is obviously unwise to allow a break to take place in the process of education if it be possible to avoid it; and, in the country especially, a well-organised evening school is the best substitute for the half-time factory school; and it may be made of more use for education. If we keep clearly before us, "that the work of the evening school is to carry on the education begun in the day school," we have a clue to the solution of many difficulties. With regard to the teacher we have to answer these questions:—(1) What sort of master are we to have? (2) What help is he to have? (3) How is he to be paid?

The work of the evening school is the carrying on the work of the day school under more difficult conditions; we need the same kind of master, and the evening school requires the abler man. Whether, therefore, we take the Government certificate or the higher standard of practical efficiency as our test of competency, we ought to secure for our evening schools the best masters we can obtain, and *bona fide* masters. It is harder to keep up a good evening than a good day school; and, valuable as unprofessional help may be, it cannot take the place of the professional teacher, or make an evening school permanently what it ought to be.

The evening school master requires help even with small numbers. The impossibility of educating large numbers with few teachers is acknowledged in proportion as the true meaning of the word *educating* is perceived—and the firmest supporters of Bell and Lancaster, as Lord Brougham well observed the other day, now demand an increase of teachers. Here unprofessional assistance may be employed; and more of such help will be obtained, when it is known that there is a responsible head over the whole. The continued success of the evening school at Sheffield, with its four hundred pupils, and five and thirty unpaid instructors, is a sufficient proof of this. Many will gladly teach if not expected to take the responsibility of arrangements and discipline. There is also some professional assistance for which we may look. As soon as the evening school is acknowledged to be a part of the day school—*i.e.* that the day school meets three times a day instead of twice, there is no objection to pupil teachers being employed morning and evening, or afternoon and evening, instead of morning and afternoon, all that is necessary being that they should not be employed three times. There is another kind of help, almost always available. Men whose education has been given in the evening school, or boys who have had greater advantages, or have staid longer in the day school, are glad for very small remuneration to act as assistants, and can give effective aid.

How is the master to be paid?—is usually the most difficult question. It is a difficulty which can be dealt with here only in its broadest form; and with the acknowledgment that increase of expense must be expected where we increase our machinery for work. The increase, however, is much less than we should expect. For there are three conditions in which schools are to be found—schools with more than one master—schools with one master, and schools with only a mistress. Where there is an assistant master, he is either competent from age and attainment to take a school, or he is not. If he be competent, he may be the master of the evening school, and so find work which will depend visibly on himself, and in which, therefore, he will take especial interest; if he be not competent for this work, he can take the entire care of the day school in the afternoon, so as to relieve the principal master, and enable him to take the superior charge of both schools. Cases arise in which, by special subscription for an evening school, it will be possible to obtain support for two masters, where at present only one can be paid, and this will be to the great advantage of the day school as well as of the evening school itself. In schools with only one master there is greater difficulty; but even here, all that is necessary in mixed schools is to secure efficient mistresses. In many cases such exist; in others, managers have been content with inferior help only for the sewing. All such schools might have a mistress competent to take charge of all the school, with the help of pupil teachers in the afternoon, and the master would thus be free for the evening school. It would often be an improvement in the country if the mistress were responsible generally for the day school, and if the master taught writing and arithmetic, and other special subjects during one part of the day, but was himself more especially the master of the evening

school. Where, from more advanced or troublesome boys, a difficulty arises to the carrying out of this scheme, it may be met by their being set free in the afternoon, and attending again in the evening, when the master himself would have charge of them. Where there is a school of boys only with one master the case is similar to the next class of schools.

There remains the case of those villages, where from smallness of population, or want of means, the school is under a mistress only. Here, unless the increase of subscriptions especially devoted to evening schools, or remuneration for other employment, enables a master to be paid, we must be content with such a teacher as can be obtained in the place; and we must seek for the superintendence, as well as help, of the benevolent amongst the educated classes.

What has been said has rather pointed at the economizing the teaching power already employed, and so saving additional expense, than at further means of obtaining money; but we must add these sources of increased income in addition to increased exertions on the part of those already over-taxed:—Special subscriptions to evening schools from those who do not care to give to day schools, and especially from the employers of labour. These last have, in many cases, answered to this appeal, and may be led to do so much more extensively. The capitation grants now extended to evening schools. Such other employments for the masters as would not interfere with school work, such as the agency of clubs in the place, or land measuring, which may be made profitable in the instruction of the boys themselves. After all there will be some increase of expense; but there would be no difficulty about this, if the average contributions of the laity for education were one-half, in proportion to their incomes, of the average contributions of the clergy.

The questions to be answered about the school itself relate to discipline or lessons. As to discipline—are we to attempt to have the same order as in a day school? This question is virtually answered by the age of the pupils; for with boys scarcely older than those in the day school, the same order should be kept, and by the same means as in the day school. More tact will of course be required, but that school will always be the fullest, as well as the most efficient, in which there is most quiet and most diligence. With regard to attendance. Much will be done to ensure regularity, when the school is known to be doing its work well. But we must use our influence over employers, as well as parents, to enforce attendance upon boys under fifteen, and we should use prizes and rewards for regularity. In two evening schools, in different counties, great regularity has been ensured by making dependent upon it admission to, or exclusion from, a tea-drinking or supper at the end of the session.

What is to be taught? The work carried on in the day school should be found in the evening classes. This is most important, and many evening schools have failed for want of attending to it. A high standard of teaching is required in our schools, and the evening student should not be behind them. The progress will be slower, but, as it will be extended over more years, a much higher point ought, in the end, to be attained by the scholars in an evening school than can ever be looked for in a day school. If the school is not open five nights in the week, which, if it be possible, it ought to be, then lessons in geography or history, or other subjects, should be given to be prepared on the vacant evenings; and a carefully analysed table should be made out for the work of every week. This is especially necessary in towns. Here, where it has been found difficult to establish classes for special subjects, good schools could be maintained, in which the same subjects might be taught less ostentatiously, as parts of the regular schoolwork. Many boys and young men would come to the school who shrink from joining a class in drawing or geometry.

What means are we to use to keep the school and teacher in efficiency? Real stimulus is needed in all schools, and not less where children are at work during the day. The chief stimulus will be rewards, and it is well to make a larger use of these than in an ordinary school. Great efforts should be made to work the school in classes, and to use the emulation which is so effective in other schools. But where this is not possible, good marks, represented by tickets, may be given for diligence, or for lessons done. These tickets may lead to rewards proportioned to their amount, if, at the end of the session, there is a sale of articles of clothing, knives, &c. Each article should have its value in tickets, not in money, upon it, and the boys should be allowed to choose in their order what they wish to have in those things which come within their means; or a certain number of marks may be fixed as representing real diligence during the session, and an excursion may be organised to which the diligent alone should be admitted. Both these plans have been tried with great success, but all that is essential is that the reward should be one which will be thoroughly appreciated by the boys themselves. Other prizes should of course be given, and elder pupils should be encouraged to sit for the prizes and certificates of this Society. But it would be well if the Southern Counties Adult Education Society could add to its work a more elementary and more general examination, in some such plan as the Oxford Diocesan Prize Scheme, which is working so well.

But the efficiency of the pupil will depend upon the efficiency of the teacher. How are the conductors of evening schools to be encouraged to continual exertion, and to learn the deficiencies of their own school, and the plans which have been elsewhere effectual to remedy similar deficiencies? No one can doubt that the periodical examinations for exhibitions at our great public schools are of great use, not only to the successful candidates, but also to the whole school; that the visit of the *Poser* has an effect upon the labours of the whole year. Nor can any one conversant with the condition of the teachers of our elementary schools doubt that such help is required pre-eminently by them. The visit of the inspector is of more value to our day schools than the grants which depend upon it, and it is to be regretted that on the extension of government grants to evening schools, it was not found possible to enforce in their case the condition of inspection. Something has been done by the Southern Counties Adult Education Society in gratuities to the teachers of those who obtain certificates, but this is not enough. It does not touch many schools, nor test the general condition of those which it reaches. We need something more, and there is no work which could be more profitably undertaken by our Society at the present time than the inspection of schools to which it gives money. This inspection has been undertaken by similar institutions in the north, with the best results, and would be gladly welcomed by the majority of schools in union with us. The present condition of our evening schools is most unsatisfactory. Little is taught in most of those which are flourishing in numbers, while in towns the pupils are disappearing because of the badness of the instruction.

Even if it were found impossible as yet to work such inspection in the best way, by a competent person, properly paid, yet something would be attained if we obtained gratuitous inspection for each district. If the statistics of existing schools, their numbers of teachers and of scholars, their hours of work, their average attendance, and the subjects taught, were thus collected and published; the difficulties which exist in different places were ascertained, and arranged so as to become a subject of discussion at our next annual meeting; if we thus showed an interest, not only in a few picked scholars, but in the condition of the whole adult population for which we profess to labour, much good would be done; and the general condition and efficiency of evening schools would be advanced to an extent which at present we are inclined to contemplate with despair.

7.—Lessons in Evening Schools, by Dr. R. Fowler, of Salisbury.

[N.B.—This gentleman is more than ninety years old.]

An evening school should teach adults how best to do their duty "in that state of life to which it has pleased God to call them." For this purpose, when reading and writing are sufficiently advanced, and the pupils write from dictation, they may be trained to observe and examine raw materials with which they are to be occupied in future; for example, carpenters with specimens of wood, and tailors with cloth and the different textures employed in their trade. Specimens should be selected and classified in the school-room. Pope's "Essay on Man" is the best book to teach adults to read. This may be useful in giving a knowledge of human nature, as the essay contains a code of moral conduct. How we live by respiration, the affinity which oxygen has for the carbon of the blood, may be illustrated by blowing out a well-lighted candle, and again kindling its carbon by holding a lighted lucifer to the ascending smoke, down which the flame will descend to the wick uniting the oxygen of the air with the carbon of the smoke. They may be shown how fits and faintings may be relieved by dashing cold water on the face, and thus exciting a full spasmodic inspiration by which the oxygen of the air enters the lungs, and by its affinity with the carbon of the blood removes the carbon and restores the vitality of the blood. They should be told why from the skin all obstructions of perspiration must be removed by washing, and thus the duty of personal cleanliness will be illustrated. They should be taught a military drill once or twice a-week for a short time, which will develope all the organs of the body, and enable them to perform their ordinary functions with more efficiency and better health.

Gravitation and its laws may be taught by a pair of scales; how it may be antagonised by motion may be shown by spinning a teetotum.

A common horse-shoe magnet and a needle may give an idea of magnetism. A mariner's compass may be still more suggestive. A barometer and thermometer will show some of the phenomena of heat and atmospheric pressure. When that part of Pope's "Essay on Man" is read describing the rotation of animal and vegetable life, the great law of rotation may be discussed:—

> "See dying vegetables life sustain,
> See life dissolving vegetate again,
> Like bubbles on the sea of matter borne,
> We rise, we burst, and to that sea return."

Section No. 2.—Town and Village Institutions—Their Wants, Practical Working, and Results.

Chairman—Harry Chester, Esq., V.P. of the Society of Arts. Secretary—The Rev. Thomas Bacon.

1.—Class Instruction under Organising Masters. By the Dean of Salisbury.

Literary and Mechanics' Institutions are intended to afford the means of self-culture to the industrial classes during the critical period between youth and maturity. They have, in a great degree, failed of their object from the want of due provision for the systematic teaching of the elementary and secondary branches of education. Every Institution should comprise a reading room, library, evening classes, and occasional lectures, amusing and instructive. Class instruction has been too little attended to, or superseded by desultory lectures. This is a fatal error. Evening classes are indispensable for rudimentary instruction in reading, writing, arithmetic, and geography, to those whose early education has been neglected, or who have lost the little that they had learnt at school, and for teaching to the pupils in general such branches of knowledge as have a practical bearing on their respective callings. Among these are book-keeping, Euclid, mensuration, drawing, and chemistry. The value of educated labour, even in the humblest employments, is now so generally recognised, that some acquaintance with these subjects will scarcely be deemed unsuitable for the future artisan or workman.

Classes of this description ought to be regarded as an essential part of all Literary and Mechanics' Institutions, and these will prosper or languish according as their classes are, or are not, vigilantly superintended and skilfully taught.

The Society of Arts, and its valuable auxiliary the Southern Counties Society, offer encouragements and incentives to self-culture, and infuse life and activity into the Institutions in union with them. Their leading principle is to test the results of teaching by examinations, prizes, and certificates. But a more direct influence might be brought to bear upon town and village institutions. We might not merely test the results, but improve the agency. We might not only examine the scholars, but improve the schools. A scheme for this purpose has been framed and carried out, in East Lancashire, by Sir James Kay Shuttleworth.

Institutions within an easy distance of one another are formed into a Union, each of them having its night school. The general management of the affairs of the Union is vested in a Council, composed of representatives from each Institution, and holding its meetings in that particular town which is most convenient from its central position. The evening classes in the several Institutions are taught by local teachers, who are generally clerks or intelligent artisans, occupied during the day in their callings. Each of them receives an annual payment of £10 from the Parliamentary grant, on fulfilling the conditions prescribed by the minute of March 1, 1855. It is by a special relaxation of their existing regulations that this aid is afforded by the Privy Council, but there is reason to believe that it would be granted to other unions by an extension of the minute of July 26, 1858, if they were organised on the same principles as that of East Lancashire. The distinguishing feature of that Union is the employment of trained and certificated teachers as organising masters; and to this I invite the particular attention of this Society.

Those masters, under the direction of the Council, aid in organising and teaching night schools. They are required, during five evenings of every week, to spend about three hours in the classes of the different Institutions, regulating the methods of instruction, and affording advice and instruction to the local teachers. On the Saturday evenings they give to the classes of each Institution, in succession, a lecture on some subject of practical utility; for example, on the mechanical and chemical properties of the atmosphere and of water, on heat, the steam-engine, and so forth. They also train and instruct certain of the most promising pupils as assistant teachers, with a view of qualifying them, in due time, for the office of local master. During the day they conduct the correspondence and general business of the Union. Each Institution which receives the aid of an organising master contributes towards his salary. The efficiency of the night schools is thus amply provided for by securing to each of them the services of three paid teachers—the organising master, the local teacher, and his trained assistant.

Examinations on the subjects taught in the classes are annually held, and prizes are bestowed on the successful candidates.

The scheme, of which the foregoing is a very imperfect sketch, is fully described in the two Reports published by the Council of the East Lancashire Union. It has been in operation for upwards of three years, with steadily increasing popularity and success. In bringing it under the special notice of the Southern Counties Society, I am fully alive to the practical difficulties which must be encountered in the endeavour to introduce it here. Not the least embarrassing of these is the financial difficulty which meets us, indeed, at almost every step of our educational progress. But, if the scheme be, as I believe it to be, eminently deserving of general adoption, we shall not,

I trust, be deterred by obstacles which have elsewhere been happily surmounted, from making a strenuous attempt to combine, if not the scheme itself, at least some modification of it, with the other agencies of our society.

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2.—The Formation of Museums. By William Curtis, of Alton.

No Institution is complete without its Museum; and a collection of specimens, for educational purposes, is easily formed, extensive enough to teach powerfully by means of objects. A museum in a village need not be a very expensive addition to a school or institution. It may be at first only a museum of elementary knowledge, established by the outlay of a few pounds. This, with gradual additions, will soon become valuable, particularly if there be an individual or two in the neighbourhood with sufficient knowledge of natural history to make local collections of plants, birds, insects, geological specimens, &c. Much assistance may be obtained, and a useful interest may be excited, by such persons setting the younger members to work to make collections of natural history—*e. g.*, of zoology, including comparative anatomy, especially osteology; birds and their eggs; reptiles and fishes; land and fresh water shells; marine shells and other products of the coasts; insects, and specimens of their architecture; plants; minerals; geological specimens, as fossil organic remains and rocks, plastic materials and stones used for building and other economic purposes. Much may be thus done in almost every district, at a trifling cost for cheap glass cases, but of course more may generally be done in towns than in villages.

Other suitable objects are local productions of various kinds, local antiquities, and raw materials of manufacture. These last, if exhibited in progressive stages, from the natural product to the finished article, would possess great interest in towns remote from the centres of manufacturing industry.

In most cases, apart from a small collection of primary objects and models, and diagrams for general instruction in the arts and sciences, the museum should be a strictly local one. The members of an institution will take more interest in collections of their own making; and, with a little guidance to a rational study of the natural sciences, will learn more from them than from a large museum containing a bewildering number of objects. In educational museums, rare and curious specimens are not the most valuable, but those which are most common, and therefore most important. A plant from the coal formation, and a flint from the chalk, may teach valuable lessons in geology.

It is to be regretted that young men destined to instruct youth, particularly in villages and small towns, are not instructed in natural history, whilst much of their energy is wasted in learning things which will never avail them in schools for children under 12 or 13. Much good might be done by clergymen, if their inclination and tastes prompted them to take an interest in these things. The selection and arrangement of specimens require a competent curator, and this office might be conveniently filled by the clergyman, or schoolmaster, if he had a knowledge of natural sciences. We ought not to see institutions, capable of carrying out effectively other educational plans, failing in one so important and simple as the formation of a museum. A visit to the South Kensington Museum will afford much useful information to those desirous of forming elementary and industrial collections.

At the last Conference at the Society of Arts, the last subject discussed was, "Whether the institutions should promote the formation of local museums—and, if so, whether these museums might not easily, and with advantage, be made to represent the productions of the locality, instead of being of the heterogeneous character often given to them." Institutions should promote the formation of museums—they may easily be made to represent the productions of the locality—and they ought not to be made too miscellaneous. In connection with the short discussion which then ensued, I will make a few observations. In Alton, where we possess a good educational museum of natural history, we have never adopted the Local Museums Act, because the sum so raised would not be sufficient of itself—because we feared that a public rate would be an excuse for withholding private aid—and because, worked in connection with the other objects of the Mechanics' Institution, we did not require additional means of support.

In the discussion, one of the speakers questioned the utility of museums, and said that, to be of any educational value, they can be formed only in the larger towns. I entirely dissent from this. If museums are, as he added, most miserable specimens of decay, it is because the public, and promoters of Mechanics' Institutions generally, are not sufficiently alive to the vast importance of teaching by the eye.

The same speaker also advocated impromptu museums. These I regard as valuable only as getting up a temporary excitement for a special purpose—as giving life to conversazioni, &c. But I attach the greatest importance to the remark made by Mr. Harry Chester on that occasion—that local museums would be of no value unless they were permanent, and the specimens properly classified and labelled.*

There would be no objection to the exhibition of miscellaneous articles, if kept apart (in a separate room if possible) from the scientific collections, for many would be enticed into a museum more by them than by natural productions arranged in strict educational order.

Suggestions respecting Provincial Museums.

The objects of provincial museums should be:—

1st. To make complete collections of local natural history in every department—mineral, vegetable, and animal—of local arts and manufactures, produce, imports, and exports—and of local antiquities—also to record local natural phenomena.

2nd. To have as complete a collection as possible of objects typical of family groups in every department of natural history, including geology, and also illustrations of the more important arts, manufactures, and imports, for educational purposes. Arrangements should be made for the delivery of familiar lectures on the contents of the museum.

To assist Curators there should be prepared classified lists of types of classes, orders, families, and sub-families—with or without descriptions—with wood cuts of the types (coloured).

These cuts might, in many cases, be placed in the museum till the objects themselves, or some nearly allied species, could be obtained. There should be printed labels for naming the typical collection.

Curators would obtain valuable aid if there were set up (say at the British Museum) a collection of these typical specimens, as a model museum, in the best and most economical manner. This would be very useful to students and amateurs commencing the study of natural history.

The Society of Arts might appoint (and, if necessary, the Government pay) an Inspector of museums, to visit them from time to time, to report on their condition, and to publish abstracts of such reports in the Society's *Journal*. His accumulated knowledge and experience would enable him to offer valuable suggestions to the curators as to their arrangements, and the means of making the most practical use of their collections. The Inspector should be kept informed as to the specimens, or objects, of every kind that there may be to spare from any of the national or other collections. In his tours he would ascertain wants and redundances, and be able to distribute duplicates to advantage.

Other useful measures might be to print and circulate

* See Report in *Journal of the Society of Arts*, July 6th, 1860, page 641.

instructions on the collection and preservation of specimens of all kinds—to encourage officers of ships (especially the surgeons) to bring home the productions, natural and artificial, of foreign countries—and, lastly, as illustrations of processes in arts and manufactures, and imported raw materials, are often difficult to obtain in country places, and would be valuable additions to many provincial museums, the Society of Arts might assist in obtaining them at a moderate cost.

The first act of the Inspector should be to make a comprehensive report of all the existing museums attached to the Institutions in Union, stating particularly their condition, means, and expenses.

I shall be happy to show our museum to any one interested in the matter, and to give any practical advice or assistance in my power.

3.—Mechanics' Institutions. By Barnett Blake, of Leeds, Agent of the Yorkshire Union of Mechanics' Institutes.

Mechanics' Institutes require a further application of the principles of Association, and of Competitive Examination. They must have classes for Elementary Instruction, and these must not depend on merely Voluntary Teachers. A man accustomed to tuition should be employed, and remunerated by a portion of the weekly subscriptions of the pupils. It is no boon to the industrious population, youths or adults, to offer them gratuitous education. They value it at its cost to themselves. Inferior night schools charge three pence a week, and the Institutions might reasonably charge as much, and, by allowing two-thirds of the receipts to the teacher, give him a direct interest in augmenting the number of pupils, besides saving the general funds from loss.

Where the pupils comprise adults as well as youths, there should be classes for each in separate rooms or on separate evenings. The man, however defective his acquirements, has a natural repugnance to be placed on a level with the mere youth. In very many instances working men would devote time to acquire reading and writing if classes were formed exclusively for adults.

The instruction of young women should be provided for by classes on separate evenings. Where they are mostly engaged at home, reading, writing, and the rudiments of arithmetic might be taught under a competent paid teacher, but where girls and young women are occupied in manufactures, prominence should be given to plain needlework. For this purpose the services of three or more experienced matrons should be engaged; the work performed should be the making and mending of garments in ordinary use. Materials might be purchased, and when made up sold to the pupils at cost price, and an incentive given to punctuality of attendance by the reading aloud of an interesting book during the time of work. Fancy-work, such as crochet, might be made a reward for improvement in the more useful kinds, and if the exertions to improve young women be carried on in a hopeful spirit, there is not much doubt of success.

Failures arise from want of proper accommodation, from the difficulty of obtaining competent teachers upon whom reliance can be placed for punctual attendance, but more often from inability in the working people to appreciate the advantages of instruction. The latter complaint might be materially obviated if periodical examinations were held, and small prizes awarded for improvement, proficiency, and regularity of attendance. The stimulus of public approval powerfully operates with more advanced students, and prizes small in cost have additional value if presented on some public festive occasion.

Elementary instruction should be the prelude to classes for higher branches of study. The knowledge of the English language is of advantage to all, and something may be gained by a class either for original essays on literary, scientific, historical, or other subjects, or the reading of passages from a selected author, to be followed by discussion. The desire to excel will prompt many young men to devote their leisure hours to study in private, and though the results may be but desultory, the mere habit of learning will promote future advantages.

The members of a Mechanics' Institute, whose advancement in life depends upon their use of their leisure hours as they approach manhood, should have definite subjects of useful study, and their attention should be directed to the examinations of the District Association, and of the Society of Arts, and classes might be formed for the distinct purpose of preparing candidates. For the several branches of Mathematics a teacher will be required, and though gratuitous aid would here be most valuable, it would be better, even at a comparatively high rate of subscription, to secure competent tuition, than forego the advantages of such an excellent system of mental training. On other subjects for which certificates are granted, mental improvement classes with good text books might prove sufficient; the chief advantage of the class over private study being the incentive of emulation. In most instances each member of the class might be in turn the teacher of the others.

A public meeting should be called in autumn, and exertions should be made to secure as large an attendance as possible of the members and other inhabitants of the locality. The chief business, after reporting the several details of the Institution, its terms and advantages, should be to explain the system of examinations of the District Association and of the Society of Arts, the subjects for which certificates and prizes will be granted, the places, days, and hours of the Examinations, the means which the Institute has provided or will provide for the preparation of candidates, and the important advantages which have been gained, and may be gained, by those who obtain certificates. The experience of the Society of Arts will furnish many striking instances of success, while the competition for the Association's Certificates and Prizes will prove a valuable preparation and incentive to continued exertions.

The Reading-room, though less beneficial in its educational influence, if it have a cheerful appearance, good fire, and lights, and a sufficiency of newpapers and periodicals, may prove valuable as a counter-attraction to the debasing allurements which tempt young men into idle or vicious habits. It should be open every evening, and if the Institute has no building of its own, it would be better to hire the best room that can be obtained in a cottage than to be without a reading-room.

The library is as important as the reading-room, and often attracts members whose subscriptions assist materially the less remunerative departments. Books likely to injure morals or to foster vicious tastes and ideas should be excluded, but this should not be carried to the opposite extreme of excluding all light literature or fiction. Good books may prove too good to find readers, whilst well-selected fiction will encourage a taste for reading, and lead from the seductive narratives of Sir Walter Scott to history, voyages, travels, and biography. The library would prove more useful if the members would read the books aloud in their homes.

Lectures are commonly included in the operations of Mechanics' Institutes, but too often prove failures, sometimes pecuniarily, and mostly from want of attendance. Uninteresting lectures, even if gratuitous, are worse than useless; and attractive lectures are sometimes too costly to prove remunerative. Lectures, however, are too important as a means of giving publicity to the Institute and bringing the members frequently together, to be set aside; but a valuable substitute might be found in those weekly readings which have proved so popular at Ipswich, interspersed with an occasional lecture to vary the proceedings.

The subscription, in some cases too high for the means of the population, is in very many instances too low for the Institute to prove self-supporting, and recourse is

therefore had to spasmodic efforts to replenish the exhausted treasury by contributions from the wealthy. The fault, however, is more commonly in the times of payment being fixed at intervals too long. The rate should be weekly, so as to be within the reach of all in the receipt of weekly wages, with a slight advantage to those who pay for a longer time in advance. Thus the terms might be fixed at 3d. a week, or 10s. a year.

Difference in circumstances will vary details, but in general the following conditions will conduce to success:—

An active, intelligent, persevering secretary.

A committee attentive to their duties, and willing to profit by experience.

Sub-committees to manage the respective departments.

A building adapted to the requirements of the Institute, and where this is unattainable the hire of at least three rooms, two for classes, and one for a reading-room, with the occasional use of a large school-room or public hall for lectures and readings.

Classes for elementary instruction, for mutual improvement in definite subjects of study, and for young women.

A library for circulation, with a fair proportion of well-selected light literature, and the continuous addition of popular works.

Lectures or popular readings weekly.

A class to meet on Saturdays for the practice of sacred vocal music.

An annual examination of the pupils of elementary classes, followed by a public presentation of the prizes awarded, and a systematic preparation of candidates for examinations in more advanced studies.

A rate of subscription within the means of the majority of the inhabitants, but high enough to make the Institution as much as possible self-supporting.

A cordial co-operation of all interested in the Institution, irrespective of individual opinions, and a never-failing hope of ultimate success undismayed by discouragements.

Constant publicity of the proceedings, and a continuous canvass of all the inhabitants.

4.—A Successful Evening Institution. By the Rev. Charles Collier, of the Training College, Winchester.

In a large town* in the North of England, a Young Men's Society, established for several years, began to decay. A few well-disposed young men, thoroughly convinced of the importance of such an institution, if well managed, determined to set about its resuscitation if the managers would grant them permission. Under the peculiar circumstances the old managers could scarcely refuse; and our young friends, having got the necessary powers, commenced in earnest.

After serious discussion, they agreed that the following principles should guide them:—"Useful efforts should be brought to bear on as great numbers as possible." "Men, by nature, have no love for religion, but religious teaching may be made attractive." "All young men have not the same tastes." "Clergymen carry religion along with them." "Young men and young women will meet together, and it is not wrong that they should under proper circumstances." "What people pay for they value." "Young men should be taught apart from boys." The first object of the new committee was to get a goodly number of pupils together; we might, said they, as well teach a hundred as fifty. If we merely instruct in reading, writing, and arithmetic, we shall not get the young men who are in tradesmen's shops and in warehouses. We must provide especially for them. "I don't see," said one member of the committee, who had a taste for music, "why we should not have a singing class and glee club;" "It strikes me," said another, "that if we could have an elocution class, the numbers attending the discussion class held at the White Lion might be diminished." Some seniors shook their heads, but others whispered "Village Hampdens," "Gems in the dark-unfathomed caves of ocean," &c.; and the thing was done. In a short time placards were all over the town, stating that the Institution was to be re-opened for young persons of both sexes over 16 years of age, and that classes were to be formed for the exposition of the Scriptures, and for teaching reading, writing, spelling, arithmetic, English grammar, history, geography, English composition, French, elocution, chemistry, music, drawing, short-hand, political economy, and derivation of words. Payment, one shilling per season. This caught; the work began in earnest, and applications for admission were numerous.

How were the teachers for the high subjects procured? Easily enough. The chemist of the neighbourhood readily gave his services, and was glad to be useful. A reporter for one of the papers was the short-hand teacher. The organist rejoiced to find that his difficulties about a choir might be so easily got over by obtaining a class from the Institute. The schoolmaster gladly gave his assistance in English composition and the derivation of words, because, while teaching others, he improved his own knowledge of subjects which were important but only slightly considered in his ordinary school duties. A young clergyman readily took the elocution class, and, as he happened to be reading political economy, he deepened his knowledge of it by teaching others. "Teaching too much;" "educating young men beyond their sphere," I hear some one say. Nothing of the kind. The chemist talked of air and water, and adulterations, and gave real sound information. The English composition teacher amended the spelling and bad grammar, and such phraseology as, "I take up my pen in hopes," &c., and showed his pupils how to write letters, and conduct business correspondence. This caused an increase of business at the post-office. The political economist talked of wages, and hours of labour, and actually put down many incipient forms of strikes; and the French teacher delighted his class by causing them to lisp in French at once, with the aid of Dr. Ahn's little books. The short-hand teacher caused many to go to church to try their powers, and doubtless many who went to write remained to pray. The elocution teacher impressed upon his pupils the importance of correct pronunciation, and thus had an opportunity of correcting the *patois* of the neighbourhood. Every teacher of the higher subjects, as they were called, took care to keep down the vanity of his pupils.

But what about the young women? They met in the same room, were taught in the same class, and sat on the same form with the young men. And no harm done? None. Nothing objectionable occurred from this arrangement while the writer was connected with the institution. The teacher (because a good teacher) kept his class interested. When the lessons where over, the young women left the room first; but that arrangement was merely to prevent disorder in going out, not to prevent their meeting. The presence of the females had a beneficial effect on the morals of the young men. The latter saw that they were trusted, and it inspired them with honour; and I verily believe that, if any young man had, in the slightest degree, abused this confidence, he would have met with a sound castigation at the hands of his indignant companions. But they would form connections? Yes, so they will anywhere, but better it should be in a Christian Instruction Society than in a beer-house or dancing saloon.

One rule in the new management was that the lessons should neither commence nor end with prayer. The Exposition Class alone formed an exception to this rule. Many who were somewhat opposed to this at the first, found that the proposal was not so extravagant as they supposed. The new committee said—"Clergymen will be amongst our teachers; and, under any circumstances, a clergyman will be at the head, or connected with, the management of the society, and will visit us occasionally. All clergymen, whether as teachers or visitors, should,

* Sheffield.

and in fact do, carry religion about with them. Just as that educational scheme is contaminated which has men of vicious character in its management, so any educational scheme which is supported by clergymen receives therefore a religious tone. "We won't," said the committee. "hold out a secular bait to win men to religion. We shall speak freely as clergymen, or as religious laymen, on any religious subject that may arise, and we will introduce, if we think well, religion in our teachings; but it shall not be formal; we will pray for success on our labours, being fully assured that no good can arise without it; and we will induce these young people to do the same, but it shall be by showing them the results of Christianity in our own character; and we will not cause any to stand aloof by our conducting the institution so as to lead youth to consider that, in absenting themselves from it, they were only absenting themselves from a strictly religious society."

The teaching was divided amongst numbers, and hence no one was over-burdened. If it were known that any person, well-disposed towards such institutions, had made progress in the study of any particular subject, he was asked to take a class in that subject. Hence young men were got to join the society, who otherwise might have been lost to it; and men had also an opportunity of making use of talents which otherwise would have been hidden. Lectures were not positively discouraged; but they did not receive that attention in this society which they receive in others: not more than five or six were given during the year, and they were rather interesting than learned. It was thought that attendance on such lectures as those usually given in Mechanics' Institutes was really a waste of time to the student; real study is the best thing for him, and he soon finds that out, when he has once commenced in earnest. Another feature of the society was an assemblage of all the members on the statute holidays (as the fair, &c.), at an evening party, where tea was provided; after which pieces of poetry and extracts from speeches were recited. The interval was filled up with songs and conversation. This meeting was invariably presided over by the secretary—a clergyman. During the summer season a railway excursion was made to some interesting spot, and the friends of the students were allowed to accompany them. The formation of a cricket club was encouraged, and practice in that fine game took place occasionally. The Scripture exposition class was opened by the teacher reading a selection from the Church Collects, and was closed in the same way, with the addition of the blessing. A book of Scripture was expounded, and an opportunity of asking questions was given. Sometimes a specific list of interesting points of Scripture was treated in the same way. The students were much interested in this class, especially when the teacher gave them real information, not a cursory practical exposition, but real matter which was the result of study, real exposition, and explanation. Young men easily find out shallowness in their teachers, and see whether they are well primed with matter or merely skimming the surface and filling up the time. Questions were freely asked. Several rooms were occupied with classes, and occasionally two classes were held at the same time in one room. A general superintendent was appointed every evening to overlook the whole work. The time occupied by each class was one hour; and, as the hours were from seven to nine, every young person had an opportunity of attending two classes each evening. Usually two or three of the more intelligent students were placed on the committee of management. The continued healthy existence of this society, and the palpable benefits resulting from it, seem to demonstrate the possibility of interesting our young men and women in the work of education. An opportunity was given to them of cultivating their particular tastes, and religion was really taught them without the exhibition of any formal religious machinery. Every youth knew that he was a member of a religious society, and was taught by religious men; and I fully believe that every teacher went to his work fully impressed with the truth that by no mere schemes, however clever, could youth be influenced for good, unless those schemes were seasoned with prayer and aided by the Holy Spirit.

The Society has been eminently successful. In the last account which the writer received of its operations, he learnt that 400 or 500 young men and women over 16 years of age were regularly attending its classes. Many of the students have become attendants at church; some are Sunday and night-school teachers, and several have gained the certificates of the Society of Arts. A new building for the use of the Society has been recently erected, and all expenses incurred in its erection and fitting up have been paid.

5.—Penny Readings. A Paper Drawn up by the Hon. and Rev. S. Best, from Materials Furnished by Mr. T. S. Gowing, of Ipswich.

Any one who, to a village population, would undertake to read aloud the newspaper of the day, might collect a willing and attentive audience, and be well repaid for his time and trouble by the thanks of his company, and by the satisfaction of knowing that he was gradually weaning them from resources of a more doubtful character, and perhaps leading them on to appreciate the value and the pleasures of education.

The "Penny Readings" (so called from the admission fee), which have been established with remarkable success by Mr. Thomas Shave Gowing, at Ipswich, have contributed largely to the financial and general success of the Mechanics' Institute of that town, as well as to several of the local charities.

The conditions which Mr. Gowing lays down as indispensable are:—

1st. That the pieces should be varied in character, complete in themselves, and so arranged as to afford by contrast mutual relief.

2nd. That no piece should exceed half an hour in length, while the majority should be much shorter.

3rd. That purely didactic pieces should be introduced either at the beginning, when the senses of the audience are fresh, or towards the middle, when a certain amount of repose may be advisable.

4th. That learned and far-fetched allusions should be resolutely sacrificed, as well as all unnecessary or questionable passages.

5th. That every thing should be read with well-considered expression, so as to bring out clearly the descriptive beauties, the passion, the pathos, or the mirthful excitement, characteristic of each passage.

6th. That the aim should be to reach men more through the imagination and the feelings, than by direct didactic instruction.

7th. That more than two or three untried readers should not be introduced on the same evening,

The readings are weekly; and in 13 evenings of the 1st session, 28 readers read no less than 102 carefully selected pieces from a great many of the best authors. The choice of the pieces has been left almost entirely to the readers; care only being taken that at least a fortnights' readings should be arranged beforehand, so that they may be duly studied, with the view to the spirit of the author being drawn out, and the piece being read effectively.

Mr. T. S. Gowing will be glad to give information to any one desirous of trying the scheme. Mr. Best adds—In the Abbotts Ann reading-room, a scheme very nearly similar in its chief characters has been carried out during the last year very successfully. It consisted in each good reader choosing a short piece of prose or poetry, according to his taste, and reading it in turn.

One evening in the week has always been devoted to a meeting of the members, or rather set apart for the special purpose of mutual instruction or entertainment. At these

meetings Plays of Shakespeare have been read in parts, several of Scott's poems have been read, and some of Miss Yonge's tales, as "Ben Silvester's Word," &c.; but, lately, as a variety, the plan of selected pieces has been adopted, and with success.

6.—The Wimbledon Village Club. By the Rev. W. A. Bartlett, of Wimbledon.

To go to matters more connected with education, there is here, in about the centre of the parish, an excellent and handsome lecture hall, connected with a reading-room and Working Men's Club, in which lectures are given every fortnight during the winter months. But the most successful thing amongst the working men has been the Penny Readings, such as have been instituted by Mr. Gowing, at Ipswich, and by Mr. Erskine Clarke, at Derby. The readings consist of some half-dozen selections of about 10 minutes to a quarter of an hour each, by different gentlemen, interspersed with music, and they have been the means of cramming the lecture-hall with genuine working men to the very doors, so that, reckoning a few sixpences from the richer portion, as much as £5 a night has been collected from these single pennies.

7.—Lectures in Course. By the Rev. C. Whiting, of Winchester.

I beg leave to offer a few remarks upon a plan which, if it could be carried out—and I think it might be—would tend to render lectures, especially to village Institutions, means of systematic instruction and intellectual discipline, rather than as they are too frequently now, desultory (however laudable) amusements. Something like what I have in mind, I think has been hinted at in proposing lectures in course, rather than singly. My idea goes still further. Suppose an institution or school in union should make an arrangement with a lecturer for delivering a course of lectures, weekly or bi-weekly, on some given subject, *e.g.*, one proposed for the next Examination of the Society of Arts, or the Southern Counties Association, and that a a class of young men or boys could be induced to undertake to attend (in addition to the usual audience) regularly at such lectures, I think one great objection to lectures in general (their incomplete desultory character, as means of instruction) would thus be removed.

Such a plan, too, would combine many of the advantages both of the lecture and of the lesson in a class; and the lecturer should take care that his subject should be so handled as to convey permanent instruction as well as temporary gratification. It would be still better if he could induce his class of regular hearers to place themselves in the position of students, and give him abstracts, &c., from time to time of the lectures. By these means they would be preparing themselves for the purposed Examinations, and also give a stimulus to the evening school, the library, or any other Institutions in their village or town.

8.—The "Parish Magazine." By the Rev. Erskine Clarke, of Derby.

The idea which has been worked out in the *Parish Magazine*, was at first suggested to me, at Christmas, 1857, by the elder lads of my Sunday school, when I was taking counsel with them as to the ways by which I might hope to make a little society, which I was going to start within my school, effective.* These lads suggested several plans, and amongst others that we should have a magazine. I referred them to the multitude of existing magazines, but they said "one of their own" would be quite a different thing.

As I did not wish to discourage them by neglecting any feasible suggestion, I said I would print a magazine for them, but that, as I knew it was expensive, I would not pledge myself to issue it every month, or to go on long; so the magazine was never numbered, but only had the month upon it. However, I found it so useful that I went on every month for the year 1858, esteeming the expense of it well repaid by the interest of my scholars in it, and the help I got from it in putting notices of parish matters on the wrapper.

This little venture, which was quite private, confined to my own parish, or at least to Derby, led me, as the year 1859 drew on, to mature the plan of the *Parish Magazine*. I thought that as I had to use the scissors and paste of the compiler, for my own parish, I might make the same labour available for my brother-clergy. I talked over the scheme with several London publishers, who thought well of it. I offered the notion and my own free services to the secretaries of the Society for the Promotion of Christian Knowledge, but they declined the venture, on the score of the risk involved, though they acknowledged that t ey ought to have a serial.

I was therefore obliged either to give up my scheme, or to run the risk of it myself. I felt so sure of the value of the plan, that though I was diffident of my own editorial capacity, I determined to make the essay. I did so, and met with considerable success; but, from inability to look into the minute details of the printing, I came out of 1859 scathed to the extent of about £200, though this amount is gradually being somewhat diminished by the sale of the surplus stock of volumes for 1859, which represents part of that sum.

At the end of 1859, I wrote to several of those clergy who had used the Magazine in their parishes, to ascertain whether it was worth throwing good money after bad by carrying the Magazine on for another year. A few extracts from their replies I venture to subjoin:—

From Rev. W. Walsham How, Rector of Whittington, Oswestry, and Rural Dean.

"I consider the *Parish Magazine* as an exceedingly useful and interesting publication, which may be made a most valuable means of communication between a clergyman and his flock, and a bond of union between the churchmen of the parish."

From Rev. J. Reynold Young, Rector of Whitnash, Leamington, Rural Dean.

"I have found your Monthly Magazine very acceptable, and I think very useful in my parish. Our population does not exceed 300, but we sell six dozen copies from our little village shop, and a still larger number among our personal friends. I print the exterior sheets at a small private press in my own house, and they form a convenient vehicle for our parish and local news, for notices of church services, collections, missionary, and other meetings. Such information, with extracts from letters and journals of those connected with us who have emigrated, or who have been engaged in military service abroad, is much appreciated by our villagers."

From Rev. E. Jacson, Rector of Thruxton, Hereford.

" . . . I have in my own parish found it to be of vast use, not only as a means of binding together and consolidating one's people, but also as a decided and visible help to churchmanship.

"I found the local cover to be of great use, as well for inculcating quietly, and without preachment, our Church's doctrine and practice as suited to one's own reading and views, as for circulating parochial notices, &c. I believe I have been saved money by means of these notices, so that in all ways I am delighted to take it in, and my people so too, for they look with pleasure and anxiously for each new number. *Expertus dico.*"

From Rev. A. L. W. Bean, Incumbent of Sowerby, Halifax, Yorkshire.

"I find it useful for the publication of balance sheets, which gives confidence to the people, while it encourages among them a spirit of more unhesitating liberality towards local and other charities. It offers also increased opportunities for making generally known the state of educational progress in the schools. It brings too a population of thousands continually into some sort of wholesome contact with their pastor."

From Rev. Frederic Southgate, Vicar of Northfleet, Kent.

"I have found the *Parish Magazine* a most useful means of communication with one's parishioners, and at the same time affording an opportunity of putting sound and useful reading within the reach of all. I should be sorry to be deprived of it. There are three ways in which it is very useful :—

1.—As providing sound and useful reading.

2.—As enabling a clergyman to speak to his people collectively on many little matters which would be out of place from the pulpit.

3.—As a medium for the publication of yearly accounts of schools and charities—catalogue of lending library, &c., and thereby saving a large sum for printing, which would otherwise have to be incurred."

From Rev. J. Hodgson Iles, Pector of St. Peter's, Wolverhampton.

"The circulation of the *Parish Magazine* in St. Peter's parish has, so far, been successful, and seems likely to continue so. We print our own covers, and find them very useful in conveying information respecting parish matters to our people. I hope that the Magazine will not be discontinued for want of the support which it so well deserves."

To these testimonials of my friends I can add my own, for I always printed a local cover for my own parish, and have found it of great use both to my own people and myself. The monthly calendar, which I print on it, is used regularly by all the really religious persons in the congregation; and so they do not fix their dinner parties on the very day when there is a missionary meeting or service in church, as often used to happen. Moreover, they are saved from many accidental forgettings of public engagements. Socially, too, this calendar has another advantage, of some moment in a large town, viz., that one's parishioners consult it before inviting one to their house, and so I am now saved from writing those notes of declinature of invitations, which it is so difficult to do without giving offence, or without seeming to make a fuss about our parish work, as if one was busier than one's neighbours.

Another important use of the cover is for annual statements of the school and other accounts, and for a quarterly statement of the weekly offertory and other charitable funds. It verges on the absurd, but the poor do often verily believe that money thus collected goes into the parson's own pocket.

At the end of the year, the twelve local covers form an interesting record of the work and progress—the short and simple annals of the parish for the twelvemonths past.

I do not myself see many of the local covers that are printed in the sixty parishes, or thereabouts, which "localise" the Magazine; but, from covers that I have seen, it is manifest that the plan is capable of very varied adaptation.

One clergyman has printed the old deeds and records in his parish chest; another gives elaborate reports of cricket matches; a third, in a large town, gives riddles and puzzles for the young, and gives the initials of all who send in right answers to the rectory before a certain day; another gives a record of all weddings, deaths, and baptisms (not births, for thus some are led to bring the infants to the font at once, instead of delaying it, as is so common). The insertion of deaths gave much satisfaction, and one old man came to the clergyman, and asked if his old wife's name might not be put in, as she had only died two months before?

Another clergyman has given an interesting little local history in the consecutive covers; and another, I believe, has used it as a sort of registry for servants.

As to the expense, this varies widely, according to the amount of local matter printed, and the number of copies circulated. I print, in my own parish, three pages every month; about 200 are sold, and I lose on them about 3s. a month. If I printed less matter, or sold more copies, I should be at no loss; but I consider that the 3s. is well laid out, and saves me more in the year, which I would otherwise have to pay for handbills, besides doing the work better.

As to the central part of the Magazine, two points may be noted. At first, I wished to provide only pure and harmless light reading, leaving the clergymen of each parish to print his own doctrinal and distinctly religious teaching on the cover; but I found that this caused difficulties. Some clergymen only put the name of their parish on the covers, without printing any religious teaching, and then the dissenters laid hold of it and said, "Here's the book your parsons put out; not a word of religion in it." I was therefore obliged to commence, with this year, to give distinctly religious teaching, and I thought it better to do this with an honest sermon, than with sermonising articles with eye-catching titles; for I agree with old Queen Charlotte, "If I must have sermon give me sermon, and if novelle give me novelle."

The other point on which I had to yield to the prejudice of my readers, suggests rather a curious truth, I fancy of pretty general application. I took great trouble to get leave, from Mr. Dasent, to extract one or two of his "Tales from the Norse," which I had found most mirth-provoking at some large parish gatherings. But no sooner did these hapless Norse tales appear, than I found that, instead of a treat for my readers, I had pickled a rod for my own back.

The notion of there being "anything to laugh at" in the Magazine, seemed to be a grievous error, and in several parishes the Magazine literally "died of laughing." People, while they laughed, thought the stories childish and silly.

And I think that this suggests a trait in the poor man's character, well worth our consideration. He reads little, and with difficulty—generally only when he is sick, or on Sundays, and so he counts that his reading should be of a serious and solid kind. He takes little, and so he likes it strong.

This, I think, accounts for the large and continuous sale, by book-hawkers, of religious and devotional books; I think, too, that this is a view of reading which we should do well by degrees to attempt to improve, and to persuade him, while he uses religious books no less, yet to learn to enjoy a book as a companion to talk to him, and make him smile now and then, just as we enjoy a book ourselves.

The book-hawker's cart ought, it seems to me, to be to the peasant what the box from Mudie's is to the squire; and till our book-hawkers sell a larger number of recreative books, I shall doubt whether they are doing all the good they might do.

As to the circulation of the *Parish Magazine*, it is at present about 15,000, and steadily increasing, a large and satisfactory circulation, I allow, when viewed by itself, but extremely minute when put beside the 450,000 of the *British Workman*—minute, too, when compared with the vast issues of the *Sunday at Home* and *Leisure Hour*—wofully minute when compared with the tens of thousands of the weekly penny numbers of the *Family Herald* and *Reynolds's Miscellany* school.

But still, though minute, I trust the *Parish Magazine* is doing some humble service for the cause of Christ and His Church in this land.

9.—The "Parish Magazine." By E. Baker, of Kingsworthy.

The Rev. Erskine Clarke, of Derby, has published, for some years past, a novel, ingenious, and useful work, the *Parish Magazine*. Its title page is so arranged that it can be adapted to any parish or district. The central sheets, (now increased to twenty pages 8 vo.) are supplied by the publishers, Messrs. Bemrose and Sons, Iron Gate, Derby, at 9d. a dozen. Matters of local or general interest, can be printed on three or more pages of the cover. The plan is applicable to the largest and smallest parishes

Eighty parishes in different parts of the country have adopted it, and have their own names insterted in the title, with a wood-cut of the local church or other public building. The undertaking may not always be entirely self-supporting; but a local printer, by supplying several parishes, might furnish the magazine in its local covers at no great cost over the return of 2d. per copy. The publishers of the magazine at Derby supply the local covers at a somewhat liberal rate, which may be ascertained on application. They do not include the cost of carriage.

Those who have time and means can be their own printers. Messrs. Holtzapffel and Co., of 64, Charing-cross, London, furnish a complete printing apparatus, "The Folio," for £27 13s. 6d. I have not seen it, but a smaller one by the same makers has been in occasional use here for some years past. If a local printer could be induced to enter into the spirit of the thing, no great expense need be entailed.

10.—"The South Staffordshire Educational Union in connexion with the Society of Arts." By the Rev. J. P. Norris, one of H.M. Inspectors of Schools.

In establishing the South Staffordshire Educational Union in connection with the Society of Arts, our purpose was to stimulate and organise the efforts which the young men—clerks, shopmen, and operatives—of the South Staffordshire mining and manufacturing district were making to provide themselves with evening instruction. Our model was the Union of East Lancashire Institutes, which Sir James Kay-Shuttleworth has formed, and for four years most successfully carried on.

The principle on which these Associations (the East Lancashire and South Staffordshire) are founded are these:

1. Private study requires to be stimulated and tested by periodical Examinations by some competent authority.
2. Such periodical Examination should be preceded by a regular course of class instruction.
3. The organisation and right direction of these classes of evening instruction in Mechanics' Institutes and elsewhere require the services of a professional organising master, who shall devote himself exclusively to the work.

The periodical examination we found in the Society of Arts scheme of local examinations and diplomas ready made to our hands.

The evening classes we found already existing to some extent, and capable of further extension, in the Mechanics' Institutes, Working Men's Colleges, Athenæums, &c., of Wolverhampton and the neighbouring towns.

The organising master we had to supply.

This last element we all felt, and Sir James-Kay Shuttleworth's Lancashire experience proved to be the essential condition of success. Once get the right man, an educational apostle, and send him with large discretion into the district, and all the rest would follow. His personal persuasions and explanations and counsels would be far more effectual than printed circulars or public meetings. We found one man, one who had been a trained and certificated schoolmaster, and had of late been engaged in a large middle-class boarding school, with a knowledge of mechanics, chemistry, and applied science, and, which was most important, in fact, indispensable, to his success, with a good address and a conciliatory temper.

The next question was how to pay him.

We raised among the noblemen and influential manufacturers of the district promises of annual subscriptions for three or four years, sufficient to guarantee him a minimum salary of £100, besides £20 as composition for travelling expenses. We then told him that he must go among the Institutions and make his own terms with them (graduating the fee for his services as organising master according to the frequency of his visit and the size of his classes) and we stipulated that one-half of the fund so arising should be retained by himself in augmentation of his salary, over and above the guaranteed £100, and the other half should be paid over to the Board. By this plan we intended to give him a pecuniary interest in the success of the scheme, and also to provide for its becoming more and more self-supporting as it advanced.

Thus the thing was floated. Mr. Jones entered on his duties in the summer. He began by visiting gratuitously every educational institute in the district that had evening classes, and by offering his services, and where they were accepted making arrangements as to terms, &c. Some engage him to visit them once a week, some once a fortnight. On his arrival at any evening class, he suggests a course of reading, gives the local teachers hints as to better methods of instruction, and tells them that he shall bring with him at his next visit examination papers in the week's or the fortnight's work. He is able to visit two and sometimes three classes in an evening. His mornings are taken up by correspondence with secretaries, preparing and revising examination papers, and occasional lectures on the Society of Arts scheme of examinations.

At the close of each week he sends his diary to the Secretary of the Board, in which he specifies how many classes he has attended, the numbers in attendance at each, the subjects of instruction, and also how his mornings have been occupied, and his addresses by post for the ensuing week. We think this diary important, as furnishing useful information to the Board, and conducing to a methodic employment of the organising master's time.

Those parts of our scheme which belong properly to the Society of Arts, I need not describe. Our Board is one of the Local Boards through whom the Society carries out its plan of local examination. As such, our Board undertakes to hold each year a preliminary examination of candidates for admission to the Society's examinations; to weed out thereby those who are clearly disqualified to pass on to the Society's examination, and then, two months later, to hold on behalf of the Society their annual Examination, sending the papers, under their guarantee as to fairness and honesty of work, to London for decision. To these ordinary functions, which belong to it as one of the Society of Arts' Local Boards, we have added the machinery of the organizing master, and it is this addition which characterises the South Staffordshire and East Lancashire Unions.

(*To be continued.*)

CITY OF GLASGOW PRIVATE TELEGRAPH EXTENSION.

A meeting of merchants and manufacturers belonging to Glasgow was held Oct. 18th, in the Religious Institution Rooms, to hear a statement from Mr. Holmes, Electrical Engineer of the Universal Private Telegraph Company, in reference to the establishment of private lines of telegraphic communication over this city. The Lord Provost presided, and introduced Mr. Holmes to the meeting.

Mr. Holmes said that the object of the Telegraph Company which he represented was to enable merchants and manufacturers, and public offices in towns, to have a private means of communication of their own. Hitherto, in all the lines of telegraph, they were obliged to make use of public wires, of public offices and clerks. In order to obtain privacy of communication, the company he had referred to had been formed in London. Instead of having wires as in ordinary cases, they suspended from posts a rope containing a multitude of wires—perhaps thirty, or, if that was not enough, forty or fifty, or more. One feature of such a plan was, that all parties could have a telegraphic communication at a very reasonable rate. The expense of erecting telegraphs according to the patent system, was about £65 per mile; but by the plan proposed by the new company, of multitudinous wires, parties were enabled to rent a wire at a sum of £4 per mile per annum. Therefore, merchants residing one, two, or three miles from their places of business, or having places of business

so far apart, could have private communication at either £4, £8, or £12 per annum. Another great feature connected with the establishment of this company was, that the apparatus was so simple, that parties required no instruction in the use of it. To send a message it was only necessary to press the keys opposite any of the letters of the ordinary English alphabet, which are marked on the index, and by turning a little handle the message was immediately transmitted to a corresponding instrument at the other end. Another thing connected with the instrument was the total absence of battery power, the current being produced by turning a piece of soft iron near a magnet. The power being so generated, and the magnet not being liable to deteriorate, the instrument was at all times in perfect order. Parties might leave their houses for six months, and when they went back they would find it in order. The police authorities in Glasgow had decided on having private telegraphs erected between the several stations, and it was desirable that the merchants and manufacturers should co-operate with them. Thus, for example, if the merchants in Calton were to co-operate with them, ropes, with a sufficient number of wires, could be laid down at once, so that the business might be a paying one, and the London Company induced to erect them. His object in calling the present meeting was to give the public an opportunity of becoming acquainted with the undertaking, and of taking advantage of it. He might mention that, besides the Glasgow Police authorities, the Loch Katrine Water Commissioners were also very favourably disposed to erect wires in the direction of Mugdock, and if they agreed to do so the manufacturers in that direction would be looked to for co-operation. As many of the merchants and manufacturers would, no doubt, co-operate with the police, he believed that within the next three months there would be from 180 to 200 miles of wire erected in Glasgow. A local board would be formed in Glasgow, both as a guarantee, not only to the directors and shareholders, but also to merchants, that the line would be carried out. He therefore trusted that the merchants who should take an interest in the company would nominate a board of influential merchants to look after the interest of the company. In Manchester, Mr. W. Fairbairn, the eminent engineer, had consented to carry out the principles of the company, and Professor Wheatstone had undertaken the management in London. Mr. Reuter also intended to have wires erected between his office in the Exchange and all the principal newspaper offices in London; and it was also contemplated to lay wires from the Houses of Parliament to the several newspaper offices in the same way. In London all the stations were being connected, and lines of communication were being extended in every conceivable direction. In Glasgow many of the leading firms had already consented to co-operate with the police, and no fewer than twenty-three of these firms had become shareholders in the company, not only because they approved of the system, but also on public grounds, that there might be no doubt of its being carried out. Mr. Holmes then proceeded to show the manner in which the instruments were worked, and in answer to questions by several gentlemen, stated that each wire was insulated, and it was impossible that the message could be transmitted to any other but the place for which it was intended, and that the charge of rent already mentioned covered also the use of the instruments.

Home Correspondence.

PRESERVATION OF STONE.

Sir,—Having had the honour of reading a paper in the rooms of the Society of Arts, on the subject of "Building Stones," &c., in the course of the last session, in which paper I ventured to express a very decided opinion in favour of Mr. Ransome's process for the preservation of that class of materials, I venture to address you a few remarks upon the subject of the Silicate Zopissa. The practical observations I have recently been able to make upon the various processes now before the world for the purpose of preserving stone, may, perhaps, also be of a nature to excuse me in thus trespassing upon your space; because the effects of the continuous rains of the last twelve months have been such as to display, in an unexpected light, some of the accidents to which this particular class of operations is exposed.

With respect to the Silicate Zopissa itself, which is said to be a secret composition, I would observe that, from some careful analyses made of stones prepared by Mr. Szerelmy, I am disposed to believe that the process adopted in its application consists in washing the stone, firstly, with a solution of the silicate of soda, in which there is a large quantity of mechanically comminuted silica; this is followed, I believe, by a second wash of the silicate of soda of a purer nature than the last, and without the mechanically suspended silica. A third, and sometimes a fourth wash, composed of the oxide of zinc, mixed with linseed oil, some bituminous substance (perhaps the heavy oil of tar), some size or glue, and a silicate of soda in small quantities, are then applied to finish the preservative coat. It is possible that the above description may not literally correspond with the details of Mr. Szerelmy's process, in every recent instance; because that gentleman has constantly modified his methods of treating stone, as may be proved by a reference to his patent, taken out and sealed, 17th March, 1857; and the operations lately carried on in the courts of the Houses of Parliament would really appear to indicate that his mind is hardly yet made up on the subject of the best preparations to be used. The analysis of one of Mr. Szerelmy's most recent works has, however, yielded the results I have quoted; and the actual appearance of the stonework so treated, confirms my belief in the correctness of the chemical examination. Dr. Faraday's observation, in his letter to Mr. Bonham Carter, that the stonework he examined had been treated by some alkaline solution of silica, protected by a subsequent bituminous coating, is an additional confirmation of this belief.

Now, without dwelling on the absolute correctness of the analysis, and judging only from Dr. Faraday's statement, and the results of the application of Mr. Szerelmy's Silicate Zopissa to the Houses of Parliament, I have no hesitation in saying that my recorded opinions on the subject of the preservation of building stones have not been modified by what I have recently seen, and I still believe that Mr. Ransome's process is both theoretically and practically the best for attaining the desired object. Mr. Szerelmy's process, in fact, consists simply in an attempt to protect the silicious solution until its combination with the subjacent stone shall have been completed; or in the addition of a bituminous coat to the solutions long since used by Kühlmann, with very unsatisfactory results. We know practically that the combination between the lime and the silica thus added is a very slow process, one which, if it ever takes place in the case of the magnesian limestones, is not effected without the intervention of years. In that time the protecting coats used by Mr. Szerelmy are tolerably sure to be removed by atmospheric action, especially upon walls exposed directly to the sun's rays; and this has actually been the case in the courts of the Houses of Parliament, where Mr. Szerelmy's Zopissa may be literally swept off by the hand. The stone in these courts may also be observed to have decayed about the zone of alternate dryness and humidity to nearly the same extent as the unprotected stones, but it would require the guidance of a person well-acquainted with the previous state of the courts to enable a stranger to identify the correctness of this assertion, so carefully have the disintegrated stones been covered by recent applications of Mr. Szerelmy's solutions. The same thing has also occurred upon the specimen bay executed by that gentleman upon the river front of the Houses of Parliament, and an inspection of the state of the upper part of the inscription, under the string moulding of

the first-floor, would suffice to convince any competent observer that there, at least, the progress of decay had not been arrested. A comparison of this portion of the two specimen bays would, in my opinion, justify me in arriving at the conclusion I have done with respect to the merits of the two processes now brought so prominently before the public.

The singularly wet season we have lately gone through has convinced me that much of the success of the processes for the preservation of stone depends on the previous dryness of the stone itself, and upon the absence of heavy rain during the early periods of the application. In both the specimen bays of the river front of the Houses, the solutions have been actually washed out of the stone in the positions especially noticed by Dr. Faraday, and the same thing has occurred to my own knowledge in other cases. But there is this difference in the practical effects of the removal of the two solutions, viz., that the second applications which are required produce very different results upon the artistic character of the work. Ransome's process leaves all the material it introduces in the pores of the stone. Szerelmy's is all left upon the surface, and the most careless inspection of the courts of the Houses would suffice to show that ultimately the surfaces thus treated become as much obliterated as though they had been covered with common whitewash. Be this as it may, it seems to me now to be proved that whatever process may be adopted, there is a constant danger of its being removed in the early periods of its application; and that, therefore, it is more than ever necessary to refrain from judging of the result of any of them from an examination of a specimen executed within six months. A much more correct opinion as to the merits of the processes of the specimen bays could be formed now than possibly could have been formed by Dr. Faraday and Sir Roderick Murchison; a still more correct one would be formed about this period next year. The recorded opinion of those eminent scientific men upon their own admission is to be received with caution, because it was confessedly arrived at on "short and inconclusive evidence," and because the results were sought for in the wrong place.

The author of a letter in the *Times* of this day, signed "An Architect," was quite right in his opinion that the whole of the subject ought to be remitted to a competent tribunal. The subject is of itself of vital importance to all who are connected with the arts of construction; and all architects and engineers must desire to see it withdrawn from the vague and unsatisfactory state which at present allows the possessor of secret processes to thrust his inventions or plagiarisms upon the public.

I am, &c.,
GEO. R. BURNELL.

October 24th, 1860.

Proceedings of Institutions.

Glasgow Mechanics' Institution.—The Society of Arts' certificates, gained by the students attending this Institution, were distributed in the hall of the Institution on the 18th Oct. Among those present were—Bailie Couper, Professor Anderson (chairman of the Local Board), Dr. Johnston, Dr. Wallace, Mr. D. More, Mr. Ascroft, Mr. Mitchell, &c. Professor Anderson distributed the certificates, which he remarked were more numerous, and of a higher class than last year. He then expressed the great gratification with which he had attended on this occasion, and on the previous one last year. He was glad to say that the candidates of this year had not only supported the position the Institution had formerly reached, but had attained for it a higher position than that which it before possessed. The result of this examination had been to place the Glasgow Mechanics' Institution in the first position of all the Mechanics' Institutions in the country. Not only had the number of competitors been large, but the proportion of successful candidates to the entire number of those examined had been high, and likewise the class of certificates obtained had been very high. They had obtained a larger number of first-class certificates than any other Institution. The Glasgow Mechanics' Institution had obtained 17 first-class certificates; the Institution which stood next in position had obtained 9; and that which stood in the third place had obtained 6. The Glasgow Mechanics' Institution had obtained 22 second-class certificates; that which stood second, 15; and that which stood third, 14. The Glasgow Mechanics' Institution had obtained 19 third-class certificates, while the next Institution had obtained 27. The candidates of this Institution had also obtained four money prizes—three of £5 and one of £3; and the Institution next in order had obtained three such prizes. The Institution itself had likewise received its proportion of prizes. The learned professor then addressed some observations to the successful candidates, and concluded by expressing his regret that the Institution was not taken more advantage of than it had been by those for whom it was more especially intended—the mechanics of the city. Mr. Thomas Johnson moved,—"That, the first place in the Society of Arts examinations being attained by the students of this Institution, while in itself highly honourable, ought to stimulate to still higher efforts in their educational progress." Mr. D. More seconded the motion. Professor Anderson proposed a vote of thanks to the teachers and lecturers, which was seconded by Mr. Holmes. The meeting was afterwards addressed by Dr. Wallace and Bailie Couper, and concluded with a vote of thanks to the chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Royal Inst., 2. General Monthly Meeting.
Medical, 8½. Dr. B. W. Richardson "Contributions towards a more perfect Clinical History of Scarlet Fever."
Wed. ...Geological, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 26th*, 1860.]

Dated 20th September, 1860.

2284. D. Jones, Machen, Newport, Monmouthshire—An improved method of, and apparatus for, raising water and other liquids.

Dated 21st September, 1860.

2303. R. Smith, Islington—Covering of iron, wooden ships, yachts, steam boats, and barges bottoms and outsides.

Dated 26th September, 1860.

2332. J. Ferrabee, Phœnix Iron Works, Stroud, and H. Ferrabee, Camberwell, Surrey—Imp. in apparatus for lighting, heating, ventilating, and cooking by gas, and part of which invention is applicable to heating apparatuses of other descriptions.

Dated 2nd October, 1860.

2372. G. Rutter, 16, Great Guildford-street, Southwark—Imp. in machinery and apparatus for and in treating flax, hemp, Rheea, China grass, New Zealand flax, plantain, and all other vegetable and animal fibres.

Dated 3rd October, 1860.

2394. E. T. Hughes, 123, Chancery-lane—Imp. in healds or heddles employed in looms for weaving. (A com.)

Dated 4th October, 1860.

2404. J. Sootheran and J. Carr, Pickering, Yorkshire—Imp. in reaping machines.

2406. H. Fley, Cross-street, Wilderness-row, Middlesex—Imp. in signal lamps.

Dated 5th October, 1860.

2414. A. Brocchi, Rue Racine, Paris—An improved waterproof cement or composition.

Dated 6th October, 1860.

2418. W. S. Parkes, West Bromwich, Staffordshire—A new or improved washing machine.

2420. W. Kennard, 19, Southgate-terrace, Southgate-road, New North-road, Middlesex—Imp. in hanging window sashes.

2422. E. Westhead, Manchester—Imp. in generating steam, and in appatatus connected therewith.

2424. A. Sarjeant, Peckham, Surrey—An imp. in malt liquors.

Dated 8th October, 1860.

2426. B. Samuelson, Banbury—Imp. in harvesting machines.
2428. J. Henson, 13, Parliament-street, Westminster—Imp. in the manufacture of chains for coupling or connecting the carriages, wagons, and other vehicles on railways, applicable also to various other purposes.
2430. S. Whitaker, Liverpool—Imp. in the construction of fluid taps or cocks.
2436. W. E. Newton, 66, Chancery-lane—Imp. in the treatment of ores and coal. (A com.)
2438. J. Calkin, Oakley-square, Mornington-crescent, Middlesex—An improved apparatus for protecting the upper portion of the face from the inclemency of the weather, dust, or otherwise.
2440. W. Clark, 53, Chancery-lane—Imp. in driving straps and belts. (A com.)

Dated 9th October, 1860.

2448. C. Stevens, 1b, Welbeck-street, Cavendish square—Imp. in atmospheric railways. (A com.)
2450. G. W. Reynolds and E. Dance, Birmingham—New or improved machinery for the manufacture of baskets and wicker work.
2452. G. Reid, Liverpool—Imp. in ventilating houses, buildings, ships, and structures generally, and in apparatus for ascertaining the state of the atmosphere in the said houses, buildings, ships, and structures.
2454. J. Chandler, Creek-road, Deptford, Kent—Imp. in glass gauges for indicating the levels of liquids contained in vessels of any kind.
2456. J. H. Tatum, Peele's Hotel, Fleet-street—Imp. in the manufacture of candlewick.

Dated 10th October, 1860.

2464. W. Clark, 53, Chancery-lane—Improved signalling and indicating apparatus. (A com.)
2466. J. Scott, Sunderland—An imp. in the manufacture of anchors, and an improved apparatus to be employed therein.
2468. R. Hornsley, jun., Spittlegate Ironworks, Grantham, Lincolnshire—Imp. in machinery used for washing, wringing, mangling, and churning.
2470. G. F. Stidolph and J. Stidolph, Ipswich—Imp. in organs.

Dated 11th October, 1860.

2472. C. Stevens, 1b, Welbeck-street, Cavendish-square—An improved crinoline protector, or double petticoat. (A com.)
2473. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in furnaces. (A com.)
2474. W. M. Williams, Handsworth, Staffordshire—An imp. or imps. in crayons, for writing, drawing, and marking.
2475. J. Silvester, West Bromwich, Staffordshire—A new or improved steam pressure and vacuum gauge.
2476. T. Wilson, Birmingham—Imp. in paper files or holders.
2477. J. Smith, Abbey-street, and T. Taylor, Wellington-row, Bethnal-green, Middlesex—Imp. in the manufacture of chenille, and in machinery for that purpose.
2478. W. Barker, Cornbrook, Manchester—Certain imp. in steam engines.
2479. E. J. Hanon, Paris—Imp. in the manufacture of vegetable albumine.
2481. J. Coleman, jun., Woburn, Bedfordshire—Improved apparatus for raising and stacking straw, and other agricultural produce.
2482. J. W. Rogers, Peat House, Robert's-town, Kildare—Improved means of, and apparatus for collecting the excrement of towns and villages, and for facilitating the drainage of houses.

Dated 12th October, 1860.

2483. J. A. West, St. Helens, Lancashire—Imp. in treating solutions containing sulphate of soda, also metallic and other matters, and in obtaining products therefrom.
2484. R. A. Brooman, 166, Fleet-street—Imp. in machinery for cutting and packing cigars. (A com.)
2485. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of furniture nails or tacks, and other articles provided with metallic pins or points. (A com.)
2486. W. E. Newton, 66, Chancery-lane—An improved fastening for window shutters and blinds. (A com.)
2487. J. W. Rogers, Peat-house, Robert's-town, Kildare—Imp. in the mode of and apparatus for preparing peat for fuel.
2488. T. Wilson, Birmingham—Imp. in breech-loading fire-arms, ordnance, and projectiles.
2489. B. Rhodes and G. Rhodes, Nottingham—Imp. in machinery and in apparatus connected therewith for the manufacture of bituminous pipes and other articles.

Dated 13th October, 1860.

2490. J. Blackwood and W. Blackwood, Craigton, Dumbarton, N.B.—Imp. in apparatus for washing yarns or threads.
2492. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the production of colors for dyeing and printing. (A com.)
2493. G. Wearing, West Bromwich, Staffordshire—Certain imp. in the manufacture of saucepans formed of cast-iron, and which said imps. are also applicable to the manufacture of general cast-iron hollow ware.
2494. S. Reston, Liverpool—An improved rotatory engine.
2495. W. Clark, 53, Chancery-lane—Imp. in lubricating apparatus. (A com.)
2496. R. A. Brooman, 166, Fleet-street—Imp. in lenses. (A com.)
2497. M. Deavin, Crystal-terrace, Rotherhithe, New road, Surrey—An imp. in gymnastic apparatuses known as see-saws, and an improved mode of working the same.
2499. J. J. Russell and B. L. Brown, Wednesbury, Staffordshire—Imp. in apparatus used for supplying steam from steam boilers or generators.
2500. T. C. Hayward, jun., Highbury-park North, Middlesex—Improved ship's signals, for day and night.
2501. J. Higgins and T. S. Whitworth, Salford—Imp. in machinery or apparatus for preparing, spinning, and doubling cotton, and other fibrous materials.

Dated 15th October, 1860.

2503. G. Davies, 1, Serle-street, Lincoln's-inn—An improved method of, and apparatus for, refrigerating and freezing. (A com.)
2505. C. Brennand and J. Brennand, Manchester—Imp. in ornamenting lappets, petticoats, window curtains, blinds, and similar articles.
2507. C. Stevens, 1b, Welbeck-street, Cavendish-square—An improved machine for cutting out bricks and drain pipes. (A com.)
2509. I. M. Singer, New York—Imp. in the construction and fitting of steam vessels.
2511. W. E. Newton, 66, Chancery-lane—Imp. in tools or machines for the manufacture of certain kinds of metallic tubes. (A com.)
2513. C. Burn, Delahay-street, Westminster—Imp. in the permanent way of street railways.

Dated 16th October, 1860.

2515. J. Bent, Newhall-street, Birmingham, and J. Luckock, Harborne, Staffordshire—Certain imp. in ladies' clasps, and which said imps. are also applicable for connecting or holding waistbands, belts, and other articles of dress.
2517. C. J. Burnett, 21, Ainslie-place, Edinburgh—Imp. in breech or muzzle loading ordnance.
2519. W. E. Newton, 66, Chancery-lane—An improved mode of constructing railways. (A com.)
2521. J. L. Jullion, Tynemouth—Improved machinery for making fences. (A com.)

Dated 17th October, 1860.

2523. F. X. Kukla, Pentonville-road, Middlesex—Imp. in apparatus for heating stoves by gas.
2525. W. Henderson, Alderley-edge, and J. Bown, Alderley, Cheshire—Imp. in obtaining copper, silver, tin, and several other metals, from their ores or any other natural or artificial compound containing one or more of these metals.
2527. J. P. Budd, Swansea—Imp. in the manufacture of terne plates.
2529. W. E. Newton, 66, Chancery-lane—An improved mode of preserving hops and fitting them for storage and transportation. (A com.)
2531. D. A. Leyshon, Brockmoor, Brierly-hill, Staffordshire—An imp. or imps. in coating certain forms or articles of iron, steel, or zinc.
2533. W. Sear, Wolverton, Buckinghamshire—Imp. in cartridges.
2535. G. Young, Glasgow—An improved hemming and binding gauge for sewing machines.

Patents Sealed.

[*From Gazette, October 26th*, 1860.]

October 25th.
1058. J. White, G. White, and J. White.
1065. F. Thonet.
1079. W. H. Samson.
1091. E. T. Hughes.
1144. E. Butterworth.
1162. G. Holcroft.
1163. S. Ridge.
1323. W. S. Nosworthy.
1334. C. Greenway.
1390. J. Jewsbury.
1455. I. Whitesmith & J. Steven.
1482. A. B. Childs.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 26th*, 1860.]

October 22nd.
2796. J. Seithen.

October 23rd.
2707. J. Macintosh.
2708. J. Thom & H. McNaught.
2785. J. Apperly & W. Clissold.
2802. C. E. Amos.

October 24th.
2713. C. de Clippèle.
2768. T. Lowe.

[*From Gazette, October 30th*, 1860.]

October 25th.
2721. J. Newall.
2749. D. Allison and J. Livingstone.

October 26th.
2748. T. Cook.
2752. E. Smith.
2753. G. W. Robinson.
2762. T. S. Prideaux.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, October 30th*, 1860.]

October 25th.
2473. E. J. Hughes.

October 26th.
2551. T. Irving.
2906. S. Messenger.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 9, 1860.

NOTICE TO MEMBERS.

The One Hundredth and Seventh Session of the Society will commence on Wednesday, the 21st inst., when the First Ordinary Meeting will take place. Sir Thomas Phillips, Chairman of the Council, will deliver the opening Address. The Chair will be taken at Eight o'clock on the following Wednesday Evenings:—

1860.	November	—	—	21	28	
,,	December	5	12	19	—	
1861.	January	—	—	16	23	30
,,	February	6	13	20	27	
,,	March	6	13	20	—	
,,	April	3	10	17	24	
,,	May	1	8	15	22	29
,,	June	—	—	—	26*	

The following are the arrangements for the Meetings previous to Christmas:—

November 21.—Opening Address by Sir Thomas Phillips, F.G.S., Chairman of the Council.

*** On this evening the Medals which were awarded by the Council for Papers read at the Weekly Evening Meetings during the last Session, and for articles submitted to the Society's Committees, will be distributed.

November 28.—"On the Acclimatization of Animals." By Mr. F. T. Buckland, M.A., Student of Christ Church, Oxford, Assistant-Surgeon, 2nd Life Guards.

December 5.—"On Electro-Block Printing, especially as applied to Enlarging or Reducing from any Printing Surface or Original Drawing." By Mr. H. G. Collins.

December 12.—"On Italian Commerce and Industries." By Professor Leone Levi.

December 19.—"On the Straw Plait Trade." By Mr. A. J. Tansley.

COUNCIL.

The following Institutions have been taken into Union since the last announcement:—

Glasgow Tonic Sol-fa Union.
Tow Law Literary and Social Institution.
Aldershot Institution.
Longford Young Men's Christian and Literary Association.
Airdrie School of Arts and Mechanics' Institution.
Rotherham and Masbrough Literary and Mechanics' Institution.

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

WARMINSTER CONFERENCE ON ADULT EDUCATION.

(*Continued from page* 829.)

11. — Village Institutions. By the Rev. John Bacon, of Woodlands, Berks.

The education of the agricultural poor is difficult. The early age at which they are removed from school almost neutralises its benefits; our only chance, therefore, is with the adult. The trial has been made with varying success by night schools; their benefits are not limited to the learning gained by the adult. Let us inquire not merely what he has gained, but from what has he been withdrawn? His daily life is known—his labour done, what has he, poor fellow, to turn to? In winter, if he is happily married, and more than usually domestic, his cottage may shelter him till he goes to bed; but otherwise, if hired for the year, a carter's boy, "fagger," or shepherd, his only shelter is the dark loft common to all, where the best of masters cannot allow a candle, or a fire to dry his wet-through clothes. What wonder he betakes him to the alehouse—the fruitful source of misery and sin; and when he cannot pay, or may not run in debt, what becomes of him then? He has no interests, no resources, but such as degenerate and corrupt. Has the night school won him from these accustomed evil propensities?—the love of learning A, B, C—of dully hammering over what he cannot understand? Try something in addition more attractive. Till he can read sufficiently the Lending Library is useless; and for those who can read well it is not enough. They complain that they have read all the books. For both readers and non-readers let there be a reading-room. The one may read, both may be read to. The matter read may include the easiest popular literature of the day, simple and attractive serials, newspapers, and amusing books. Tempt him to learn, and then improve his learning. The public reader and the room may be difficult to find; yet, where there is a clergyman and a school-room, their wants may be supplied. Wherever a proprietor resides let his help be sought, and now and then an intelligent farmer will give aid, pecuniary or personal.

Let the scheme be popular in constitution. Scientific subjects can be so treated as to interest the rustics. Natural history they have an inherent love for. In the writer's parish, sparse and poor, without a village or hamlet, his children's love for butterflies and caterpillars has infected many a smock-frock. Larvæ and chrysallides are brought up to the parsonage, and the greatest curiosity is evinced to see their changes. The habits and the culture of plants are specially studied by country folk. The shepherds know the stars, though not their names, better than many a gentleman or lady, and long to hear about them.

The writer has lectured an old woman on the planetary orbits, with a chalk-drawn diagram on her round elm table, till the spectacles have nearly fallen from her nose in wonder. And she has learned that it was not profane to doubt the sun's correctness as a timekeeper, which she had for years secretly suspected as she daily watched his shadow-line on the brick floor at noon, and turned to ask her favourite clock if he was right.

Sitting in a cottage in a thunderstorm, the interval between the flash and clap has led to explanations which have rivetted attention. That remarkable explosion in the air which was heard on the 17th of January last, caused great astonishment and curiosity among the rustics here. They listened eagerly to what was said about aërolites; and, if they did not understand it all, it made them more inquisitive, and gave the very opening we want—it brushed away that stolid indifference which generally bars access to them. In another village a more formal lecture was given to the members of the reading-room on Hydrostatics, hiding of course the name. The interest was apparent, and next day three of the rustic

audience began to try their hands at making a peculiar kind of waterclock.

The village reading-room and lecture-room may form the nucleus of other entertainments. A musical society, including choir and band, might often be organised. In several places in the same neighbourhood the old church choir, in every respect a nuisance, with its bass-viol, clarionet, and fife, had been extinguished, but has revived in better form. The singing now offends not the ear; and in one poor spot among the downs the amateur choir is often called upon to sing before the squire's guests or in the mansion of a neighbouring peer.

Some time ago, in the sequestered parish before instanced, the night school were assembling, and a party passed with a flute-player among them. The musician was duly complimented. The rest were asked whether they would allow London-lane thus to outdo King's-heath and Inholme's-common? The hint was quickly taken, and henceforth three several awkward squads were regularly marched in rival triumph through distant muddy lanes with flute, accordion, and whistlepipe, and the night school rose at once to nearly forty in a population of 300.

The Cottage Garden Society, a most useful institution, fills well the gap which the closing of the night school leaves. The village cricket club and other manly games demand our sympathy. Let us do all we can to humanize, to give worthier enjoyments than are within the peasant's reach at present, to bring him nearer to the class above him; by social intercourse and sympathy show him that his "betters," as he humbly calls them, have an interest in him, and do not wish to treat him merely as the beast of burden, toiling monotonously all the day, caring for nothing but the coming pay, and then abandon him to find his only recreation in the indulgence of his lower appetites.

12.—Athenæums. By Mr. Stent, of Warminster, Wilts.

The objects of an athenæum are the education of those who have laboured under early disadvantages, and a healthful intellectual recreation to those who have neither time nor inclination for close study.

It should unite all classes, and induce each member to identify himself with it—be self-sustaining, and independent of all political and religious controversies. The managers should be numerous, chosen from amongst the most intelligent of each class, so that all should feel themselves represented. The election should be popular, though not necessarily by universal vote, and while this general body should be the managers, two or three must be especially the executive—men of tact, judgment, and perseverance. The office of manager should be open to all, leaving it to the good sense of the body to select the best.

The first essential is a reading-room, light, well ventilated, easy of access, abundantly supplied with periodicals, papers, and magazines. The period of blind obedience has passed, and such an Institution should help its members to acquire and store knowledge, that they may be competent to judge for themselves. For the library, sound works on the arts and sciences, history, political and social economy, should be the nucleus of a permanent library; light literature must also be provided; facilities must be given to the general body to suggest books, but good sense must be exercised in the selection. Maps and diagrams, and other useful objects, should adorn the room. Silence should be observed in the reading-room; if possible a conversation room should be provided, and this may be used for the library, for chess, and other innocent games. The lectures and lecturers should be essentially popular. A good clear voice, and easy sustained style, are necessary in the lecturer, with a thorough mastery of his subject, and condensed form, stimulating to further investigation. Lecturers should be chosen occasionally from the members, or neighbourhood. The lectures should embrace the subjects of the day, especially educational subjects; they should be suggestive, rather than give detailed information. It has been well said, "The aim of good lecturing is to convey useful knowledge agreeably, and to prompt thought." The lectures should be varied occasionally by musical entertainments, and social gatherings. Most important are mutual educational classes. The athenæum here will never realize its full capacity for good till classes for the education of adults have been more perfectly worked, either by paid masters, or voluntary efforts of the better educated members.

13.—The Chief Wants of Town and Village Institutes. By Mr. Wyndham S. Portal, of Malshanger, Hants.

To ascertain the chief wants and requirements of Institutions and reading rooms, let us ascertain their aim, purpose, and title to support. The total number of Institutes in Union with this Society is 150, their professed objects are commonly "Mutual improvement, intellectual, moral, and religious," by means of lectures, lending libraries, reading-rooms, tuition in classes. Their aim and purpose then are to promote education, in the full sense of the word, to make intelligent and useful members of society and good Christians. "He would be a fool (says Mr. Sydney Turner) who would underrate intelligence, and worldly skill, but shall he be counted wise who forgets that the highest intelligence is united inseparably with the highest goodness? Intellect without God makes a devil." Is there need of such an educating Institution in every town and village? or is society in general already sufficiently moral, intellectual, religious, Christian, to render them unnecessary? Do the day schools accomplish all that is needed to make men and women Christians, good and useful members of society? We all know that day schools are now little more than infant schools, that the majority of children leave them finally at the age of eight or nine, having learnt so little, and that little so imperfectly, through the irregularity of their attendance, that they soon lose what they have learnt, and seldom make any effort to retain, still less to improve it. What is the fate of too many of these young people? Look at the statistics of crime, intemperance, reformatories, penitentiaries. Look at the ignorance, vice, and crime, which deface the world. Everywhere we see proofs of the insufficiency of the day school. The chaplain of the County Prison at Winchester says:—"When I examine the state of the young who come to us in prison, I am often constrained to ask myself, can it be possible I am living in Christian England? I meet with instances both of old and young who cannot tell even the name of the Saviour." This ignorance is mainly owing to the indifference of parents, and the necessity or habit of early labour. "It is an established fact," says Mr. Foster Rogers, "that the seeds of crime are sown in youth. Very few become criminals after 16 or 17 years of age." There are at this time 7,000 juvenile criminals, *i.e.* of 16 years of age and under. The proportion of the criminals who can read intelligently is about one in 18.

Out of four millions of children of all ranks, between five and fifteen, in Great Britain, scarcely one-half that number are in attendance at any school, and the greater portion of those who attend are of the upper and middle classes. No wonder, then, that criminals belong to that class which tells us, "I never had any schooling," "I am no scholar," or that they fall an easy prey to "drink" and "bad company." A virulent and infectious plague of ignorance, vice, and crime, is in our towns and villages. Against it we must put forth all our energies. Let us see what institutions may do to lessen it. Every president, secretary, treasurer, and manager, will agree that these are the chief wants of their institution: funds, suitable accommodation, teachers, interest amongst employers, and a definite plan of operations. As Sir J. Pakington told us, at Birmingham, there are two ways of dealing with

difficulties—to be perpetually talking of them and magnifying them, and yielding to them; or to say, with a firm spirit, here is a great wrong which demands a remedy, and as to the difficulties, we will trample them under foot. To a considerable extent we have trampled down the difficulties of establishing day schools; let us now trample down those of the institute and evening school. In the last fifty years, since Dr. Birkbeck established the first of these institutions at Glasgow, they have helped to show that our future progress must depend on the improved habits and greater enlightenment of the people, and that these can only be secured by a wider and more thorough system of education than can be given to children. The lectures, libraries, classes, all illustrate this conclusion. They have done great good by bringing all ranks together in the reading-room and lecture-room. They afford a neutral ground in politics and religion. They have provided rational amusement and innocent recreation by exhibitions of art and manufacture, by music, and other means. They have often led to the establishment of penny banks, good benefit clubs, friendly and provident societies, &c. We must not undervalue the immense number of lectures which they have provided, gratuitously or at a small cost. There is now taking place a gradual change in the character and objects of these bodies, and more attention is given to classes for continuous study; systematic instruction is gradually taking the place of the desultory lecture. 400 Institutions in our largest cities and towns have formed themselves into an union with the Metropolitan "Society of Arts, Manufactures, and Commerce," for the purpose of organising and arranging measures which tend to the education of all classes.

The offers now made to every villager or townsman in Wiltshire, Dorsetshire, and Hampshire, are money and honorary prizes; money to the teachers in these Institutions, honorary and honourable certificates, medals, and prizes to teachers and pupils, lists of gratuitous lectures, a large and expensive collection of diagrams, models, and other apparatus. These are no small advantages, and yet how few towns and villages avail themselves of them. Out of about 1,000 parishes in Hampshire, Wiltshire, and Dorsetshire, only 153 (or about one parish in every 7) avail themselves of them.

To fill up this sad void, a more complete organisation is our chief want. Some extraneous force is needed to prescribe the right way of undertaking to establish night schools and evening classes in every town and village of our three counties, and to supervise them when established. This want in day schools has been somewhat supplied by H.M. Inspectors of Schools; but, besides inspectors, the day schools for children between 3 and 10 have from Government certificated masters and mistresses, trained pupil teachers, and grants for building, teaching, and attendance. For institutes and classes let me hope that we may have organising and supervising masters, who may advise as to the best way of establishing adult schools and classes, and who may visit every town, village, and hamlet, teaching how to teach, lecturing, advising, and making known everywhere to the working classes the claims and advantages of education, suggesting rules to ensure regularity of attendance amongst scholars and teachers, and furnishing to each place the best methods of registration of individual progress. The efficiency of the Yorkshire Union of Institutes is mainly due to the active services of a paid agent and lecturer. Our society has no adequate machinery, no organisation except for drawing classes in connection with the Government School of Design. Alternating between Andover and Basingstoke, we have a highly efficient master (an organising master he may be called), who is certificated by the Art Department of the Committee of Council on Education, and has under his charge from four hundred to five hundred pupils, in from five to twenty classes or schools. In all other great movements, agencies of various kinds, tracts in dialogue and other forms, addresses, answers to objections, and the personal exertions of qualified men, are extensively used. The working classes of this country might by proper appliances be interested in a work of such immense importance to them as the education of themselves and their children when they leave the day school. We want, however, an organisation, real and substantial, which shall provide the means. The South Staffordshire Union of Institutions, connected with the Society of Arts, has a competent organising master, or travelling secretary, for organising, instructing, and examining classes in the Institutions and Evening Schools in that Union, and preparing candidates for the Examinations of the Society of Arts. The Northern Union of Mechanics' Institutions employs an agent to assist in organising the small outlying village societies, and otherwise help them in extending their usefulness. Our efforts have hitherto been fitful, spasmodic, desultory. Many town and village Institutes, started zealously and promisingly, have waned for lack of organisation and method. Let us throw into these Institutions and their classes some of the energy which has characterised our efforts for juvenile education in day schools. With a suitable organisation we shall by degrees see all the wants of our Institutions supplied. We shall see the establishment of self-improvement classes in every village, and these will be for four classes of persons; men, big boys, women, and big girls. There must be no attempt to combine boys and girls with men and women. Women are perhaps less reluctant to be associated with girls than men with boys. But with both sexes, as a general rule, the attempt to combine adults with children is fatal to success. Let me instance to you what may be done by organisation. The Huddersfield Institution began in 1840 a system of class instruction, with one teacher and one pupil. It has now upwards of 90 classes, and 800 pupils, with about 30 paid, and 40 voluntary teachers. Now look at the other side of the picture; an Institution in Hampshire (in Union with this Society), commenced not long since some evening classes. The Institution had 230 members. They began with 140 pupils, and 24 gratuitous teachers. Within three months these classes had ceased to exist, and the Secretary informed me that their failure was caused by want of organisation and system. We want competent teachers, and competent, for the most part, means trained if not certificated teachers. The adult who earns his own livelihood is sufficiently his own master to refuse to come to be taught, unless he feels sure of being taught well and quickly; moreover, being wearied with his day's work, he needs to be taught in a lively and interesting manner. There should be, too, a constant stimulus to exertion, by local prizes and distinctions, both to the students and to the gratuitous teachers. We have, at present, neither funds nor agents for this work. We want for it masters equal to masters of the day schools; for the present, at least, they ought to be paid partly by the Government, and partly by the Institutions. If the Government would transfer some small portion of the national grant from the infant day schools to Institutes for adult education, much might be done, and there are many reasons why the government should do this. The demand for labour is competing hard with education; and however young may be the child that is given to labour, in small towns and villages at least, his daily instruction instantly ceases, and what has been impressed on his mind at school is soon obliterated. The Institution, moreover, is neutral ground in religion as in politics. Cordial co-operation between men of earnest views, but of opposite parties in religion, even amongst members of the Church of England, in so vital a matter as the child's day schools, has been hitherto found to be unattainable. But this is not at all the case in the classes of Institutions. Aid given to them, by national or government grants, would be given on equal terms to all parties and denominations without distinction. In our classes we hold out the right hand of fellowship and brotherhood to every man who fears God and endeavours to walk uprightly, of whatsoever denomination he may be. Here we can all work together—do good together.

Together we can humanise the degraded, and educate the minds and morals of the masses.

Section 3.—Education as it Affects the Working Man's Home.—The Working Man's Home as it Affects Education.

Chairman—The Rev. Prebendary Fane. Secretary—The Rev. W. F. Tregarthen.

1.—Education as it Affects the Working Man's Home. By Mr. Warren, of Warminster, Wilts.

Cheering effects have been wrought in homes by education, and upon education by the influence of homes. To realise the results, we should remember what cottage homes were before schools made inroads on their barbarism, expelled some of their bad habits, and rescued a portion of those of maturer years from a stolid indifference to the mental and moral culture of the young, and the young from associations which not only helped to keep the mind in ignorance, but prepared it for crime. Witnesses of the past yet linger amongst us—persons who know not the alphabet—whose mental energies remain heavy and lethargic.

As the lair is to the beast, so may the home be expected to be to the man, with this difference, that man, debased, is lower than the brute, who is ever true to his nature and instincts.

The state of Warminster-common was thus described fifty years ago. Many of our men were barbarians; many of our cottages hovels; worth, in fee simple, in some cases, from £5 to £10. A labourer's dormitory of those days was the hay loft reached by a ladder. Will you bear the effluvium of half a score of sleepers there, nor pity, nor blush, when you find they are of different sexes as well as ages? Will you think it a pleasant fancy that, stepping into a "home," you find the horse in ordinary companionship with the family? Listen to a septuagenarian relict of one of "our old families." "We never heard the Lord's prayer; were never told of the Bible; never went to a place of worship; were never baptised; we all slept in the same room, father, mother, and ten children, like pigs." The walls were unplastered, the natural earth the floor; vermin abounded; the washing of the family linen was a night operation, that it might be ready for the morning's use. Not one adult in forty ever attended public worship; the ordinary pastimes were bull and badger-baiting, wrestling, cudgel-playing, and cock-fighting. Poaching was an art in which the "commoners" were dexterous. The Sunday's elysium was known as the "Drove," where the groups might be sketched as "sloth in filthiness"—drinking, swearing, gaming. Two congenial scenes were got up on the same Lord's day, a badger-baiting, and a pitched battle between a man and a woman.

The district of Warminster common consisted of some 1,200 or 1,400 souls; of these, in 1812, an investigation showed that 139 families, comprising 653 individuals, had not a Bible nor Testament. We may be sure that few if any of the 653 destitutes could read; the influence of the school on the home had not then commenced. Thankfully let us own the change since those days. Blessed influences have been at work, and amongst them—education. For several years every cottage at the Common has had its Bible. Purchases, gifts, and school rewards have, in many cases, duplicated copies. A humanising influence has flowed from schools. The men and women at the Common now very largely walk in faith and hope; in profession and practice. Sin, ignorance, barbarism, are driven into corners. Who yet lurk at the corners of our streets, in dirt and indolence, offending the ear of the passer-by with oaths or ribaldry? are they not the remnants of our vandalism, the utterly uneducated, the dead-weights upon society? poor creatures, without an industrial resource beyond that which was their birth lot. A new idea never enters their minds. A new energy would be a wonder. Education is the power which most eases poor rates, and thins work-houses. The "schoolmaster" is the great financial reformer.

In education parents have discovered a value which they are willing to pay for. How many of our working classes are buying knowledge at a price—the school-pence forming a regular item of calculation in cottage estimates? Let us not think lightly of the sometimes difficult sacrifice, nor believe that the Scripture lesson, the Bible chapter, the rehearsed Commandments, the learnt prayer of the school, have found no echo in the family at home. The regularity, required neatness, good behaviour, and principles of the school are not without their influence on the home. Wherever there is education it exerts a great moral power over homes.

2.—The Landlords of Cottages. By the Rev. W. F. Tregarthen, of Osmington.

Within the last fifty years much has been done to improve the working man's home. In almost every village in England a change for the better has been wrought in the outward features of social life. The wave of improvement has passed over the land, and we may detect tokens of its passage in remote and unfrequented places. Attention is yearly more and more directed to the influences of home, and it is more and more acknowledged that morality suffers grievously from the neglect of the science of social economy. Persons familiar with country life will admit that many vices which destroy the happiness of the labourer would be robbed of their power if homes were more attractive and comfortable. The warm, well-lighted, cheerful, comfortably-seated rooms in the house, with the sign-board, on the hill, would not prove so enticing if the cottage chimney did not smoke, and its windows and doors admit cold draughts, enough of a frosty night to make the most hardy shiver. The working man does not like retiring to rest as soon as it grows dark. Village lectures or meetings in the evening are generally well attended. On Saturday nights the labourer stays at the beer-shop later than on other evenings, not always because he has more money, for wages are not always paid on Saturday night, but because, feeling no necessity to rise so early next morning, he is inclined to indulge longer in conversation. His home offers few inducements for a half-hour's conversation with his wife or friends. There is nothing in the appearance of his room to encourage a communicative mood. Considering how few have been their advantages, how many their trials, often nobly and patiently endured, let us touch tenderly the blemishes in their lives, and do our utmost to lift them out of the wretchedness and ignorance in which, alas! too many of them are sunk. Many a man denied the necessary relaxation and rest in his own home and chimney corner, has sought it elsewhere, and mistaken drunkenness for it. Many cottages in every village are still most wretched, some with only one bed-room. The landlords are the only persons who can remedy this evil. And in many cases, to their honour, they have publicly acknowledged their obligations and shortcomings, and set to work to fulfil the one, and remedy, as far as possible, the other. The Duke of Bedford, in a letter which accompanies some excellent plans for improved cottages, sets forth this duty of the landlord in its true light, and enforces it in the most telling way,—by example. "To improve the dwellings of the labouring classes," the Duke says, "and to afford them the means of greater cleanliness, health, and comfort in their homes—to extend education, and thus raise the social and moral habits of those most valuable members of the community—are among the first duties, and ought to be among the truest pleasures, of every landlord." It is cheering that many landlords have ceased to view the cottages on their estates through the eyes of stewards and agents. But it is still not uncommon to let the cottages together with the farms, thus placing the occupancy entirely under the control of the farmer. The labourer thus lives in a building of which the farmer is practically landlord. Farmers, as a class, have generally

not reached that point of intelligence, which recognises an unselfish outlay as a profitable investment. And in many places, whilst the landlords have spent large sums on sheds for cattle, nothing—or next to nothing—has been done to improve the labourer's home. To collect rents from cottagers is undoubtedly tiresome; this system of making the farmer the virtual landlord saves the real landlord trouble; but what he gains the labourer loses. Many a farmer, as long as the labourer performs his work, troubles himself little as to his comforts at home. This is an unnatural system, and gives rise to unnatural feelings. It debases the labourer, as it deprives him of the feeling of independence, and makes the farmer tyrannical. The farmer possessing the power of ejectment. it is often cruelly used. This system exercises also a baneful influence on education. The great obstacle of education is the early age at which children leave school. As long as our boys and girls are withdrawn from school at the age of eight and nine, their education must necessarily be most rudimentary. So great has this evil appeared to some who, from their position and interest in education, are well able to form an opinion, that they have urged legislative interference. At the Social Science meeting at Glasgow, Lord Brougham animadverts on this great obstacle. He says:—"It is now many years—I won't say how many—since I took occasion in the House of Commons to make a declaration that the schoolmaster was abroad—that the schoolmaster being abroad, I had no fear whatever of another person who had been said to be abroad in these times—I mean the soldier. I think that with the schoolmaster, with his primer in his hand, I would meet, for the benefit of society, the soldier with his sword. But I will now add another declaration, but not of so hopeful a nature as the other. If the schoolmaster is abroad, the workmaster is also abroad, and he counteracts the schoolmaster, which I have no fear of the soldier doing. And I would entreat the attention of our friend Sir James Kay Shuttleworth and his department to this great problem—to solve if they can this problem—and if they cannot give a solution to it to give an approximation as to how the effects produced by the workmaster in impeding the schoolmaster can best be removed, and how the children's parents can be weaned from the inclination to keep their children from school, in order to gain a little from their labours."

Half-time schemes, industrial schools, night schools, owe their origin and importance to the existence of this social evil. A very imperfect education—how imperfect those only who teach in night schools and examine the scholars can judge—is all that we can confer on children of the labouring classes under the present system. Whether the State should interfere and exercise a judicious control over the labour market, it is for wise men to determine. But, as a matter of fact, this sending of children to work in the field at the ages of eight and nine is the great hindrance to education, and fosters a process of intellectual and physical stunting. The ordinary village school is nothing more than an infant school, and the work of the night school in the winter's evening is in general necessarily confined to reading and writing, and a very little arithmetic. Education in rural districts has confessedly not made the progress which from our outlay of money and labour, and the improvements in system and apparatus, we had a right to expect. In a village with which I am familiar, where there has been a school for the last 25 years, with a good mistress and diligent supervision, the majority go to work before they have learnt to read and write tolerably. A few Sundays ago I jotted down the ages of five scholars in a class in the Sunday school, and the time they had each been engaged in out-of-door labour:—

J. S.	11 Years	.....	2 years in field.
J. M.	13 ,,	.....	4 ,,
G. H.	12 ,,	.....	4 ,,
G. N.	10 ,,	.....	1 ,,
T. F.	10 ,,	.....	at school.

The boy at school, and the boy who had left school only a year, read the Bible with tolerable fluency and seeming intelligence; the others performed their task in a very very unsatisfactory manner. And I am certain that in many places this system of letting cottages with the farm to the farmer goes far to increase this evil. Perhaps I can best explain how it works by relating the particulars of a case. A family from a neighbouring village came to reside in the parish of B, and to work for a farmer in it. A boy eight years of age formed one of the family. It was known to the clergyman of B that up to that time this boy had attended school in the neighbouring parish. He reckoned upon his attending the school in his parish, but a week passed and he did not appear. The parents were talked to, and the importance of keeping the boy at school for some time longer was set before them. To this they readily assented; and, when asked why they acted towards their child in opposition apparently to their conviction, the answer was this, "Master wants un." Surely it is an unhealthy state of things which hinders a parent from giving to his child advantages of the value of which he is sensible. The only person who can remove the hindrance is the landlord. He alone can untie this knot by the kindly exercise of his influence. Lady Londonderry, on a late occasion addressed her tenants in these noble words:—"With the assistance of the National Board there are now good schools all over the estate. Do you avail yourselves of them for your children? Do you sufficiently consider the solemn duty of training them up in the way they should go, or do you, when there is farm work to be done, make them assist you and neglect their attendance? My friends, it is my duty, after what I have heard, to put these questions before you. I leave you to ask your consciences to answer them." The day is not far distant, we hope and pray, when landlords in all parts of England will become imbued with the noble and true Christian spirit which characterises the conduct of some of the greatest landlords of this land, and then we shall no longer deplore the existence of this unnatural system of "Cottage home administration." The social machine is so constructed by the wise Designer of the Universe, that the work of one wheel cannot be thrust upon another without all the other parts suffering from the unequal distribution. Confusion and mischief, unhappiness and discontent, are the unfailing results of neglect of duty amongst the high and the low, the rich and the poor. It is the duty of the landlord to see to the comfort of his poorer brethren who labour on his estate. It is his duty to see that fair advantages of education are available to the children of the labourers in his parish. We would have him acknowlege and discharge these responsibilities, and not permit others to exercise powers which from their position they are strongly tempted to abuse. Cottage discomfort and educational obstacles will vanish in proportion as the landlord performs his duty. We would have him feel that the agricultural labourer on his estate is his tenant. Upon social and educational grounds we deplore the system which transfers the power of the landlord to the farmer, and gives him an influence over the labourer which is not legitimate, and therefore is prejudicial to the interests of society.

3.—The Working Man's Home. By the Venerable Archdeacon Jacob, of Winchester.

The present condition of the English labourer's home has been brought out by physicians, clergymen, and statisticians, and by intelligent employers, including farmers. Twenty-three publications stand at the head of a very able article in the "Quarterly Review" for April last, under the title of "Labourers' Homes." I have before me reports of Farmers' Clubs, the London and Central (10th Nov. 1856), the Botley Club (January, 1859), in which the same subject is ably brought out. At the former by Mr. Spearing, of Chilbolton: at the latter by

Mr. A. Warren. This subject is a chapter in the great book of what has been denominated by Sir James K. Shuttleworth the correlation of moral and physical forces. It is impossible to advance beyond the first attempts in educating adults without finding the subject of the adults' home in your way. There is a school for the child, but where is the adult's equivalent resort for mental exercises, in the way of self-improvement or entertainment? We must look to the labourer's home for this place. Does it afford the means for self-improvement? The labourer has become far better fitted by his infant and private teaching to appreciate an improved home. But has he light, room—a place for his books, his chair? I desire that we may move in the right direction towards attaining a better labourer's home, that we may raise him from sottishness and semi-barbarism to correct habits and civilisation. Whose experience does not confirm this account of their homes? "We see cottages with no more than one room upstairs and one downstairs, or, at the most, two small bed-rooms and a room below." The description of the cottages in Bedfordshire, as given by a writer in the sanitary report (I am quoting from Mr. Spearing's lecture in London) is this—if we follow the agricultural labourer to his dwelling, we then find it consists of two rooms only. The day room, in addition to the family, contains the cooking utensils, washing apparatus, agricultural implements, and dirty clothes. The windows are broken and stuffed full of rags; boys and girls are indiscriminately mixed; and, if there is a second room, a lodger is added to the family. The liability of children so situated to contagious maladies frequently plunges the family into misery. The husband enjoying but little comfort resorts to the public-house and impoverishes his family. How can children thus brought up learn habits of self-restraint and foresight? How profit by any teaching, even if there be adult schools or evening classes? The chaplain of Winchester gaol bears a true testimony when he states that, with respect to juvenile offenders, "their domiciliary condition has much to do with their criminal character." Mr. Sturge, in his report of the farmers of Somersetshire, states, in relation to the dwelling of the labourer, "One crying evil remains—want of proper sleeping accommodation for the family; many cottages have only one, few more than two, sleeping rooms, to accommodate a man, wife, and grown-up sons, and daughters." How, under such circumstances, can the population be expected to grow up in habits of decency, morality, and virtue, and how can we wonder at the immorality and vice which prevail? In what condition is the labouring man to return to his morning work after his night's lodging in such a dwelling as his too often is! Many who would be slow to bear witness of this character are constrained by facts to declare it, and, while acknowledging some happy exceptions, affirm that the state of the cottages in the South and West of England, the very sphere of our Society's operations, is generally bad. But if the labourers' houses are little fitted to promote self-improvement in the way of reading, or other profitable employment,—what shall we say of the no houses at all which fall to the lot of the under-carters,—a large part of our ladhood? How many taking their meals in the day time, sometimes in this, and other times in that cottage, at night resort to the unglazed, wet, unshuttered loft above the stables of their horses. Artificial lights of any kind are scarcely admissible, unless it be the light of the horned stable lantern. Can it surprise any that the young man, thus homeless and comfortless, should resort to the beer-shop or public-house for recreation after the day's work, spending his spare money in drink, and his more precious time in wasteful idleness. How is education compatible with such houses, or rather no houses? I am too well aware of the argument which objects to such statements as very indiscreet, and the general assertions that these things must be left to the natural principle of supply and demand; that cottage building is unprofitable as a speculation and outlay; and that you cannot expect persons to lay out their money in a less profitable way, when a more profitable one is open. I am aware that to the independent spirit of the British workman, who hates anything offered with the air of charity or of dictation, it is attributable that the better houses which have been provided under the combined influences of different societies (Society for the Improvement of the Condition of the Labouring Classes—a purely charitable society, and Metropolitan Association for Improving the Dwellings of the Industrious Classes, which is not a charitable society) have not been generally accepted by these classes when it might have been expected they would have rushed into them. But these facts go to show that such dwellings are of indirect rather than of direct benefit; in short, that it is a landlord's question, and not one of speculation. The benefit to be reaped is found not in the increase of rent, but in the improvement of the staple of the labourer, in his intelligence, moral culture, and higher aptitude for his various duties—in his improved health, and greater ability to give a good and better day's work for his day's wages. These improvements are capable of being expressed in money value, but not exactly or demonstrably. They affect the employer of labour rather than the mere house landlord, who seeks more interest for his money, as they are rather indirect than direct advantages. They are not, however, the less real or less valuable, and they tell upon the individual and general prosperity of a people with unerring certainty.

I have thus attempted to show the almost impossibility of educating adults in the too common state of the labourers' homes, in the absence of room, light, air, all so necessary to health, and due exercise of the physical and mental powers; and that the matter concerns the landed proprietors of the country in the first instance, and ought not and cannot be delegated to the mere speculator. Now that the labourer has become far better fitted to appreciate the comforts of an improved home, now that the man himself has been improved, may the time at length arrive for the improvement of his dwelling with a view to afford facilities for the education of his youth, or for supplying it if defective in earlier years, and of advancing him in the higher walks of moral, religious, and intellectual exercise.

4.—Education as it affects the Working Man's Home. By Mr. Crispin, of Warminster.

Taking education in its most enlarged sense, as embracing all the instruction and development of mind and body, from childhood, through youth, to manhood, I proceed to notice the effects it is calculated to have upon the home of the working man. On unorganised and inanimate substances the effect is in general proportionate to the cause; and similar causes produce similar effects. But in education we have a different material with which to deal. Though the same amount of instruction may be attempted to be imparted to different individuals, and they may be brought under apparently precisely the same educational influences, very different results follow. Hence, if in some cases there are exceptions to the aphorism, "As the twig is bent the tree 's inclined," still we have the command, "To sow the seed in the morning, and in the evening not to withhold our hand, for we know not which shall prosper, this or that; or whether both shall be alike good." Whatever is comprised in a practical and enlightened educational curriculum must affect the recipient's practice, and consequently his home. The first point is the power to read, and understand what is read. In this age of cheap literature, he who can read need never be at a loss how to employ his leisure; and whatever may be his tastes, he will not be likely, miser-like, to monopolise the whole of his reading to himself, but make his wife and family participants of his enjoyments. His feelings will be similar to those which Milton ascribes to Eve:—

> "For bliss, as thou hast part, to me is bliss;
> Tedious, unshared with thee, and odious soon."

The power to read, if used aright, will be a never-failing source of domestic comfort. One of the most fruitful sources of misery to the working man is his ignorance of the maxim that "mony a mickle makes a muckle." From this result extravagance, debt, ruin, which might have been prevented by the knowledge of a little arithmetic.

Another source of misery is ignorance of the "Phenomena of Industrial Life," or, in other words, political economy. A right knowledge of the law of supply and demand would have prevented the misery of strikes, the repining, discontent, and hard thoughts in reference to the employer.

Labour is almost everything to the working man. Deprived of it he becomes dependent on alms. Hence, to him the especial importance of health. This depends largely upon attention to the laws of health. An education in this particular is calculated to promote the happiness of the working man's home almost beyond that of anything besides.

A right education gives a more enlightened acquaintance with religion and its duties. It raises him above superstition, leads him to trace effects to their causes, and to remove evils by legitimate means instead of having recourse to knaves, or weakening his powers of body and mind by indulging in despair. The relations of husband and wife, parent and child, are better understood and more carefully practised by the educated. The educated man values his home and its associations, and seeks happiness there instead of from injurious sources. He exercises forethought, and consequently prudence, in making provision for future casualties. To the best of his ability he makes provision for a rainy day through benefit societies and penny savings' banks.

Education refines and softens the manners, suppressing boorishness, and begetting self-respect, which leads to a respect for others.

Most of the homes of working-men are inconveniently small. They consist of a room down stairs, and a larder, or cupboard; and, at most, of two rooms up-stairs, generally only one. Supposing the family to comprise three or four children, and of different sexes; in sickness, childbirth, or death, it is impossible to preserve anything like Christian decency. Where the whole family, father and mother, brothers and sisters, herd together, the youthful mind receives an early taint, and embraces the first opportunity of reducing its polluted imaginings to practice. Whatever efforts the parents in such a home may make to educate their offspring they will be marred by the home. The wife doing her utmost to keep things tidy and straight, battling with difficulties until health and spirits succumb, becomes peevish, fretful, and querulous, towards her children and husband. He, not practising that forbearance which the circumstances require, retorts upon her. Words too frequently end in blows, and to obtain peace he goes to a public-house. Well is it then if the wife does not follow her husband. Children growing up with these associations can be recovered from their sunken condition only by a miracle of grace. The punctuality, obedience, respect, the moral and religious feelings, which the schools cultivate, are more than counteracted by the example at home.

If the house itself be what it should be, there will be efforts to provide suitable furniture for it. This begets thrift and sobriety. Self-respect induces the matron to make the best of the little she has, and, instead of gossipping with her neighbours, she keeps her house and its contents clean and tidy. Dirt and rags assort ill with such a home. The clean, regular, punctual children at school tell wondrous tales in this respect. As the family comes on, the first thought is their education. What self-denial, what rising early and sitting up late, what anxiety do the parents of a well managed home generally manifest that their children shall have a fair start in life. The educational life of the children is inquired into every day. Everything that can be done by the parents is done by precept and example to stimulate them to intellectual exertion. In such a home the lessons appointed by the teacher are pleasurably performed by the children. It is folly to expect nine-tenths of the children who attend our National and British schools to perform neatly-written exercises at home. The disposition on the part of the child and the ability may be there, but the parental encouragement and the means are wanting. In homes where cleanliness, industry, honesty, order, and all the domestic virtues, are duly practised, and, above all, where religion has reared her altar, there only can be raised up an intelligent and worthy peasantry.

5.—Saturday Night. By the Rev. J. Erskine Clarke, of Derby.

The very name of Saturday night suggests brawls and drunkenness. In the village and in the town, Saturday night is the dread of the workman's wife, and the source of anxiety to the clergyman.

On Saturday night, the workman has his week's wages; sometimes he is paid in the public house; often he has a score on the ale house shutter to settle, and so he takes the tap on his way home. He feels he has earned a right to some enjoyment. He knows he needs not to be up to work in the morning. His notion of enjoyment is almost limited to beer and tobacco, a song and a fiddle. He finds these and freedom from all restraint in the public house, and so he spends his Saturday evening here. Well is it if he does not spend also the money on which his "missis" is reckoning for the week's housekeeping—well is it if he does not reel back at midnight to his trembling wife and scared little ones.

After such a Saturday night, we can hardly expect a satisfactory Sunday morning; and accordingly the workman probably sleeps till noon—then lounges over pipe and paper—perhaps dresses himself for afternoon church, and spends Sunday evening where he spent Saturday night. There are thousands of glorious exceptions to all this, but there are quite enough examples of it to make it worth a parson's while to do something, if he can, for the working men on Saturday night. The women on that evening are, or ought to be, cleaning and swilling, making their houses in such a state that, unless the good man of a two-roomed cottage be a domestic hero, he cannot be expected to stay in it.

I have devoted myself in my own sphere of work largely to the improvement of Saturday night, and I have found it have the best effect on Sunday.

For the six winterly months of 1859 and 1860, on every Saturday night we had, in a large hall, a musical and literary entertainment, lasting from 7.30 to 9.30. The charge for admission was 1d. and 2d., with a few 6d. seats in front. The hall held 1,000 people. We never had less than 700 present; and on one occasion we had 1,200, and sent away a street-full clamorous to get in. Our audiences consisted mainly of full-grown men. They used to sit in the same seats night after night, just as they would in church.

Our entertainment was after this fashion—an overture by a brass or reed band. Five of these bands gave their services cheerfully, requiring only some light refreshments. Their names will indicate their composition—"Rifle Band," "Midland Railway Band," "Darley Village Band," "The Dun Cow Band,"—after the public-house where they practised—and "St. Michael's School Drum and Fife Band." After the overture would follow a song or glee by members of one of the choirs in the town. Then a reading—about ten minutes in length, by some gentleman of the town. Then the band, then another song; then, perhaps, a solo on the piano—(they once listened contentedly to a brilliant solo half an hour long!)—then a second reading by another gentleman—then song, band, glee—a third reading, the band, and God save the Queen.

We generally had about 12 pieces, and we went on

sharp from one to the other. Variety, and nothing too long, was the secret of a successful night. On three occasions we engaged ventriloquists, and once a conjuror, but we still kept our readings in the programme. The readings we generally tried to make of varied character. The first the most solid—say, a few pages of Macaulay. The second poetical; pathetic ballads, or humorous verse, were most appreciated. The third reading was generally of broad humour, such as a scene of Dickens.

Subjects read :—Mr. Duberly Doubtington—Paper on Probability of French Invasion—The Favourite Scholar—The House Fairies—John Bull at Paris—Christmas Poems—How Poll Paid the Rent—King John and the Abbot of Canterbury—The Village Blacksmith—Maud M ller—The First and Last Dinner—The Combat—The Wife—Won't, Can't, and Try—Mansie Waugh—The May Queen—The Cataract of Lodore—Christmas Storms and Sunshine—The Search after Truth—William Whitehead's Will—Essay on Roast Pig—The Enfield Rifle and the old Brown Bess—Black and White Slavery—From Adam Bede—The Siege of Calais—The Death of Marmion—Eugene Aram—The Destruction of Sennacherib—The Lazy Genius—Something on a Delicate Subject—The Guests at the Red Lion—The Derby Blues and the Valiant Tailor—Brighton, Tunbridge Wells, and Bath in 1682—The Three Warnings—The Turned Head—From Richard II—William Tell—Betsy Brown—The Violet Boy—Try Again—The Bashful Man—The Shallow Trust—Little Jim—The Happiest Time—The Heart's Charity—Henry of Navarre—The Mourners—The Cannon and the Press—The Honeymoon—On a Pebble—Original Paper on Printing, &c.—Mulhaussen on the Rocky Mountains—How the French Fared at Fishguard in 1797—Blucher's Judgment—Dora—The Black Cottage—The Dream of the Reveller—The Three Preachers—American Poets—Lord Ullin's Daughter—Lochinvar—Misadventures at Margate—Night before Waterloo—Hohenlinden—Arm—The Rifle—Alonzo the Brave—The Cruise of the Fox in the Arctic Regions—The Importance of Trifles.

The reading required to be loud and distinct, so that all could hear without effort. The voice pitched high and kept up—this was preferred to showy and dramatic reading. In music nothing came amiss, but perhaps national and patriotic songs were the favourites. One matter of detail may be worth naming. The words of the songs were printed on the back of all the programmes, which were circulated in the manufactories and shop-windows; so that every handbill became that most precious treasure to the mass of the working people, "a song book!" From this cause the bills were eagerly sought for, and the shopkeepers could not keep them in their windows; they were so pestered to give them away.

The expences of the 24 entertainments amounted to £120, and the receipts at the doors to £150, leaving a balance for the Working Men's Association, by whose committee of working men the money was taken at the doors, and people shown to their seats, and order kept, for all these nights.

The moral results were far more satisfactory than the pecuniary one. I heard, from working men, of well-known frequenters of the public-house who never missed one of our entertainments. I heard of men beginning to put into the penny bank, and getting clothes to go to church, and I heard that the publicans complained that we had got all their best customers. The regret, too, of the working men of the town when we gave up, and the present anxiety that we should recommence, prove that they fully valued the opportunity of spending an evening of rational enjoyment.

The only objection which was worth refuting, because made by religious people, was that ours was not the proper way to spend "the preparation for the Sabbath," as they called Saturday night. My reply was that I acknowledged it not to be the best conceivable way, but that it was a thousandfold better than the public-house way, which to scores was the only alternative; and that after all I did not see that our music and reading differed so widely from the open piano and conversation of the drawing-room. Others said that the men went drinking after our entertainment. There was no means of testing this, but I do not believe they did. They may have dropped in for a glass of beer; but after two hours in the pleasant atmosphere of music and song, and congenial company, I believe that few were weak or vicious enough to commence drinking to excess. I believe, too, that they would find the companies in the bar parlours all formed—the games at cards organised—and the strong period of temptation over.

Of course entertainments, on as large a scale as those here referred to, are only possible in towns, and I do not suppose that Derby is better fitted with appliances for them than any other town of equal size. But I think that something of the same kind might well be introduced even in the village school-room. Well warmed, well lighted, with a few of the church choir to sing, and with the doctor, or railway clerk, or schoolmaster to read, I think a strong counter-attraction to the allurements of the ale-house might be secured.

Even during this summer (if any summer we have had) I have found that a considerable number of young men were delighted to come to somewhat similar meetings, which we held in a smaller and private reading-room. As the ale-house benches are not tenantless in summer, there seems no real cause why such rational evenings should not be carried on in summer as well as in winter; and many of my working people wished me to carry on my series of great entertainments even in summer, but I was afraid to risk it, and thought it safer that the audience should leave off with an appetite.

I trust that I may be pardoned for such an egotistic paper—but I feel strongly that it would be a blessing to the poor if the clergy would direct the recreation of Saturday night. Perhaps it would be, now and then, a blessing to ourselves to be obliged to get our sermons finished earlier, and thoroughly to unbend our own minds. Above all, I have great faith that if working men were tided safely over the earlier hours of Saturday night—instead of being left listless and unoccupied and uncomfortable, a ready prey to temptation—they would often have saved, for their high and holy uses, the blessed hours of God's Day of Rest.

6.—Improvement of Taste and Morals among the Working Classes. By the Rev. J. C. Joyce, of Strathfieldsaye.

Every age in its turn has roundly abused its own iniquity and drawn disadvantageous comparisons between itself and predecessors: "Omne crimen mox ferrea protulit ætas," is as old as Domitian. "Every vice to which human nature is liable, but particularly the hatred of truth, at present destroys all good in this island, says Gildus, of Britain, in the seventh century. Locke, in his celebrated "Treatise on Education," which bears date March, 1690, plaintively says of the England of his own day, "By what fate vice has so thriven amongst us these few years past, and by what hands it has been nursed into so uncontrolled a dominion, I shall leave to others to inquire." Ought we then to be so astonished that we should hear much of the crimes and vices of our own age, or that this most natural sentiment should take the form in our day of a misgiving as to the success of educational movements. Should we feel surprised if some faint distrust of this kind should find its way into Parliament, or seek utterance for itself in the reports of school inspectors? It ought not to amaze or stagger us; it would seem but the fulfilment of a general law. That there are such murmurs current is undoubted. To meet and fairly weigh them, by an examination into their value at its real worth, and to inquire whether the working classes are improving or going backward in their general character, is the object of this paper.

It is not, however, my purpose to endeavour to convince

you that there are no grounds for complaint. I begin by an admission that there is vice and crime, but to prove that they are curable to a very great degree. My aim is to exhibit from evidence which can hardly be gainsaid, that, despite the acknowledged vices and the uneradicated evil habits of the lower classes, there has been a steady advance to better things among them, and that this advance is mainly attributable to improved education. Geologists tell us that the coast line of the South American Continent is undergoing a slow but ascertainable elevation every year, and a similar assertion is made of the floor of the Baltic Ocean. These great phenomena of natural forces, by whose secret operation the surface of a continent or the floor of an ocean are slowly and almost imperceptibly raised, whilst the elevation produced is matter of scientific certainty, present us with an instruction to the results of education upon the working classes.

The lowest stratum of the social system covers so vast an area; is in itself a mass so inert and so enormously difficult to elevate, that we cannot measure progress by momentary observations upon particular localities, but only by comparing epoch with epoch—certainty with certainty—decade with decade. Such a proceeding will alone enable us to detect with any approach to accuracy the advances or retrogression which are being slowly but steadily realised, in our own day.

I must guard also against misapprehension of my own meaning, when I speak of education as one of the main causes of improvement, I would be distinctly understood to mean moral training by that word, as well as intellectual. Education improves men in proportion as it makes the formation of moral habits its chief aim, its first and not its second object; and this great truth is much more appreciated than it was. In 1835, before a Select Committee of the House of Commons on Education, Mr. Wilderspin said, "I think moral education is almost universally neglected, both in agricultural and manufacturing districts. What we have called education has not embraced moral education." I find all our schools defective in that particular. This was in 1835. Fifteen years made a decided difference in this; for instance, in February, 1850, in the petition to the Queen, adopted at a great Church Education meeting in London, this principle was fully and clearly recognised. "We consider," said they, "that education means training for time and for eternity." The definition is assuredly true. It is unworthy the name of education, because entirely incomplete if the more important of its functions is overlooked or omitted. And, on the other hand, every step which is made towards recognising that moral training—that is instruction in good habits—is not alone a part—but the better and more important part—of education, at schools and at home—is a sure advance. Every year now, after admitting all drawbacks, unquestionably adds a more distinct acknowledgment of this view.

I propose, therefore, to do two things—first to adduce evidence to prove that the admitted vices of the working classes of our day are no other than wide-spread evil habits, which, up to a very recent date, infected all ranks, but which superior education has now greatly lessened among the gentry and the tradespeople of this country: and, secondly, to show proof that we may trace a gradual and increasing development of good habits — habits of prudence and virtue—among the masses, as the result of a slowly-spreading improvement in education.

To begin with drunkenness—the most ruinous of the vices of the working classes—I will show its universal prevalence in this nation up to a very recent date. We are all ourselves witnesses to its partial extinction, at least among the upper ranks of English life. "There is nothing," says Locke, "so ordinarily given children, in England, as strong drink, and nothing so destructive." He wrote this of the children of the gentry, in 1690. Porter, in his work on the "Progress of the Nation," says, "The addiction of the people to drink had reached such a point in 1736, as to occasion continued debates in Parliament. Publicans enticed customers with a notice, 'You may here get drunk for a penny, dead drunk for twopence, and clean straw for nothing.'" The Legislature passed an Act levying a duty of twenty shillings on spirits, and prohibited the sale of them by retail: it signally failed. In 1738 a proclamation was issued to enforce this Act, known as the Gin Act. Within two years from its date, within the area circumscribed by the bills of mortality, no less than 12,000 persons had been convicted under the Act for the sale of spirits, of whom 500 had been sentenced to pay a penalty of £100. The prisons were filled with such offenders. Evidence was taken before the Commons, in 1743, on the quantity of spirits made for consumption in England and Wales. The following enormous quantities were returned—and, far worse, the following rapid increase of consmption:—

In 1733...	10,500,000
1734...	13,000,000
1740...	15,250,000
1741...	17,000,000
1742...	19,000,000

Thus, in ten years, the consumption had almost doubled, and as the then population, including men, women, and children, did not exceed six millions, the return for the year preceding the inquiry, *i.e.*, 1742, gave the frightful consumption of between three and four gallons of spirits per head a year.

Compare with this the consumption of spirits 100 years later. The population had then become sixteen millions. The consumption of spirits had fallen off from nineteen million gallons to 8,166,985 gallons, or about half a gallon per head.

Every description of the manners of the date I have spoken of is full of drunkenness. The noblemen, the gentry, the bar on circuit, and, I grieve to add, even the clergy at their meetings, regarded drinking as a pastime. As information reached them, and education became general, the manners of the upper class altered, but those immediately below them remained as they had been. The vices of the working class of our day are those of the tradesmen of fifty years ago. How changed for the better now I need not point out.

The evidence of Mr. Francis Place, before the Select Committee on Education in 1835, is most instructive upon this point. Mr. Place was a superior London tradesman, largely connected with the first rise of the educational movement, and one of the original founders of mechanics' institutes. He gives this evidence of what tradesmen were only fifty years ago in London:—"It was the almost universal custom for decent tradesmen, as they were called, to attend public-house parlours of an evening, and most of them supped there. At many of those houses there were lottery clubs and punch clubs. This custom was the ruin of an immense number of them. I have a list of twenty-seven, all living within 500 yards of St. Clement's Church, who were reduced to poverty by their bad habits; some of them died in the workhouse, and those were men who ought to have done well and saved money." He mentions that the wives of respectable tradesmen, and mothers of families, would be guilty of singing, or allowing to be sung, improper songs; and, he adds, the ballads sung about the streets, and the books sold openly, cannot be adequately described. The songs were of the most indecent kind. They were sung and sold publicly in the streets and markets, and were bought by servant maids. Of the apprentice class in London at the close of last century and commencement of this he gives a startling description:—

"I was myself a Fleet-street apprentice. When I was an apprentice, between Blackfriars-bridge and Westminster-hall there were fourteen cock and hen clubs. He describes what these were, which is hardly fit for recital. The conduct of such youths, he goes on to say, was such that there is nothing which can be compared to it at present. It can scarcely be believed without good evidence. There were twenty-one apprentices in one gang (in Fleet-

street). They used to go to Temple-bar in the evening, set up a shouting, and clear the pavement between that and Fleet-market. There was no police or any mode of interfering with these boys. They played all sorts of blackguard tricks. Only two out of the twenty-one turned out steady—myself and another. We were all sons of master tradesmen, or of persons of some consideration—not sons of the meanest of the people, yet among us this bad conduct was suffered to exist unchecked and uncontrolled."

Let us inquire here what was the state of education among this degraded and depraved generation of London tradesmen. "The instructions my father gave to my schoolmaster," says the same witness before the Committee of the House, "was that when I got to the end of the rule of three I was to be taken away, as he thought that a competent education for his class." Here is another specimen from the same evidence—"The prejudice against a man having books was very great. In my own case, even as late as 1812, I lost as many customers as paid me £500 a year on a gentleman discovering that I had a room full of books. When he discovered that I, a common tradesman, presumed to collect books, he took pains to take away my whole connexion. If I had been a sot he would have had no complaint."

What a contrast to this picture is the London tradesman of to-day; in some instances employing the services of a chaplain to watch over his extensive household or his populous works, supporting schools, building and even endowing churches, with his sons and shopmen teaching in the Sunday-school, or turning out in uniform to attend rifle drill at the same hour that Fleet-street apprentices fifty years back held outrageous possession of the pavement.

Mr. Place, when questioned by the Committee of the House as to the cause of the alteration for the better up to 1835, answered, "I principally attribute the improvement to information. You will find as the working people get more information they get better habits."

What I assert, then, in connection with these most instructive details is this, that the vices of the working classes which we now sometimes despair of eradicating, and which as yet appear to have given way but a little before the progress of education, are no other than the same habits which once prevailed almost universally in the classes of society above them, from which they have now partially disappeared. And I would raise this argument upon the assertion, namely, that as these habits of vice have already yielded so largely within half a century in one part of our social system, we may fairly believe that in due time, and after due labour, they will not fail to give way in almost, if not entirely an equal degree among the labouring class.

That this improvement has begun and is steadily progressing is certain—that it is only begun, and is far from a complete development, is equally true.

I wish to show from documents similar to those already quoted, chiefly Parliamentary returns, that the advance, though possibly more slow when it reaches a wide area, and feeble in proportion to its more extended effect among the masses, is vital and continuous in its action.

We must refer first, however briefly, to the two great index hands of the moral state of the masses. These are the decrease of crime, and the decrease of pauperism. As regards crime, although the past six months have produced an extraordinary crop of crimes and conviction, yet there can be no reasonable doubt that in the main crime has decreased very materially. Porter, in his "Progress of the Nation," traced many years ago the apparent connexion between ignorance and criminality. He takes the returns of 13 years, and adding the totals of the committals together, shows that whilst 335,429 persons had been in the hands of justice in that period, out of all that vast number only 1,333 had enjoyed the advantages of instruction beyond that of a rudimentary sort. In the year 1841, the last he appears to have examined, he points out that out of the women living in England, 7,673,633 individuals, not one educated woman had been tried for any offence. And looking from trials to convictions, he shows that out of 15 counties, with a population of 9,569,064, only 74 educated persons were convicted, but out of the other 25 counties, with 6,342,661 souls in them, not so much as one educated person, male or female, had been convicted of crime.

I have examined the prison returns at a much more recent date. The latest which have been available are those for 1858. They tell the same tale in a very striking way. The summary of convictions for one year, of all ages and sexes, shows that the number of those who were either wholly unable to read and write, or who read and wrote imperfectly, was 110,053. Those who read and wrote well, only 6,813. Those who were of superior education, 397. This is, in short, 397 persons of superior education against 110,053 of no education at all.

The value of reformatories, in repressing and extirpating crime, is one of the most extraordinary curative features of modern education. A certain proportion of boys sent out must be expected to turn out badly, but that proportion is wonderfully small. In the Hants Reformatory, I was informed recently, that not one boy as yet had turned out ill. Mr. Barwick Baker is most sanguine of the result of these institutions as regards regular crime, and he is preparing a list of every young thief in London, with a view to picking out all the leaders. He states that the numbers are much fewer than he had been led to expect; the number of Reformatories in England and Scotland in July, 1859, were, in all, 75, and the children in them 3,221.

As regards pauperism, its decrease may be partly attributed to the great prosperity of England at present, but I will adduce to you a few extraordinary instances in which the decrease is directly traceable to education alone.

In the report of Mr. Tufnell, one of the Government Inspectors of Schools for the current year, 1860, the following particulars appear:—

That kind of dependence, called hereditary pauperism, is of all others the hardest to deal with, and the most difficult to extirpate in any population; and, unfortunately, in too many unions the education received by pauper children in the house has had a tendency to make them both paupers and criminals for life—to create, in fact, a pauper class. There is something, therefore, particularly cheering in these details. At Stepney Union, during 20 years, 1,467 children have been got out into service, out of whom only 13 have since become dependent on the rates. In the five largest pauper schools near London, during the last two years, there has been a decrease of 25 per cent. The Government Inspector says of these:—"The treatment which the children now receive in these schools thoroughly dis-pauperises them, finds places for them, keeps them independent, and eradicates the vice of hereditary pauperism." Here there is an acknowledged and evident connexion between the decline of pauperism and education.

It is extremely difficult to arrive at any sound conclusions as regards drunkeness, as statistical papers can but very imperfectly guide us. I may mention, however, that on comparing the quantity of malt brewed by public brewers in the years 1857 and 1858, there is a slight increase in the latter year, 22,818,560 bushels having been brewed in 1857, and 23,021,836 in 1858. The increase is, however, only a little over 200,000 bushels. On the article of spirits there is a more marked difference, for it is a very curious fact, which I will not attempt to account for, but leave to speak for itself, that on the consumption of spirits in 1858, there was a decrease from the year before so enormous as 4,860,521 gallons—about 1-6th of the entire quantity used.

I must beg you to turn now from these blots upon the working-class, crime, pauperism, and drunkenness, in order to take a hasty survey of some evidence of their virtues, more particularly those which belong to the working-man's home.

Time will not admit of my doing more than briefly pointing to the proofs of their improvement in habits of providence.

The uneducated working man, having earnings in his pockets, spends them at the public-house ; or, if he saves, ties them up in an old stocking, keeps them sewed into an end of his bolster, or entrusts them to a broken tea-pot. Not so the educated working man. He pays part to his friendly society as a provision against sickness, the residue he pays to the savings' bank, or he sends home to his father, wife, or friends, by a money order at the post-office. Any of these institutions will prove that this is a fact. Take the case of friendly societies and benefit clubs. It is not the poor man's fault, but his little misfortune, that these are not on a better and safer footing. Of their financial position we can tell nothing, as they for the most part decline to make any returns to Government, but the number of enrolled and certified societies which receive the earnings of the working men in this way is about 20,500. Many of these have very extensive numbers, and it is probable, that at the lowest estimate, so large an amount of hard-earned money as £1,000,000 a year is paid over to their respective treasurers. Where would this million have gone 50 years ago? In the next place, take the evidence of the savings' bank returns. Now, of these, there are only 597 in all England. They are open for the most part only one day, and sometimes but one hour in each week. The distant villages are almost entirely shut out from adopting them, yet these banks received almost exclusively from the working classes, in 1858, the enormous sum of £7,901,925. This, remark, is not their total deposit, but their yearly receipt. If you go back some ten years you will find that they received then a very considerable sum, but one which was from half a million to one million less in amount yearly: for example, contrasting 1858 and 1846, *i.e.*, twelve years difference in time, there is an increase in 1858 of £601,558 saving yearly. Or, again, take the third evidence of provident habits, and, indeed, of affection in many instances ; I mean the money order office returns. Now money orders are used by all classes, therefore they are not exclusive proof ; but as the number of orders issued is enormous, and the sums are individually very small, we may, at the very least, conclude that half the money passing through this office is earned by the working class, and transmitted to friends or relations. The astonishing sum of £12,662,105 was sent by money order in 1858. This amount is one which has gone on rapidly rising year by year. Not less than £5,595,149 more, was forwarded by this channel in 1858 than in 1846.

It is surely a perfectly fair argument to assert that we have here most substantial evidence of a growing prudence among the masses; the vast sums I have quoted could come only from the earnings of the million.

I will direct you again to the Post-office for a very singular illustration of the increasing necessity and desire for education among the workers. The number of letters which pass through and are safely delivered by the post office is almost incredible. The greater proportion we can form no opinion about, they may, or may not, be the letters of working men. There is, however, one class of letter which proclaims itself, namely, that which is so illegibly directed that it must have been written either by a very rich or a very poor man. We have a singular proof in such letters of the extent to which our labouring people now use or abuse the accomplishment of writing, seeing that no less than 1,700,000 letters were so illegibly addressed in 1858 that they could not be delivered. This one fact, which we can hardly contemplate without a feeling of pain, speaks nevertheless most strongly of improvement also; for that these were written at all, by persons so incapable, is a proof that they were either answers to others, or expected others from better scribes in reply. If we could learn the ages of the 1,700,000 writers, they would in all likelihood carry us backward to the days when an old woman was the principal, if not the only instructor, in the art of writing in every country parish of England. That a much larger proportion of the population can read and write than were able to do so fifty years ago is not open to a doubt. But the instruction received in schools, whether intellectual or moral, is at present, to a most considerable extent, neutralised by the evil influences of the homes of our labouring classes. The whole aspect of the home—the whole associations of it have been such as to weaken the power of moral precepts, and counteract the formation of moral habits. They have been such—such they still remain—with the great masses of the population. The decencies of civilised and educated beings have been literally almost out of the question in these dwellings. In towns, whole families crowded into one room, or, at the utmost occupying two—which serve for eating and for sleeping indiscriminately. In villages, the dwellings of half a century old have been mere hovels—as regards sleeping accommodation no better—and as regards actual space even worse than the town houses for the poor. Hence commixture of sexes, even after maturity, has been almost as often the rule as the exception in populous parishes. The whole of the associations have been of evil tendency. The language heard by the labourer's child at home has been violent, obscene, and blasphemous. The efforts both of schoolmaster and clergyman have too often been spent in vain, as far as regards any real progress either in morality or religion. In such homes comforts there have been literally none. The only apartment where leisure hours have been passed has been a taproom. There has, until recently, been no rational occupation of any amusing or interesting kind at home, beyond the garden—if there was a garden—to occupy the disengaged mind. The very walls have reeked with impurity, and their only ornaments have been, for the most part, the one immemorial sampler worked at the dame-school, coarse engravings of such subjects as Rush, the murderer, and Rush's paramour; or Oxford, the maniac, shooting the Queen; or the last speech of the latest criminal who was executed, with a vignette of the gallows at the top. Surrounded at home, from infancy to manhood, by such influences and such associations, to what else was it likely the working labourer should come, but to sensuality and to sottishness, drowning care and vacancy of thought and helplessness in one common grave, with intelligence, religion, and morality, under the all-devouring deep of habitual drunkenness?

Improvement in the working man's home itself has made rapid strides in the last ten years. It has not merely begun, but has been carried forward to a most encouraging extent both in town and country.

The exertions of many noblemen and gentlemen have greatly improved in many localities the houses of the labouring population, and it is all but impossible to look for permanent improvement in morals among them until their homes are such as may be compatible with self-respect and decency. The Earl Spencer, the Dukes of Northumberland and Bedford, deserve the gratitude of the working poor for their noble outlay upon their dwellings. Earl Spencer has altered or built houses for 230 families, at a cost of £33,220. The Duke of Northumberland has done the same for 460 families, at an expenditure of £38,950. The Duke of Bedford, in no less than six counties, has new housed 566 families, laying out upon the houses of the labouring poor on his estates the princely sum of £62,680. The stimulus given to this movement by these and other gentlemen is so great that it may be traced in every direction, but more particularly in those edifices called model lodging-houses in our great towns. So profitable and valuable have these latter proved as an investment of capital, that an enterprising builder in London has recently undertaken some as a private speculation. The whole subject of suitable dwellings for the working class has engaged so much attention that no less than two important public societies have turned to it their specific attention, and with the view of assisting the movement, have brought out working plans and elevations, with

estimates, and a specification of work. An extremely valuable paper was circulated on the subject by Mr. Bracebridge, at a late meeting of the Social Science Association. Many of the influential manufacturers in the North of England have likewise given much consideration to the dwellings of their own work people, and very large sums have been sunk, in some cases, to secure the object. There is then a prospect, and let us hope no very remote one, that by little and little all parts of England, whether urban or rural, will be reached and influenced by this growing improvement. Of the eventual bearing upon the morals of this class of this house building advance there can be hardly a doubt. The houses of working men are no longer bare of any resource for the vacant mind. The book hawkers visit at regular intervals, bring books to every door, and theirs is now in many places an expected and welcome call. The district visitor, or the clergyman's wife, carries there religious reading in the form of well-written tracts—cheap periodicals are on the shelves or the dresser, with the Bible and the Church Prayer-book.

The garniture of the walls is very different to what it was only 25 years back. The pictures of the *Illustrated News* are pasted up in rows. The 6d. photograph of "The Son in Australia," or of "The Daughter Gone to Service," has found its way to a place above the chimney-piece; and one of the latest endeavours to let in another ray of brightness and of good is the recent production of wall prints, in frames at exceedingly low prices, such as book-hawkers may supply along with selected cheap literature, and which promise to find a most ready sale wherever they have been offered.

The rapid survey which has now been taken of the condition of the working classes has not proclaimed any conspicuous or astonishing result, but it has been adequate to show, from a variety of points of view, that a simultaneous elevation in many particulars at once is gradually taking place. The attentive eye can assuredly perceive, though it be through obscurity and obstruction, something better than the stirrings of mere corruption or the stagnation of moral death. These improvements have their centre in the working man's home, with their spring in his better education; but as educators, if we expect progress, we must labour distinctly as Christian workers for God—well assured, as matter both of faith and history, that there is no such friend of permanent advancement as the religion of our Lord Jesus Christ, and that all education is incomplete which is less than the definition given to it already, training for time and for eternity.

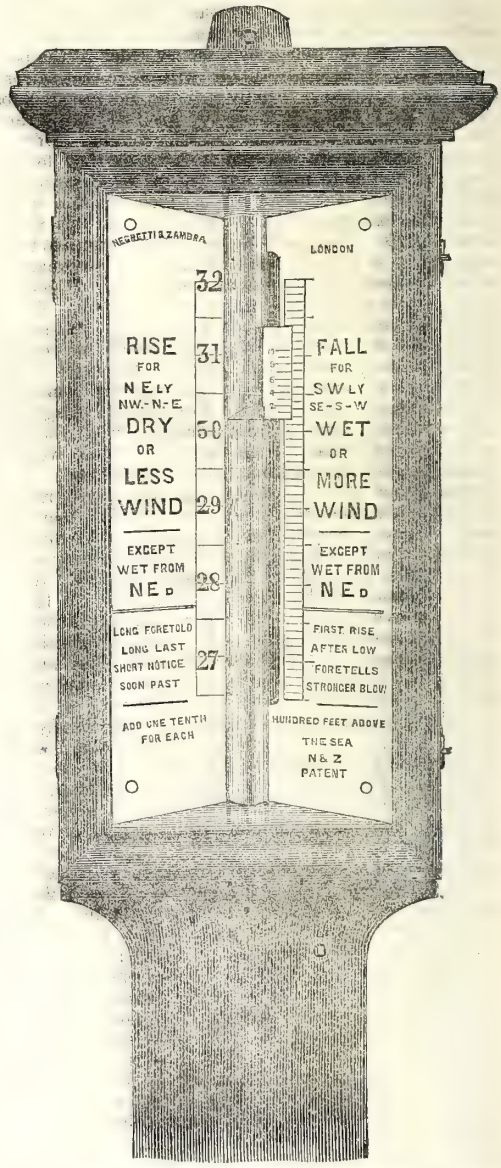
(*To be continued.*)

BAROMETERS FOR LIFE-BOAT STATIONS.

Public attention has frequently been called to the invaluable use of a barometer for indicating a coming storm. It not unfrequently happens that a notice of a gale is given by a barometer two or three days before it actually takes place. It seems plain that with such powers placed in our hands the calamities now endured by our fishermen and coasters might in many instances be avoided. A good barometer in a public situation would warn them in time what to expect, and they would thus be frequently able to avoid the consequences of storms, so often at present proving fatal to them. The facts disclosed in the Wreck *Register and Chart*, of which an abstract was published recently,* render the present a peculiarly fitting time to bring the subject before the members.

Rear-Admiral Fitz-Roy, F.R.S., has compiled a thoroughly practical Manual for the use of a barometer, so that seafaring men or fishermen may soon become perfectly familiar with the indications of the instrument. Some time since, as chief of the Meteorological Department of the Government, he obtained the sanction of the Board of Trade to supply some forty of the poorer fishing villages with barometers, some of which have been of great service to the fishermen.*

His Grace the Duke of Northumberland, K.G., has also, jointly with the Meteorological Society, recently provided barometers for some of the principal fishing-stations on the Northumberland coast, under the superintendance of Mr. James Glaisher, F.R.S., of the Royal Observatory, Greenwich.



The subject has also been taken up practically by the National Life-boat Institutio . Admiral Fitz-Roy, who is a Member of its Committee, and Mr. Glaisher, have promised to give the undertaking their cordial and valuable co-operation. Admiral Fitz-Roy's own Manual, as well as large placards containing extracts from it, will be extensively circulated on the coast, fully explaining the working of the barometer.†

* See present Vol. of *Journal*, p. 800.

* See a notice in the *Journal*, Vol. vii., p., 639.

† These Manuals can be purchased at one shilling each.

It is proposed to fix such instruments, wherever found useful and practicable, in suitable positions at the Society's life-boat houses, which are situated on most parts of the coasts of the United Kingdom.

To carry out effectually this plan the Institution has, fortunately, the machinery at hand, for to each of its life-boats is attached a permanent coxswain, who receives a small annual salary for his superintendence of the working part of the life-boat establishment. It is proposed to instruct such of these men as are found capable, in the indications of the barometer, so that they may act as so many storm-warners in the towns or villages in which they reside. It is estimated that a good barometer cannot be fixed at a life-boat house under £6, so that it will require a considerable sum to carry out effectually the above plan of the Institution. A benevolent gentleman has presented to the Institution £50, to be applied specially to the purchase of barometers for its life-boat stations. Messrs. Negretti and Zambra have supplied the beforenamed 40 instruments to the Board of Trade, for various fishing stations on the northern coast, and also a number to the British Meteorological Society, for the coast of Northumberland. The object of the Institution will be to obtain a good instrument, and one that will not easily get out of order in travelling, or require renovating at frequent intervals; in short, a barometer that, having been once set up at a life-boat station, will be a permanent instrument of instruction, and one that will not entail any future expense to the Society. In order to meet these requirements, the makers have, therefore, introduced the following changes in the regular instruments, which may fairly come under the head of important improvements. The brass or ivory scales that barometers are generally furnished with are here replaced by a substantial plate of porcelain, on which the degrees and figures are legibly engraved, and permanently blackened in, so that, as far as the divisions and figures are concerned, there will be no danger of their becoming faded or obliterated. This is a very important improvement, especially for an instrument that has of necessity to be placed in an exposed position, where the mariner may be able to consult it at any time, even in the middle of the night, should he wish to do so.

The tube of the barometer is of large diameter, admitting a column of mercury $\frac{4}{10}$ of an inch in diameter, so as to render the mercury easily visible, and show the slightest variation; and it is so constructed that the liability of air entering it is entirely obviated. To prevent the admission of air to the vacuum above the mercurial column, a trap is laid at the bottom of the tube near the cistern, so that if any air should find its way into the tube, it cannot possibly pass the trap, but is there detained, and the instrument is in no way deteriorated or injured by its presence. The mercury too is "boiled" in the tubes, by which means, as is well known, greater accuracy is obtained. In the old system the scales are marked with Fair, Change, Rain, &c.,—words which in reality have often a tendency to mislead, and to throw discredit on barometrical indications. The plan to be adopted in the life-boat barometer is shown in the accompanying engraving.

Admiral Fitz-Roy, has suggested considerable changes, and these suggestions are adopted by the National Life-boat Institution.

Subjoined is a synopsis of Admiral Fitz-Roy's Instructions on the use of Barometers. These instructions will be printed on large placards for use on the coast, wherever the barometers of the National Life-boat Institution are placed, and elsewhere:—

"The barometer should be set regularly, by a duly authorised person, about sunrise, noon, and sunset.

"The words on old scales of barometers should not be so much regarded for weather indications as the rising or falling of the mercury; for if it stand at *changeable*, and then rise towards fair, it presages a change of wind or weather, though not so great as if the mercury had risen higher; and, on the contrary, if the mercury stand above *fair* and then fall, it presages a change, though not to so great a degree as if it had stood lower: besides which, the direction and force of wind are not therein noticed.

"It is not from the point at which the mercury may stand that we are alone to form a judgment of the state of the weather, but from its rising or falling; and from the movements of immediately preceding days as well as hours—keeping in mind effects of change of direction, and dryness, or moisture, as well as alteration of force or strength of wind.

"It should always be remembered that the state of the air foretells coming weather, rather than shows the weather that is present—(an invaluable fact too often overlooked)—that the longer the time between the signs and the change foretold by them, the longer such altered weather will last; and, on the contrary, the less the time between the warning and the change, the shorter will be the continuance of such foretold weather.

"If the barometer has been about its ordinary height, say nearly thirty inches at the sea-level, and is steady or rising, while the thermometer falls, and dampness becomes less,—north-westerly, northerly, or north-easterly wind, less rain or snow may be expected.

"On the contrary, if a fall takes place with a rising thermometer and increased dampness, wind and rain may be expected from the south-eastward, southward, or south-westward.

"A fall with low thermometer foretells snow.

"When the barometer is rather below its ordinary height, say down to nearly twenty-nine inches and a half (at sea-level), a rise foretells less wind, or a change in its direction towards the northward—or less wet, but when it has been very low, about twenty-nine inches, the first rising usually precedes or indicates strong wind—at times heavy squalls—from the north-westward, northward, or north-eastward; after which violence a gradually-rising glass foretells improving weather, if the thermometer falls; but if the warmth continue, probably the wind will back (shift against the sun's course), and more southerly or south-westerly wind will follow, especially if the barometer's rise is sudden.

"The most dangerous shifts of wind, or the heaviest northerly gales, happen soon after the barometer first rises from a very low point; or if the wind veers gradually, at some time afterwards.

"Indications of approaching changes of weather, and the direction and force of winds, are shown less by the height of the barometer than by its falling or rising. Nevertheless, a height of more than thirty (30·0) inches (at the level of the sea) is indicative of fine weather and moderate winds; except from east or north occasionally.

"A rapid rise of the barometer indicates unsettled weather; a slow movement, the contrary; as, likewise, a steady barometer, which, when continued, and with dryness, foretells very fine weather.

"A rapid and considerable fall is a sign of stormy weather, and rain or snow. Alternate rising and sinking indicates unsettled and threatening weather.

"The greatest depressions of the barometer are with gales from S.E., S., or S.W.; the greatest elevations, with wind from N.W., N., or N.E., or with calm.

"A sudden fall of the barometer, with a westerly wind, is sometimes followed by a violent storm from N.W., or N., or N.E.

"If winds set in from the E. or S.E., and the gale veers by the south, the barometer will continue falling until the wind is near a marked change, when a lull may occur; after which the gale will soon be renewed, perhaps suddenly and violently, and the veering of the wind towards the N.W., N., or N.E., will be indicated by a rising of the barometer, with a fall of the thermometer.

"After very warm and calm weather, a storm or squall, with rain, may follow; likewise at any time when the atmosphere is heated much above the usual temperature of the season.

"Not only the barometer and thermometer, but appearances of the sky and clouds should be vigilantly watched.

Signs of Weather.

"Whether clear or cloudy, a rosy sky at sunset presages fine weather; a red sky in the morning bad weather or much wind, perhaps rain; a gray sky in the morning, fine weather; a high dawn, wind; a low dawn fair weather.*

"Soft-looking or delicate clouds foretell fine weather, with moderate or light breezes; hard-edged, oily-looking clouds, wind. A dark, gloomy, blue sky is windy; but a light, bright blue sky indicates fine weather. Generally the softer the clouds look, the less wind (but perhaps more rain) may be expected; and the harder, more "greasy," rolled, tufted, or ragged, the stronger the coming wind will prove. Also, a bright yellow sky at sunset presages wind; a pale yellow, wet; and thus, by the prevalence of red, yellow, or gray tints, the coming weather may be foretold, if aided by instruments, almost exactly. Small, inky-looking clouds foretell rain; light scud clouds driving across heavy masses show wind and rain; but if alone, may indicate wind only.

"High upper clouds crossing the sun, moon, or stars in a direction different from that of the lower clouds, or the wind then felt below, foretell a change of wind.

"After fine clear weather, the first signs in the sky of a coming change are usually light streaks, curls, wisps, or mottled patches of white distant clouds, which increase, and are followed by an overcasting of murky vapour that grows into cloudiness. This appearance, more or less oily or watery, as wind or rain will prevail, is an infallible sign.

"Light, delicate, quiet tints or colours, with soft, undefined forms of clouds, indicate or accompany fine weather; but gaudy or unusual hues, with hard, definitely-outlined clouds foretell rain, and probably strong wind.

"When sea-birds fly out early and far to seaward, moderate wind and fair weather may be expected. When they hang about the land, or over it, sometimes flying inland, expect a strong wind, with stormy weather. As many creatures besides birds are affected by the approach of rain or wind, such indications should not be slighted by an observer who wishes to foresee weather.

"Remarkable clearness of atmosphere near the horizon; distant objects, such as hills, unusually visible; or raised (by refraction), and what is called 'a good hearing day,' may be mentioned among signs of wind, if not wet, to be expected.

"More than usual twinkling of the stars, indistinctness or apparent multiplication of the moon's horns, halos, 'wind dogs' (fragments or pieces of rainbows, sometimes called 'wind galls'), seen on detached clouds, and the rainbow, are more or less significant of increasing wind, if not approaching rain, with or without wind.

"Lastly, the dryness or dampness of the air, and its temperature (for the season) should always be considered, with other indications of change, or continuance of wind and weather.

"On barometer-scales, the following contractions may be useful:—

RISE	FALL
FOR	FOR
N. E.LY.	S.W·LY.
NW.-N.-E.	SE.-S.-W.
DRY	WET
OR	OR
LESS	MORE
WIND	WIND.
EXCEPT	EXCEPT
WET FROM	WET FROM
N. ED.	N.ED.

When the wind shifts against the sun,
Trust it not, for back it will run.

First rise after very low
Indicates a stronger blow.

Long foretold, long last;
Short notice, soon past."

* A high dawn is the break of day seen above clouds, instead of the horizon.

Home Correspondence.

RAIN-WATER TANKS IN THE SOUTH OF ITALY.

In these volcanic regions, where wells are extremely precarious, rain-water tanks are of universal adoption, and they are more permanently and philosophically constructed than appears to be the case in that very exceptional city of Venice.

In the South of Italy they afford an abundant supply, not to be distinguished from pure spring-water, except, perhaps, by its superior softness. They are sunk in the ground, of course, and are built up upon a good foundation of concrete, with hard-burnt bricks set in buff lime mortar, very fully described by me in a former *Journal*, made-up with pozzolana instead of common sand. These tanks, which are absolutely proof against leakage or infiltration, are arched over with a groined vault, in the centre of which a circular opening is left, about seven or eight feet in diameter, secured by a breast-high parapet and coping, as in ordinary wells.

At this opening the water is drawn by means of a rope or chain, with a bucket at each, and a large pulley about eighteen inches in diameter. The use of the pump would not be so well, because the splashing and dash of the buckets tends very much to aërate the water, and render it as sparkling and palatable as that from a spring. In order to obtain the water from the roof of a building in as pure a state as possible, two, and often three tanks are sunk close together, so that the water may flow from the first to the second and third. The first is made a filter by being partially filled up with clean washed sand and gravel, and the water is made to flow off by means of a syphon tube built in the wall, and of course the filter tank remains always full, a circumstance very necessary for its due preservation. The second and third tank communicate by the bottom in the usual way, but there is a sluice-cock between them, in order that the supply may not be stopped during the operation of cleaning out.

There is also a sluice-cock at the foot of the main stand-pipe, in order to turn off the water from the cisterns after long-continued droughts. Sometimes a tap is used to draw off the water in a cellar or other underground apartment, but the mouth of the tank is always exposed to the open air, otherwise it will be rain, and not spring water. An umbrella shed roof prevents the falling in of leaves or other impurity.

The calculations for the supply and the size of the tanks are simple enough. Take, for example, a small house, ten yards square. Thirty inches annual rain-fall will give, evaporation included, about half a ton per square yard per annum. The total quantity for one hundred square yards of roof, horizontal measure, will therefore, average about—

$$\left.\begin{array}{r}\text{50 tons, or}\\ \text{200 hogsheads, or}\\ \text{12,600 gallons}\end{array}\right\}\text{ per annum.}$$

or about 35 gallons per day, a very fair allowance for the size of the building.

It will not be necessary, however, to construct a tank capable of holding the entire quantity, but merely of sufficient capacity to hold out for the longest probable drought; say of three months, or ninety days, and a tank eight feet by ten, and nine feet deep, would answer the purpose, but if good water be desirable, there ought to be two such tanks besides the filter.

In the vicinity of the metropolis I presume that a double filter will be required, the first filtering downward, as usual, the second upwards; and the sand and gravel ought to be of a calcareous nature, or partly consisting of comminuted sea shell. I am, &c.,

HENRY REVELEY.

Poole, Sept. 7th.

Proceedings of Institutions.

Glasgow Institution.—The distribution of the prizes and certificates awarded to the students of this Institution who were successful in the last examination of the Society of Arts, took place recently in its Hall, Dundas-street. Mr. Sheriff Strathern, who presided on the occasion, addressed the meeting on some of the subjects which its coming together there naturally suggested. It was a pleasing fact that such Institutions had, in regard to their utility, made a deep impression upon all in authority, and that was peculiarly evident in the great interest which was generally manifested in the education of the young, especially of the working classes. He dwelt upon the good that the Society of Arts was doing, and affirmed that it had an inspiriting effect upon our educational establishments; for it not only encouraged and attested, but also rewarded persevering students. It was every year becoming more useful to the working classes; for last year the number of subjects for examination was 25, whereas this year it is 29. Thus every young man had an opportunity of following the bent of his genius, and if he were industrious, he could calculate on receiving a reward. The Sheriff was proud of Scotland for two reasons,—first, because the students from it had attained the highest rewards; and secondly, because out of the 500 students who had been examined by the Society of Arts. one-fifth of them were from Scotland, which proportionably needed to have been represented by only one-tenth. He was further glad to see that, of the three Institutions in Glasgow connected with the Society of Arts, this one stood at the top, comparing its progress with that of former years, and was in a most flourishing condition. He trusted that year after year he would witness such progress. The learned Sheriff then proceeded to distribute the prizes and certificates, addressing a few words to each Candidate as he delivered them. The Institution having received two £5 prizes on account of students who obtained first prizes, half the amount of each was awarded to the teachers who taught those that obtained the prizes, namely, to Alexander Ramsay, A.M., F.E.I.S., on account of the first prize in Latin to Mr. John N. Russell; and to Mr. J. A. Peterkin, on account of the first prize in Latin to Mr. Wm. H. Smyth. The certificates having been distributed, the meeting was addressed by Mr. Morrison, Principal of the F. C. Training College, who in the course of his remarks drew pointed attention to the fact that, while Scottish students of the working classes stand very high in the examinations they undergo, both by the Society of Arts and otherwise, Scottish students who come forward to the Government and other high-class examinations stand very low. He would not pretend to account for the fact, but fact it was. The meeting was then addressed by the teachers who received prizes, by Mr. Smith for the students, and by Mr. Cochrane, President of the Institution.

Gosport and Alverstoke Literary and Scientific Institution.—The "Fine Art and Industrial Exhibition" recently held in connexion with this Institution, obtained an unprecedented success, the number of visitors amounting to upwards of 16,000; and, although the expenses were necessarily large, a balance remains in the hands of the Committee of £140, which will be applied in securing an important addition to the library of the Institution. The Committee are deeply sensible of the generous and encouraging support they have received in the promotion of the Exhibition, which they believe has been the means of imparting a large amount of valuable information, and conferring considerable benefit upon the locality.

Metropolitan Evening Classes, Sussex Hall.—In the list of those who have recently passed the Bachelor of Arts' Examination at the University of London, the name of Thomas Brodribb is in the first division. This gentleman was for many years a student at Crosby Hall, and about three years since Mr. Brodribb gained prizes at the Society of Arts' Examination, and, subsequently, was awarded two prizes from King's College—one for German and the other for general proficiency, with five certificates for other subjects—and at the termination of his studies he was made an Associate of the College.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Geographical, 8½ (Burlington House). 1. "Australia.—Proposed Exploration in North Western Australia, under Mr. F. Gregory." 2. "Africa.—Letter from the East African Expedition, under Capt. J. H. Speke."
Medical, 8½. Clinical Discussion. M. Groux, the subject of "Congenital deficiency of the Sternum," is expected to attend to exhibit certain phenomena connected with the heart's action.

Tues. ...Syro-Egyptian, 7½. 1. Rev. J. H. Cowper, "Notes on the Comparative Geography of the Book of Judith." 2. Mr. Joseph Bonomi, "Description of an Engraved Stone in the Egyptian Museum of Lord Ashburton, at Alresford." 3. Mr. Charles E. Harle, "On the Seal of a King contemporary with Sennacherib."
Civil Engineers, 8. Renewed Discussion upon Mr. Michael Scott's Paper "On Breakwaters, Part II."
Medical and Chirurg., 8½.

Sat.....Asiatic 3.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 2nd*, 1860.]

Dated 25th July, 1860.

1810. T. Fowler and De Grasse Fowler, Northford, Connecticut, U.S.—Imp. in machinery for manufacturing pins.

Dated 14th September, 1860.

220. C. T. Launay and A. M. A. Dominé de Veruez, Paris—Imp. in treating coal-naphtha, and in apparatus employed therein.

2228. P. Pautard, Castres Tarn, France—An improved apparatus for supplying air to persons in water, and in mines or other places. (A com.)

Dated 20th September, 1860.

2290. V. H. Laurent, Plancher-les-Mines, France—Imp. in machinery or apparatus for forging nails, screws, bolts, rivets, and railway spikes.

2297. J. R. Morley, Woodbridge, Suffolk—Imp. in the manufacture of baking dishes.

Dated 2nd October, 1860.

2380. E. Steane, Commercial-place, Brixton-road, Surrey, and F. Palling, Esher-street, Lambeth—An improved mode or apparatus for preventing candles dropping or guttering.

Dated 4th October, 1860.

2400. C. Whicher, 28, Crozier-street, Lambeth—An improved machine for applying steam in a manner to cause direct rotation. (A com.)

Dated 5th October, 1860.

2408. C. Tuckett, jun., 3, Bickerton-terrace, Haverstock-hill—An improved method of ornamenting book covers, which is also applicable to other purposes.

2410. T. Wimpenny, Holmfirth, Yorkshire—A certain imp. in machinery or apparatus to be employed for spinning cotton and other fibrous substances.

Dated 6th October, 1860.

2416. W. Clegg, T. Wild, and J. Tomlinson, Rochdale—Imp. in certain machines for preparing cotton and other fibrous materials.

Dated 8th October, 1860.

2432. E. J. Hughes, Manchester—Imp. in the preparation of certain colouring matters, and also a process of printing and dyeing woven fabrics, yarns, and other substances. (A com.)

2434. H. Bright, Sandwich-street, Burton-crescent, Middlesex—An improved guard or cutwater for ships or vessels, for the purpose of lessening or preventing injurious effects resulting from collision.

2442. E. Gardner, Maidstone, Kent—Imp. in machinery or apparatus employed in the manufacture of paper.

Dated 9th October, 1860.

2446. E. Worthington, Manchester, and R. Mills, Rochdale—Imp. in apparatus for preventing the retrogression of railway carriages on inclines.

2458. F. Danby, Exmouth—An improved anchor.

Dated 10th October, 1860.

2462. C. Wheatstone, Hammersmith—Imp. in electro-magnetic telegraphs and apparatus for transmitting signs or indications to distant places by means of electricity, and in the means of and apparatus for establishing electric telegraphic communication between distant places.

2463. A. Hobson and J. Hobson, Wirtemberg-street, Clapham, Surrey—An atmospheric trap for the prevention of smells arising from cesspools, drains, water closets, urinals, or any other place where smells may arise.

Dated 15th October, 1860.

2502. W. Grimshaw, Wharton-lodge, Lytham, Lancashire—Certain imp. in apparatus for superheating steam in locomotive steam engines.
2504. J. T. Webster, Mansfield, Nottinghamshire—An imp. in driving the spindles of doubling frames.
2506. S. Roberts, Hull—Imp. in steam engines.
2510. A. McDougall, Manchester—Imp. in materials or compositions for destroying vermin on sheep and other animals, and for protecting them therefrom.
2512. C. Burn, Delahay-street, Westminster—Imp. in tramrails for street railways.

Dated 16th October, 1860.

2526. J. Bergen, 63, Long-lane, West Smithfield—Imp. in chimney pots.
2520. J. L. Jullion, Tynemouth—An imp. in the manufacture of pape .
2522. S. Frankau, Bishopsgate-street Within, London—Imp. in plugs for smoking pipes.

Dated 17th October, 1860.

2526. J. Ridsdale, the Minories, Middlesex—Imp. in apparatuses for signalling, particularly applicable to marine engine room telegraphs.
2528. W. Clarke and S. Butler, Nottingham—Imp. in the manufacture of fabrics in twist lace machinery.
2530. A. V. Newton, 66, Chancery-lane—Imp. in lamps. (A com.)
2532. H. A. F. Duckham, Terthewey-lodge, Junction-road, Holloway—Imp. in gas meters and regulators.
2534. R. G. Mc Crum, Milford, Armagh, Ireland—Imp. in machinery or apparatus for preparing "cards" for jacquard machines.
2536. W. Eades and G. Worstenholm, Birmingham—Certain imp in screw stocks and dies for cutting or forming metal screws

Dated 18th October, 1860.

2537. A. White, Great Missenden, Buckinghamshire—An apparatus for drying hay, corn, and roots and other thing.
2539. A. B. Jacout, Rheims, France—Imp. in water meters.
2541. E. Harel, J. Holzwasser, and E. Burns, Manchester—Certain imp. in steam engines.
2543. A. V. Newton, 66, Chancery-lane—Imp. in the construction of passenger carriages. (A com.)
2545. J. L. Jullion, Tynemouth—Imp. in paper making machinery (A com.)
2547. J. Macintosh, North-bank, Regent's-park—Imp. in apparatud for compressing air, and in raising and forcing water an other fluids.
2549. G. B. Bruce and A. Stein, 24, Great George-street, Westminster—Imp. in rail and tram-ways.

Dated 19th October, 1860.

2551. J. A. Munn, 13, East-street, Red Lion-square—A metallic thermometer. (A com.)
2553. J. Jack and D. Rollo, Liverpool—Imp. in the construction of surface condensers and feed water heaters, and in the combination of certain parts of steam engines, especially adapted for marine purposes.
2555. C. Hoare, Allington, Dorsetshire—Imp. in machinery for twisting and laying flax, hemp, and other fibrous materials.
2557. A. G. Hunter, 43, Dean-street, Newcastle-upon-Tyne—Imp. in treating sulphurets.

Dated 20th October, 1860.

2559. W. Young, 9, Tavistock-place, Tavistock-square—Imp. in ship-building.
2561. W. Jamieson, Ashton under-Lyne, W. Robinson, and C. Rowbottom, Glossop—An imp. or imps. in apparatus for grinding or sharpening the cards used in carding fibrous materials.
2563. R. D. Smith and J. Smith, London-wall—Imps. in the manufacture of leggings or knickerbockers.
2565. A. C. A. Bertrand, 2, Cheshunt-terrace, Grange-road, Bermondsey—Imp. in the manufacture of matches and cigar-lights
2567. W. Clark, 53, Chancery-lane—Imp. in the manufacture o articles of jewellery, and in apparatus for the same.

Dated 22nd October, 1860.

2569. J. Farmer and J. L. Fuggle, London—Imp. in the manufacture of scarfs, cravats, and similar articles.
2571. R. A. Brooman, 166, Fleet-street—Imp. in apparatuses for evaporating and concentrating, specially applicable to the manufacture of sugar. (A com.)
2573. A. Dietz, New York—An improved process or method for tanning skins, hides, &c., and converting them into leather.
2575. W. E. Gedge, 11, Wellington-street, Strand—Imp. in feeding steam boilers (A com.)
2577. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for measuring the flow of liquids, partly applicable to ordinary water cisterns. (A com.)

Dated 23rd October, 1850.

2579. W. H. Clark and J. De la Mare, Jersey—An improved lubricating composition to be used with other lubricators.
2581. E. B. Wilson, Parliament street, Westminster—Imp. wheels for railway purposes.
2583. J. Webber, jun., Trentham-terrace, Grove-road, Mile-end, Middlesex—An improved mode of, and apparatus for, converting rope into oakum.
2585. G. Beazley, 3, Highbury-park, South Islington—A new mode of preparing dyes produced from aniline.

Dated 24th October, 1860.

2587. W. H. Walenn, 19, Talbot-road, Camden-road, Holloway—Imp. in magneto-electric machines, and in electro-magnetic engines.
2589. J. Kenyon, Adlington, Lancashire—Certain imp. in looms for weaving.
2591. D. Allison and J. Kay, Manchester—Imp. in window frames and sashes.
2595. W. Eddington, junr., Chelmsford, Essex—Imp. in machinery for draining, ploughing, and cultivating land.
2597. J. Chisholm, G. Chisholm, and R. T. Kent, Mark-lane—An improved method of obtaining compounds of nitrogen.

Dated 25th October, 1860.

2601. J. Richards, Tipton, Staffordshire—A new or improved break for arresting or stopping carriages or trucks on inclines, when by the breaking of coupling links or other accident the said carriages or trucks are in danger of running down the said inclines.
2603. W. Mann, Barnsbury, Middlesex—Imp. in apparatuses for washing and condensing gas.
2605. H. Cook, of Cheetham hill, Manchester—An imp. in the manufacture of crinoline.
2607. W. Hodson, 3, Kingston-upon-Hull—Imp. in fire baskets or moveable grates and ovens.

Invention with Complete Specification Filed.

2651. W. T. Vose, Massachusetts—An improved pump or portable fire annihilator.—October, 1860.

Patents Sealed.

[*From Gazette, November 2nd*, 1860.]

1st November.

1094. A. Upward.
1098. G. Bower.
1107. M. Bonner.
1109. T. Silver.
1111. J. Brickhill and J. Noble.
1115. G. Davies.
1116. H. Reid.
1118. T. Railton.
1127. A. Tweedale, J. Tweedale, and S. Taylor.
1145. J. B. J. De Buyer.
1171. W. Clark.
1257. J. Hinks.
1299. G. Wallis.
1365. J. Juckes.
1503. J. Smith.
1673. J. Davis.
2051. J. Wilkes, T. Wilkes, and G. Wilkes.
2053. A. V. Newton.
2121. W. Forgie and T. Finn.
2159. A. D. Lacy and W. C. Homersham.

[*From Gazette, November 6th*, 1860.]

November 6th.

1128. J. D. Dougall.
1132. J. A. Eisenstuck.
1136. W. McDonald.
1142. H. Kemp.
1146. J. Reid.
1148. J. M. Fisher.
1151. W. B. Johnson.
1154. H. Wildsmith, J. Carter, and J. J. Carter.
1157. A. Wilson.
1165. R. A. Brooman.
1166. A. Robertson.
1167. J. H. Morrell and H. Charnley.
1170. J. Owen and G. Veitch.
1176. R. Young.
1178. J. Chamberlton & W. Smith.
1180. A. Pulman, T. Cresswell, and R. Longstaff.
1197. S. C. Salisbury.
1198. J. Denis.
1200. R. J. Jordan.
1208. W. E. Newton.
1209. C. M. Guillemin.
1214. M. A. F. Mennons.
1230. J. Ferguson.
1234. S. Davey.
1239. J. Longmaid.
1248. S. R. Samuels.
1288. W. Baker.
1324. F. Heindryckx.
1340. A. V. Newton.
1347. W. H. Harfield.
1354. A. G. Hunter.
1360. W. E. Newton.
1394. M. McIntyre Cranston.
1556. W. E. Newton.
1571. W. Clark.
1699. J. Pile and J. R. Smyth.
1996. R. Read, jun.
2016. M. Jacoby.
2125. C. Mason.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, November 2nd*, 1860.]

October 29th.

2759. W. Harwood
2760. J. Davy and W. Bentley.
2763. S. Knowles.
2777. G. H. Cottam and H. R. Cottam.
2782. M. F. Isoard.
2788. J. Mallison, jun.

October 31st.

2765. G. B. Galloway.
2783. C. Iles.
2798. W. F. Batho and E. M. Bauer.

[*From Gazette, November 6th*, 1860.]

November 3rd.

2814. H. R. Palmer.
2821. H. Baines.
2840. A. Parkes.
2849. E. H. Ashcroft.
2968. F. G. Grice.

Patents on which the Stamp Duty of £100 has been paid.

[*From Gazette, November 2nd*, 1860.]

October 29th.

2528. J. Chesterman.

October 30th.

2514. G. Hamilton.

[*From Gazette, November 6th*, 1860.]

November 1st.

2543. H. Brierly.

November 3rd.

2603. Lieut. W. Rodger, R.N.
2610. E. G. Banner.
2682. M. Poole.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 16, 1860.

NOTICE TO MEMBERS.

The One Hundredth and Seventh Session of the Society will commence on Wednesday next, the 21st inst., when the First Ordinary Meeting, will take place. Sir Thomas Phillips, Chairman of the Council, will deliver the opening Address. The Chair will be taken at Eight o'clock on the following Wednesday Evenings:—

1860.	November	—	—	21	28	
,,	December	5	12	19	—	
1861.	January	—	—	16	23	30
,,	February	6	13	20	27	
,,	March.....	6	13	20	—	
,,	April	3	10	17	24	
,,	May	1	8	15	22	29
,,	June	—	—	—	26*	

The following are the arrangements for the Meetings previous to Christmas:—

November 21.—Opening Address by Sir Thomas Phillips, F.G.S., Chairman of the Council.

*** On this evening the Medals which were awarded by the Council for Papers read at the Weekly Evening Meetings during the last Session, and for articles submitted to the Society's Committees, will be distributed.

November 28.—"On the Acclimatization of Animals." By Mr. F. T. Buckland, M.A., Student of Christ Church, Oxford, Assistant-Surgeon, 2nd Life Guards.

December 5.—"On Electro-Block Printing, especially as applied to Enlarging or Reducing from any Printing Surface or Original Drawing." By Mr. H. G. Collins.

December 12.—"On Italian Commerce and Industries." By Professor Leone Levi.

December 19.—"On the Straw Plait Trade." By Mr. A. J. Tansley.

COUNCIL.

The following Institutions have been taken into Union since the last announcement:—

Accrington Mechanics' Institution.
Newcastle-on-Tyne Mechanics' Institution.

WARMINSTER CONFERENCE ON ADULT EDUCATION.

(*Concluded from page* 844.)

Section 4.—Societies having an Influence on the Advancement of Education.

Chairman.—John Ravenhill, Esq. Secretary.—Hon. and Rev. S. Best.

1.—Book-hawking. By the Rev. G. Sumner, of Alresford, Hants.

Whether we are idle or not, the enemy is not idle. The country has been saturated with evil literature; infidel, licentious, sceptical, indecent publications are broadcast over England. Not a murder or other great crime takes place but all the sickening details are published, with a portrait of the criminal, and sold by thousands. To counteract such evils, book-hawking societies have been set in operation. A hawker, carefully selected, goes from house to house in circuit, offering for sale books chosen by the committee or secretary.

It may be asked, why do not shops answer the purpose, or why cannot the clergyman supply his people with books? Shops are very well for the upper classes. We do not mind going into a shop to see if anything will suit us, but it is different with the poor. A smock frock, especially if dirty, or a fustian jacket, especially if torn, is unpleasantly looked upon in a bookseller's shop. The shopkeeper thinks that it may drive away more lucrative custom. The poor do not frequent the bookseller's shop. They do not know the titles of books, nor what to ask for. The hawkers bring the shop to the cottager's door, put out their wares before him, help him to examine them, point out this or that book as interesting; one with large print for the old woman, another with pictures for the child, and so many buy of the hawker who would never enter the shop. Why cannot the clergyman supply his poor parishioners with books chosen by himself? Bibles and Prayer-books the poor will come to ask for, but the clergyman cannot keep such a constantly varying stock in all bindings, at all prices, as the hawker can show, nor can the clergyman go round from door to door with books.

Book-hawking societies have a powerful influence on the advancement of education. Negatively, as undermining the sale of mischievous literature; positively, as supplying books of a healthy tone. Suppose a child who has gone through the village school, and kept up the smattering of knowledge already obtained by attending adult and Sunday-classes, one of the main objects attained in such a case will be that this man or this woman can read fluently. In other words, he has attained the power of self-culture. His education is far from finished, but he has acquired a power which brings everything within his reach. But the mere power of reading will not do this. He must have that which will call his faculties into exercise, and the Book-hawking Society brings within his reach well selected books. The poor appreciate this advantage. The hawker finds custom amongst them. The secretaries of the various societies have ascertained the station of the majority of their customers. The report for 1859, from the East Durham district, states that in two collieries the *British Workman*, *Band of Hope Review*, *Leisure Hour*, and *Sunday at Home*, have become so popular, that the vendor of objectionable periodicals has discontinued his monthly visits. In West Middlesex, in 1859, the various classes of purchasers were:—

Labourers	1,405
Servants	379
Mechanics	59
Tradesmen	183
Gentry and clergy	189
School teachers	141
Soldiers and families ...	259
Farmers	261

And in North Hants, in 1859-60:—

Labourers	2,155
Servants	616
Tradesmen	390
Gentry and clergy	408

Out of £177 received in one district in Norfolk, only £25 was from the gentry.

By book-hawking, a class of customers is reached which before were unable to purchase suitable books.

In education the first step is to give the power, the second step is to give the means, of self-culture. The first book-hawking society was formed in Hampshire about ten years ago, under the suggestions of the present Bishop

* The Annual General Meeting: the Chair will be taken at Four o'clock. No Visitors are admitted to this Meeting.

of Rochester, and its success was so undoubted that, during the last ten years, new book-hawking societies have sprung into existence at the rate of one every two months. There are now throughout England between sixty and seventy societies at work. The great majority are in connexion with the Central Book-hawking Union in London, a society which greatly facilitates the commencement of book-hawking operations, and furthers their development by opening a register for hawkers—furnishing the secretaries with information, and supplying them with books.

Each hawker has to pay annually £4 for his license. This is a tax upon the society's funds. Might not petitions be made to Government to remit this tax on Education? The small sum which Government would lose by its remission might be looked upon as a grant to education. To some societies the amount may be trifling, because they have capital, but many struggle against considerable difficulties. The South Hants Society is striving to maintain two hawkers with a subscription list of £32 8s. The North Wilts Society is struggling to keep one hawker at work with a subscription list of £13 17s. In the former case, the sum paid to Government absorbs a quarter, and in the latter case nearly one-third, of the subscriptions. Will not the abolition of the tax open the door to immoral hawkers? Is not the £4 a year a check upon them? In the first place many of them have no license—they may cry their goods in the street without a license; the only thing they may not do is to offer their goods for sale from door to door. Hence, the vendors of trashy songs and last dying speeches and confessions never carry a license. The withdrawal of the necessity for the license might be accompanied by some such requirements as the following:—

1. The hawker to sell nothing but books and prints.
2. The hawker to find security in three respectable householders for £20 that he will not sell infidel or immoral works.
3. His pack to be at all times open to the inspection of the police.
4. The police to be instructed, in case they find in his pack works of a suspicious character, to bring the matter before the magistrates in the nearest town.
5. If their decision be adverse to the hawker, his licence to be cancelled and his securities to be forfeited.

Religious publications are the most popular. In Pembrokeshire, in 1859, 863 Bibles were sold; in east Sussex, 857 Bibles and 1,732 Prayer Books. The books which find the readiest sale are "Oxenden's Pathway of Safety," "Paxton's Cottage Gardener," "Oxenden's Labouring Man's Book," "The Pilgrim's Progress," "The Earnest Communicant," "Inquire Within," "Johnson's Dictionary," "Nicholl's Help to Reading the Bible," and of periodicals, the *British Workman*, the *Penny Post*, *Leisure Hour*, *Sunday at Home*, and *Churchman's Monthly Penny Magazine*. Almost all of these are books of a religious tendency, and this points out the necessity for care in the selection of a hawker. It is a question whether hawkers should not wear some distinctive dress.

2.—The Provident Society. By Mr. Dear, of Abbott's Ann, Hants.

The following illustrates the *modus operandi* of a provident society, for both sexes and all ages, which has been in successful operation for 30 years. Let us suppose a number of depositors in a savings' bank agreeing to assist each other in sickness. One wishes to draw 10s. a week in sickness, another 8s., and another 6s., each one drawing what he likes, but not more than his weekly earnings. Suppose next that this sum is taken from each depositor's fund, viz., 10s. from the first, 8s. from the second, and 6s. from the third, and put aside till one falls ill. For convenience sake we will call the sum, thus raised, the sick-rate.

Suppose next, that they agree that in sickness the sick person shall draw one-fourth of his weekly allowance from the fund standing in his own name in the bank, and the remaining three-fourths from the sick-rate. When the first falls ill, he draws 2s. 6d. from his own fund and 7s. 6d. from the sick-rate. The second draws 2s. from his own fund and 4s. 6d. from the sick-rate. The third draws 1s. 6d. from his own fund and 4s. 6d. from the sick-rate, and as long as they can draw these sums from their own funds they will be guaranteed 10s., 8s., and 6s. a week. When they can no longer do this (in other words, when their own fund is exhausted) their sick pay ceases. A certain sum must, of course, remain in each depositor's name, as a security to the others, and this is never to be drawn out by the depositor for any purpose but sickness, as long as he claims sick pay. The sum thus fixed will be proportionate to his sick allowance; say 10s. for every shilling. He who draws 10s. per week must, therefore, keep £5 in his name; he who draws 8s. must keep £4; and he who draws 6s. must keep £3, everything above this being at his own disposal.

This then is the principle of our provident society. I have shown its operation in the case of the healthy man. To adapt it to sex, age, and different degrees of health, it is necessary to have five classes of members. The same regulations apply to all, the difference being in the proportion drawn from their respective funds in sickness. The first class, as we have seen, draws one-fourth from his own fund and three-fourths from the rate; the second class draws half from his own and half from the rate; the third class two-thirds from his own and one-third from the rate; the fourth, four-fifths from his own and one-fifth from the rate; the fifth draws all from his own. He is merely a depositor, and receives all his own money, with nothing from the rate, to which he therefore pays nothing. His only advantage is medical attendance in sickness, with the ordinary advantages of the savings' bank, which, to such as unhappily come under this class, by reason of ill-health, is felt to be a great boon. The provident society unites the principle of the savings' bank with the full advantages of the benefit club; I say "full advantages," for although fears have been entertained that, in cases of long and protracted illness, a man's fund would be exhausted, 30 years' experience has shown that these fears are groundless, for, in no one instance, where a first-class member has paid regularly the usual subscription of a common benefit club, and withdrawn none of it, has there been a failure; and, in general, a considerable balance, and in some cases large ones have remained to be paid on death. The great advantage, therefore, which this provident society possesses over most other societies is, that it offers assistance to all who need it, not only to the healthy male, who least requires it, but to females, the weak and sickly, and the young.*

3.—Temperance Societies. By Mr. Farmer, of Warminster.

On this topic we must not indulge in the spirit of partisans, nor pretend to unmixed good or evil on either side. The object of the Temperance Society is the suppression of intemperance. The means, viz., total abstinence, are efficient, whether expedient or not. The principle is, that strong drink is not only unnecessary in health but absolutely injurious. Whether this principle be true or false, the object and practical effects are important. Though education is not the direct object, it is an indirect result of the Temperance Society. But for "drink," education would not only be of a higher character, but more diffused. The golden season for education is youth; but children are taken from school, for the slender pittance they can earn, just as they are at the threshold of their course. Need this be so? Much of it is owing to "drink." Ill as working-men can

* In the four parishes, Andover, Abbott's Ann, Penton, and Longfranck, there were in July last, 1,017 members; in Abbott's Ann, population 680, there are 520 members.

afford it, they waste their money on that which is not bread, which makes them neither wiser, nor stronger, nor better; which impoverishes their health and morals, and frustrates efforts to educate their children. Think of the money mischievously squandered in drink by labouring men, and (even on the supposition that the drink is no evil) what a vast fund is here lost, which might be used for supporting schools. Were all the money thus misapplied spent on education, little charitable help would be necessary. Athenæums and similar Institutions for adults are used only by a handful of the working classes. But, let us imagine the masses of working men, or a large number of them, to abstain from "drink." Their time, money, and minds would be at liberty to be devoted to intellectual pursuits. Men, however ignorant, have some desire to be less so, and though they may object to others being educated above their stations, they have seldom any such fear for themselves. In such circumstances then, the thirst for knowledge not being overcome by a thirst for drink, to use the Institutions would become a necessity of their being.

4.—Societies having an Influence on Education. By Mr. W. W. Beach, M.P.

It is the primary duty of a country to educate the people. The best mode of rendering education reproductive and useful in life is difficult to determine. Knowledge is now requisite for success in every department of life: every one should increase the information that he has acquired. Children are taken at the most tender age from their instructors to factories or to the plough, and never return to school. Means should be devised whereby a desire for further instruction may be created, and opportunities for acquiring it may be afforded. Societies can effect by arrangement and organisation far more than the most sanguine anticipate.

The first object of Mechanics' Institutes was to afford information to mechanics with respect to the particular work in which they might be engaged. A desire for general information speedily caused the foundation of Institutes, which took a wider scope, and had for their object the general dissemination of knowledge.

Their objects are generally:—

1. To diffuse knowledge by lectures on popular subjects.
2. To supply a well selected library and newspapers.
3. To form classes for particular branches of study.

In England and Wales there are 622 Institutes, with 103,522 members. The lectures delivered in one year were 5,149. The issue of books amounted to 1,837,548 volumes. The numbers attending evening classes was 16,300. Lectures are more attractive than productive of permanent benefit, because the auditors cannot realise the details of a subject on which they possessed no previous information. A lecture may serve as an introduction to study or to arrange the ideas of those who have studied. But to those who neither possess nor intend to acquire the requisite information, the lecture may be productive of amusement but not of practical benefit. Consecutive study is required. The mind cannot comprehend and grasp facts and trace their import and influence without labour and reflection. A library affords information and amusement. It should embrace every character of literature—works of fiction should not be discouraged. The mind in time grows satiated with that style of reading, and seeks for a record of real events. Biography is especially engaging; a narrative depicting the career of Napoleon or Wellington rivals the most glowing creation of fancy. The acts of heroes prompt men to heroism: it is interesting to hear how some man, sprung from the humblest classes, grappled with the disadvantages of his position; how his genius and strenuous exertions carved out for him a distinguished career — to trace his success is pregnant with encouragement. Classes should afford to the members of an Institute facilities for acquiring permanent and useful knowledge. The difficulty is to obtain well-qualified teachers; they are generally men who serve in the most liberal spirit, with every desire to perform their duties, but having other occupations, sometimes they are prevented from attending—perhaps they may not have the facility of communicating knowledge. It is not always easy to inspire the young with a desire to learn. After a day of labour they require considerable resolution voluntarily to enter on study, therefore it is necessary to combine recreation with instruction. In some places, where classes have been permanently established, the pupils have satisfactorily increased. In the Mechanics' Institutes of Yorkshire, for example, in 1854 there were 2,160 pupils in 127 Institutes; in 1859 there were 7,699 pupils in 138 Institutes. The most flourishing Institutes, however, derive benefits from a District Union, such as the Southern Counties' Adult Education Society. At the Annual Conferences collective experience is furnished to each Institute, and their arrangements and rules are adapted to their acquirements. The Central Union introduces emulation—prizes help to lead to study—not only for their value, but the desire for success. Many a man, thus led in early youth to exert himself, has owed his future position to the habits and tastes implanted in him. A powerful influence is exercised by Central Associations, such as the Society of Arts and the Association for the Promotion of Social Science.

But there are necessarily many whom the advantages offered by Institutions can never reach. A scattered population cannot possess the same facilities for the acquisition of knowledge as the inhabitants of towns. It is of the greatest importance to give them at least the opportunity of reading useful and attractive books. The Book-hawking Society has proved of great efficacy. Their books have driven out those pernicious publications with which the minds of the poor had previously been saturated.

Lord Stanley computed that, out of one hundred criminal children, ninety were born of dishonest or profligate parents. To raise men out of ignorance, and to elevate them in the social scale, is a noble work of necessity.

5.—Penny Banks. By Mr. Cruse, of Warminster.

Among the principles traceable through the varied works of the Creator, economy is everywhere apparent. But in human morals disorder and disproportion, abuse, waste, and extravagance are discernible, with their natural consequence—distress; and, though these evils have been greatly mitigated by education, there remains among the lower ranks much which the philanthropist must endeavour to mitigate, if not perfectly to remedy. Among mitigative institutions are Penny Banks, having the principle of economy as their basis; a principle needful for the well-being of all, but specially of those who depend upon precarious resources and daily toil. The Penny Bank is designed as the first and temporary reserve fund, the preliminary treasure-house of the industrious poor, the stepping-stone to the savings' bank. The Penny Bank receives deposits of smaller amount, and encourages them by an allowance of interest. It is intended to catch, not such regular periodical payments as are made to "benefit clubs" in reference to health or clothing, but occasional contributions, chance pennies, gratuities, earnings for over-work; the overplus of any kind, which might otherwise soon vanish at the ale-house, or elsewhere, in worse than unprofitable results. It presents facilities for laying up little sums, from a penny as a minimum, which might otherwise go astray, and for withdrawing any amount at the shortest notice. It secures a little fund for a fixed purpose against a fixed day. It befriends the young by forming a nucleus treasure which they gladly see increase, or by intercepting their waste through thoughtlessness or novelty of spending. It befriends the honest and industrious labourer by taking care of his spare pence; domestic servants by protecting their savings and perquisites. The widow and orphan resort to it to withdraw what had been deposited beforehand for their temporary use in need. By

it the punctual payment of rent is promoted, and the cultivator of allotments is aided in meeting his expectant landlord. The grown-up sons in a family, awaiting in uncertainty the exact time of leaving home for distant work, have cherished in the Penny Bank their little accumulations, and found them serviceable at the right moment.

There are more than 200 Penny Banks established chiefly within the last ten years, and nearly all under gratuitous management.

Our own Penny Bank had its origin partly in example shown by other towns (particularly Southampton), and partly in the warning which grew out of a disgraceful abuse in this town of a casual distribution of about £20 as fire-suppression-money; when a portion of the rewards bestowed upon 330 men, women, and children, who had been engaged in rescuing their neighbours' property, was dissipated in drunkenness and riot, which did not terminate without manslaughter in our streets. Almost ever since our bank has been steadily in progress, and money recently distributed in the same manner has been deposited there. Since the 27th December, 1858, a convenient room has been devoted to this business in a situation central, but not in the main thoroughfare, and we have received nearly £300 from 507 depositors, in 5,800 deposits. Of this sum, upwards of £160 has been lodged, in the names of our treasurers, at the Savings' Bank, and, though we have paid out in withdrawals more than £130, in 357 payments, we have never diminished the Savings' Bank investments. Depositors include a few residents in five adjoining parishes, and we have received an application to form a branch in one more distant. In every town and village support to these useful establishments may be urged upon the parishioners on the plea of economy in local taxation. For we promote among the working-classes, and all persons occupying a sphere of dependency, the habit of thrift and frugality, and, if we can induce the commencement of the habit, and it be allowed to acquire its legitimate strength, and to yield its appropriate fruits (viz., moral independence and freedom from want), we benefit not only the depositors, but every person subject to the payment of poor rates.

6.—Outline of a Scheme of Insurance for providing Means for the Expense of Education. By the Right Hon. T. S. Sotheron-Estcourt, M.P.

Annual subscription for ten successive years, £10, £15, £20, £25, or £30.

It is assumed that, of three boys insured, one alone will complete the period of ten years; that the other two will have ceased to subscribe, in consequence of death, inability, or other cause.

It is proposed, in all cases where the boy does not complete his ten years' subscription, to return to the parents half the amount which they have paid, and to carry the other half to the general account, to augment the premium payable to those who complete their ten years.

The premium to which those boys will be entitled who complete their ten years' subscription, will consist of the accumulated subscriptions paid by their parents, with interest, and a share of the insurances forfeited during the ten years immediately preceding, by boys who cease to subscribe.

Example.

A. B. insures his boy at the age of one year, and pays yearly £10, for ten years:—

His premium will consist of £10 for ten years...	£100
Interest	22
Share of forfeited insurances (say)	50
	172
Deduct for management (say 10s. yearly)	5
	£167

The premium, when due, shall be payable to the parent, on receipt of a certificate that he has put the boy to some school, and he shall receive it by instalments, spread over two or more years, at his option.

Home Correspondence.

THE EFFECTS OF TEA AND COFFEE.

Sir,—At page 797 of the *Journal*, Mr. Mann asserts, "Experiments with theine and caffeine have proved that, even when given in very minute quantities, a considerably smaller amount of food has been required; and it has likewise been found that in households in which the use of tea has been discontinued the looked-for economy did not result, the consumption of bread and meat having more than proportionately increased." At the late meeting of the British Association, at Oxford, Dr. Edward Smith read a paper which tended to prove the very opposite, and that, in fact, the use of tea tended to increase the waste of muscular tissues. This view was corroborated by many eminent physiologists, who took part in the somewhat lengthened discussion which followed his paper, and I believe were not questioned by anyone present. Dr. Milner stated the result of an experiment of his on—if I recollect rightly—as many as two hundred prisoners, directly bearing on this point, which unmistakably proved the correctness of Dr. Smith's views. Although, of course, the Society is not responsible for such a statement, yet assertions in this *Journal* have considerable authority in many quarters, and you may perhaps think it worth while to have attention drawn to it. I am, &c..

W. SYMONS.

17, St. Mark's Crescent, Regent's-park, Nov. 1, 1860.

MECHANICS' INSTITUTIONS.

Sir,—In my last letter I offered some remarks on the introduction of what is called light literature into the libraries of Mechanics' Institutes. This is entitled to more consideration than it ordinarily receives, because it has not unfrequently been the case that the success of an Institution has been imperilled through a too rigid adherence to a rule which excludes all fiction, as well as works of a religious or political tendency. I am ready to admit that if we could influence all the working classes of this country not only to become readers, but also to confine their reading to such books as we might select for them, some advantage might be gained by supplying them with instruction as distinguished from mere amusement; yet, even then, it is questionable whether some amount of relaxation would not be desirable. But, on the other hand, when it is remembered that the working classes are characterised by their love of independence; that the support of an Institution is purely voluntary; and that in most cases a taste for reading can only be promoted by making it attractive, the exclusiveness alluded to is the more injudicious.

It has often been lamented that most of the cheap literature in circulation amongst the working classes is not only sheer trash, but too often of an immoral tendency. The antidote, however, will not be found in the opposite extreme, but rather in a better class of fiction, and to this end it is desirable that attention should be directed. Much useful instruction is conveyed, and moral truths enunciated in many tales read only for amusement, and if the result be to encourage a habit of reading, a great amount of practical good will be accomplished, if not all that could be wished. How few comparatively would ever acquire the power of reading with sufficient care to make it a pleasure, were it not for the charm of fairy lore to the youthful imagination, and the many tales for children which smooth the rugged path of learning, by strewing the way with flowers. Are we to expect more resolution on the part of the sons of toil who have not yet been able to comprehend the delights of literature, or to appreciate knowledge for itself? They can only be induced to read at all by allowing them to taste some of the sweets; and

if by the addition of well-selected fiction to the library of a Mechanics' Institution, more members can be obtained, and those members become readers, they will not only be in some measure weaned from more vicious kinds of recreation, but a great point will be gained in preparing the way for those civilising influences which are the principal objects of such Institutions.

It would not be difficult to mention several writers of fiction whose works may be read at least without injury to morals if not with positive advantage. The historical novels of Sir Walter Scott have led many to become readers of mere reliable history, whilst other writers in the guise of fiction have conveyed really useful lessons of life. It is, perhaps, of more importance to exclude the injurious, and not to mistake ephemeral popularity for literary merit. There are, perhaps, few modern writers who have occupied a more prominent position than Mr. Charles Dickens, and yet it would be difficult even for his warmest admirers to explain in what his claims to merit consist. For his powers of description he has not been inaptly described as an elaborate penny-a-liner; his language is anything but good English, whilst of his morals, the less said the better. His delineations of character are grotesque caricatures of human nature; he is most successful in depicting the most revolting exhibitions of vice, whilst his pretended good characters are mere absurdities, without one particle of religious faith, or the slightest allusion even to the ordinary observances of a Christian life. The perusal of such works is calculated to do considerable injury to young minds, by giving them false notions, and by rendering them familiar with vice in its worst forms, not only to weaken the horror of it, but too often to induce imitation.

The works of Mr. Thackeray may not be open to the same objections, but they have a tendency to encourage a taste for slang, whereas the object of all reading should be to promote a knowledge of the English language in its greatest purity. Much of the barbarism of provincial dialects has been overcome by the teaching of Mechanics' Institutes, but the changes will be for the worse if the relics of the Saxon, Norse, and Norman tongues are substituted by modern vulgarisms.

Fortunately for the credit of modern intelligence, the writings of Mrs. Ellis are no longer popular. It was a libel upon common sense that such diluted twaddle, such milk-and-water sentimentality, should ever have been read by intelligent beings. Let us hope that their rejection is a sign of more mental vigour.

But if a Library Committee exercise a reasonable amount of discretion, they will not only have an abundance from which to select, but the admission of a fair proportion of fiction will do much to gain the object they have in view.

The following table, which is taken from a circulation of nearly a quarter of a million of books, may afford some idea of the description of works chiefly read by the members of Mechanics' Institutions. It will be seen that works of fiction constitute one-third of the whole, whilst the addition of periodicals brings it up to more than one-half:—

Theology	3·10	per cent.
Philosophy—Education	3·15	,,
Politics—Statistics	0·75	,,
History—Biography	12·60	,,
Voyages and Travels	5·35	,,
Poetry—the Drama	3·45	,,
Fiction	33·90	,,
Fine Arts—Literature	8·10	,,
Science	3·85	,,
Natural History—Gardening	2·45	,,
Bound Periodicals	9·72	,,
Unbound ditto	13·58	,,
	100·00	

It would, perhaps, be as well if some of your readers would state the result of their experience on this question.

I am, &c., BARNETT BLAKE.

Sir,—Your excellent correspondent, Mr. Barnett Blake, has started a discussion in your columns, for the further development of which I should suppose you will not be unwilling to find space, especially as there can be no doubt that there is a large demand at the present time, on the part of promoters of Mechanics' and other similar Institutions, for reliable information with regard to the principles on which such associations should be established. It may not, therefore, be unacceptable to many of your readers if I venture to place before them the administrative plan upon which the Institution I have the honour to manage has been conducted for many years with safety and success, together with some details which may serve to develope the scope of our operations, and the purposes we are seeking to attain.

I begin with the directorate. It would seem to be of the first importance that the managing body should be composed as little as possible of ornamental, and as much as possible of *bona fide* working members. There will be plenty of room on the list of patrons, vice-patrons, and vice-presidents, for the ornamental and complimentary element, but the directorate should be composed exclusively of men whose active and personal connection with the Institution itself, or with similar undertakings, marks them out as competent to legislate upon the plans and schemes which will come before them. Our own directors have been, almost to a man, educated in the Institution, and connected with it from their boyhood; and in the lively interest born of so long a connection, lies, no doubt, to a large extent, the secret of our success.

The Board being thus constituted, the work of each individual director must now be marked out, to which end separate committees should be formed, to whose care the several departments of the Institution should be entrusted. Some members of the Board will be qualified, by superior education and by literary tastes, for entertaining questions relative to the educational operations of the Institution, and to these the management of the classes should be committed. Others, again, will show themselves to be intelligent, shrewd men of business, well posted-up in the economics of commercial life, and these should be placed on the committee for general purposes. Others may be conversant with counting-house routine, and may well be deputed to manage financial matters. And to others of an artistic, ingenious turn of mind, may be committed the task of arranging bazaars, exhibitions, soirées, or other schemes for providing funds. Each of these committees will work independently of the others, meeting for the purpose as often as may be deemed necessary, and the business of the general board will be to receive the reports of the various committees, and to discuss, and, if approved, adopt, the recommendations therein contained. I may, perhaps, venture to add, without running much risk of being deemed egotistical, that Mr. Blake is quite right in saying that "it cannot be too strongly urged that much of the success of an Institution will depend upon the activity and intelligence of the secretary." That officer will be the organ of communication between the directors (whose legislative powers exist only during the sittings of the Board) and the various departments of the Institution. On him will devolve the task of watching the working of the various plans matured in committee and entrusted to him to carry out; and the consideration of his suggestions for such alterations and improvements as his daily experience may enable him to point out, will form the staple work of future committees. He should be trusted with a large amount of discretionary power, to enable him to act with promptness and confidence in cases where instant decision is required, and the committees will often consult the best interests of the Institution by endorsing the well-considered and promptly-executed measures of their representative, even when those measures are not precisely in accordance with the strict letter of the law.

I now proceed to discuss the purposes which, as it appears to me, Institutions thus organised should seek

to fulfil. "Mechanics' Institutions," says the *Times*, "which began with the idea of teaching science to artizans, are now places for the exhibition of dissolving views, and the delivery of lectures on or by popular novelists." To a large extent, this sweeping censure is no doubt well deserved. We ourselves, indeed, must plead guilty to the charge of having originated exhibitions of dissolving views, not, however, as a substitute for more legitimate operations, but as a temporary expedient for providing funds to meet an extraordinary outlay; but we do not plead guilty to the charge of having sunk the educational purpose of our existence in an attempt to provide light amusement. It is, however, matter for regret that in so many of our provincial Institutions the whole energy of the executive should be expended in arranging programmes of amusing lectures, getting up bazaars, and conducting soirées; nor is it easy to conceive of any Institution so circumscribed in its possibilities, as that a programme of light lectures, a Christmas party, and perhaps the formation of a chess club or a discussion class, should necessarily form the sum total of a year's operations. The original purpose for which Mechanics' Institutions were established, namely, that of "teaching science to artizans," may possibly be now out of date, but good and cheap popular education is not out of date, and there can be no question that never has there existed so active a demand for information and instruction as is evinced at the present moment. Gradually, but surely, the standard of public intelligence is creeping upwards; government measures help it, competitive examinations help it, and on all sides of us, young men, whose early education has been neglected, are discovering that the assistance they may derive from the Mechanics' Institutions whose educational facilities are what they should be, is the only chance that remains to them of saving themselves from being left behind by their more qualified competitors in the race for place and position.

Regarding, therefore, the task of developing a sound system of class instruction, as the most, if not the only, legitimate work of every well regulated Mechanics' Institution, I propose to devote the remainder of this letter to a few details connected with the arrangement of evening classes for young men, which may, perhaps, be of service to those who have the management, or who contemplate the establishment, of such classes.

The choice of subjects for study will, of course, be governed greatly by circumstances and locality. In the following statement, I have tabulated a list of our own classes in the exact order of their popularity, as indicated by the number of students attending them.

Subject of Study.	Class Fees.
Writing	Free.
Writing from Dictation and Derivation of Words	,,
Elementary Arithmetic...	,,
Lessons on Common Things	,,
Phonography	,,
Elementary Grammar	,,
Reading	,,
Mechanical and Architectural Drawing	6d. per quarter.
Advanced Arithmetic	Free.
French Language	5s. entrance fee.
Geography	Free.
Chemistry	1s. for the course.
Book-keeping	Free.
Mathematics	,,
German Language	5s. entrance fee.
Advanced Grammar	Free.
Free-hand Drawing	5s. entrance fee.
Drilling	1s. per quarter.
Elocution	2s. entrance fee.
Pianoforte	10s. per quarter.

In the case of all the free classes above named, the ordinary membership fee of 5s. per quarter gives free admission, while the fees indicated are in addition to the subscription just named. There are many arguments in favour of monthly, and even of weekly payments, admitting to single classes, without necessarily making the subscriber free to all. These are details, however, which must be settled in accordance with the varying exigencies of various localities.

The cost of the materials for study is with us brought down to its minimum. The reading books and the slates are provided free of cost; the black board, in many instances, is made to do duty for more elaborate treatises, and very frequently the only outlay entailed is 3d. for a copy-book. In cases where home study is possible, a grammar and an arithmetic may be needed, but the whole cost of books to a student in the free classes seldom exceeds half-a-crown.

The great difficulty to be encountered is that of obtaining regular attendance and continuous application on the part of the students. The more numerous the free classes, the more tempting is the opportunity for desultory and unsystematic study, until the young student becomes like a boy wandering among the gay booths of a country fair, allured on all sides by brilliant toys and tempting dainties, and unable to decide in which direction to lay out the penny he has brought with him. The difficulty of securing regular attendance, especially on the part of our junior students, we have largely overcome by a very simple expedient. We are provided with attendance tickets, of the size and appearance of an ordinary railway ticket, separate sets being kept for each class and each day of the week. On every ticket there is printed, on the one end "Late," and on the other end "Early," either of which words can be removed by a cut with a pair of nippers such as are used by railway guards. Every pupil, then, is supplied, at every class, and every evening, with an 'early' or 'late' ticket, according as he presents himself in time or otherwise, and the parent or guardian is requested to require the production of the ticket on the return home of the student. At the end of the quarter the tickets are returned, and quarterly and annual certificates presented to deserving pupils. This plan of course applies mainly to those students who are under parental control; to the elder ones, a desire for the acquisition of knowledge, and a personal attachment to the teacher, will generally prove a sufficient incentive to regular attendance.

There are other details on which I should like to have touched, but I have already occupied too much of your space. With the hope that the foregoing suggestions may prove useful to some of my fellow-labourers in the good cause of popular education,

I am, &c.,
THOMAS MARSHALL,
Secretary to the Manchester Mechanics' Institution.

October 18th, 1860.

Proceedings of Institutions.

Bradford Mechanics' Institute.—The winter session of this Institute was inaugurated on Friday, September 28th, with a soirée, at which J. V. Godwin, Esq., President of the Institution, was the Chairman. Tea was provided in the News-room, at half-past six o'clock, and a company of 260 partook of the repast. At half-past seven a meeting was held in the Lecture-theatre, and was very numerously attended. Among the gentlemen on the platform, near the President, were the Rev. Dr. Godwin, Rev. W. R. Smith, Rev. J. R. Campbell, Messrs. Alderman Farrar, W. George, D. J. Crebbin, J. Wales, W. Godwin, James Hanson, C. Lund, &c. The President said, the last occasion on which they met together in that

room was their annual meeting, when they assembled for the purpose of taking a review of the session which had just then closed. In some departments that review was complete and full, but there was one department, and that the most important in that Institution, in which it was necessarily somewhat deficient—he alluded to the classes. At that time they were only able to state the numbers who had entered the various classes, and to speak in general terms as to their attendance and application during the session. It remained for the awards of the examiners of the various classes to enable them to judge more correctly of the progress which had been made and of the quality of what had been done. Those reports were now before them, and whilst they had the most full and implicit confidence in the strictness and impartiality of their own examiners, they stood before their friends that night with the consciousness that they honourably sustained the ordeal of another and still further test, the examiners of the Society of Arts. The object, therefore, of their meeting that night was two-fold,—the first to proclaim the awards of the examiners and distribute the prizes and certificates, and in the next place to inaugurate the new winter session and to ask the meeting to approve of the programme of the committee. The meeting had taken the shape somewhat of a festive gathering; but it must not be supposed for a moment that there was the slightest intention to abandon the pursuit of self-culture, which had been the basis of their prosperity as an Institute—and in lieu of it to trust to the precarious footing of amusement, which had been the ruin of so many kindred Institutions, especially in the south part of England. He then proceeded to distribute the prizes and certificates to the successful candidates, remarking that in the institute list there were forty-one prizes to present, but it must be borne in mind that the members of their classes during the last session amounted to no less than 705 individuals. In the course of the evening a choice selection of music was sung by Mrs. Sunderland, Miss Freeman, and Mr. Delavanti. Mr. Ward presided at the pianoforte.

Watt Institute, Portsea.—On Thursday, the 27th September, the presentation of certificates to the successful candidates at the above, was made by the President, Andrew Murray, Esq., supported by Mr. T. W. Miller, Mr. Robert Rawson, and Major-General Whylock. Mr. J. Spence, second vice-president, was on the continent. After the business of presenting was gone through, Major-General Whylock gave an appropriate address to the candidates, in order to excite them to further study, which was heartily responded to by Mr. Mills, one of the candidates. Mr. Robert Rawson gave a short address to stimulate them to greater exertions; after which an entertainment was given by the junior members, consisting of recitations and performances on the concertina, and several glees were sung by the friends of the members.

MEETINGS FOR THE ENSUING WEEK.

Mon. ...Medical, 8½. Lettsomian Lectures, on Medicine, by Dr. Chas. J. Hare, "Practical observations on some of the points of difficulty in the investigation and diagnosis of Tumours and Intumescence of the Abdomen."

Tues. ...Civil Engineers, 8. Mr. George Hurwood, "On the River Orwell, and the Port of Ipswich."
Statistical, 8. Mr. T. B. L. Baker, "On the Criminal Returns, 1854-9, with especial reference to the Influence of Reformatories."

Wed. ...Society of Arts, 8. Sir Thomas Phillips, Chairman of the Council, "Opening Address of the 107th Session."
Geological, 8. Mr. David Forbes, "On the Geology of Bolivia and Southern Peru.

Thurs...Philological, 8.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 9th*, 1860.]

Dated 17th September, 1860.

2257. G. F. Smith, 15, Golden-square—Imp. in the smelting of iron and other ores. (A com.)

Dated 21st September, 1860.

2302. A. A. Trinquier, Paris—Imp. in surveying instruments.

Dated 8th October, 1860.

2437. L. J. O. Jolly, 33, Boulevart St. Martin, Paris—Imp. in the means of winding up and setting watches. (A com.)

Dated 10th October, 1860.

2460. J. Ramsbottom, Crewe, Cheshire—An improved mode of lubricating the pistons and valves of steam engines and other machines actuated by steam.

Dated 16th October, 1860.

2518. R. Roberts, and Captain T. E. Symonds, R.N., Adam-street, Adelphi—Imp. in marine steam engines, and in machinery and apparatus connected therewith.

Dated 18th October, 1860.

2542. H. Williams, Weston-super-Mare, Somersetshire—Imp. in the manufacture of boots.

2544. A. V. Newton, 66, Chancery-lane—Improved machinery for crushing quartz and other substances. (A com.)

2546. M. Wesolowski, Cincinatti, U.S.—Imp. in the obtaining of light, and in the apparatus employed therein. (Partly a com.)

2548. W. Andrews, Woburn-chambers, Henrietta-street, Strand—Imp. in insulators for telegraph wires.

Dated 19th October, 1860.

2556. T. Moy, 1, Clifford's-inn, and Major F. B. Wardroper, Warwick-square, Pimlico—Imp. in the construction of vessels for river navigation.

Dated 20th October, 1860.

2560. J. Ash, Blackwall, Middlesex—Imp. in the construction of iron ships

2562. W. Grimshaw, Warton-lodge, Lytham, Lancashire—Imp. in machinery or apparatus for drying, mixing, and pulverising clay and other materials.

2564. P. Margetson, New Weston-street, Bermondsey—Imp. in boots

Dated 22nd October, 1860.

2574. J. Wadsworth, Marple, Cheshire, and J. Wadsworth, Salford, Lancashire—Imp. in gas burners, and improved modes of manufacturing the same.

2576. G. W. Hart, 9, Stanley-terrace, Southsea, Hants—Imp. in the construction of vessels of war, and in propellers for the same.

Dated 23rd October, 1860.

2578. W. H. Tylor, Warwick-lane, Newgate-street—Imp. in apparatus for heating and aerating saline or other liquids for baths, and in the salinometers employed in connection therewith, parts of which imps. are applicable to other purposes.

2582. R. Baynes, Downshire-hill, Hampstead—Imp. in lawn mowing machines.

2584. C. Lungley, Deptford, Kent—Imp. in the construction of iron ships and other vessels, for the purpose of rendering them unsinkable and increasing their strength.

2586. T. W. Headlam, 3, Montague-villas, Tottenham, Middlesex—Imp. in stuffing chairs, couches, mattresses, pillows, and other such like purposes, especially adapted also for stuffing cabin furniture, and the seats and backs of public and private vehicles.

Dated 24th October, 1860.

2588. G. Lacaire, Créton, France—An improved penholder.

2590. E. K. Dutton, Stretford, Lancashire—Certain imps. in machinery or apparatus for singeing textile goods or fabrics.

2592. J. Taylor, Staleybridge, Cheshire, H. N. Gartside and J. H. Wood, Saddleworth, Yorkshire—Imp. in self-acting mules for spinning and doubling.

2594. J. McInnes, Glasgow—Imp. in machinery, apparatus, or means for actuating or working railway brakes.

2596. T. Garnett, Low Moor, near Clitheroe, Lancashire—Certain imp. in looms for weaving.

Dated 25th October, 1860.

2600. W. Prosser, 24, Dorset-place, Dorset-square, Middlesex, and J. Standly, 9, Pall-mall East, Westminster—Imp. in apparatus employed in the production of light.

2602. J. Kay and J. Hartley, Burnley, and T. Mallinson, Manchester—Certain imp. in "self-acting mules" for spinning cotton and other fibrous substances.

2604. R. A. Brooman, 166, Fleet-street—Imp. in apparatuses for raising liquids. (A com.)

2606. W. C. Cambridge, Bristol—Imp. in the construction of harrows

Dated 26th October, 1860.

2609. F. S. Barff, Dublin—An improved self-acting apparatus for extinguishing candles in lamps or otherwise.

2611. H. Boys, Northfleet, Kent—Imp. in preparing the bine and leaves of the hop plant.

2613. H. S. Aumonier and C. J. Wellard, Saint John-street, Clerkenwell—Imp. in facilitating the division of sheets or pieces of paper, or other substances into required forms, and in the means or apparatus employed for the purpose.

2615. C. F. Clark, Wolverhampton—An imp. or imps. in enamelling or coating with glass certain kinds of metallic articles.

2617. W. Palmer, Grange-road, Bermondsey, Surrey—Imp. in packing the pistons of cylinders.

2619. E. F. Prentiss, Liverpool—Imp. in cars or carriages to run on street railways or tramways.

Dated 29th October, 1860.

2621. E. Sparkhall, Cheapside—An imp. in umbrellas and parasols.
2623. J. Burch, Crag, near Macclesfield, and E. Booth, Manchester—Certain imp. in extracting coloring matter from vegetable, animal, and other substances, and making decoctions and infusions therefrom.
2625. W. Mabon, jun., and W. P. Gaulton, Manchester—Imp. in apparatus for heating the feed water for steam boilers by the exhaust steam from high pressure engines.
2627. J. Harris, Ess Hill House, Newton Abbott, Devonshire—Moveable armour for protecting ships of war and batteries from the effects of shot and shell.
2629. W. Mann, Whitefriars—A method of indicating at a distance the revolutions of shafts, spindles, and axles.
2631. F. H. Elliott, the Strand—An improved case for aneroid barometers for marine purposes.
2633. W. Clark, 53, Chancery-lane—Imp. in corsets and their fastenings, which are also applicable to other articles of dress. (A com.)
2635. A. H. Renton, 49, Cambridge-street, Eccleston-square, Pimlico—Imp. in apparatus emyloyed in the production of light.
2637. N. Brough and G. T. Kilby, Birmingham—New or improved fastening for articles of dress, and for fastening belts and bands generally.
2639. J. A. Knight, 4, Symond's-inn, Chancery-lane—A new system of photographic or daguerrean apparatus or objective, to be called "Korn's polyograph." (A com.)
5641. F. H. Elliott and C. A. Elliott, the Strand—An instrument for indicating the approach of vessels to shoals, rocks, and land.
2643. T. Greenwood and J. Dockray, Leeds—Imp. in machinery for carding, opening, and straightening tow and other fibrous substances.
2645. W. E. Newton, 66, Chancery-lane—Imp. in looms. (A com.)
2647. C. Crockford, Holywell, Flintshire—Imp. in the manufacture of spelter from the sulphuret of zinc.
3649. M. Henry, 84, Fleet-street—An improved method of manufacturing railway wheel tyres and other articles of steel. (A com.)

Dated 30th October, 1860.

2653. D. S. Miller, 51, Marlborough-street, Calton, Glasgow—Imp. in weaving and in the apparatus used for that purpose.
2655. A. V. Newton, 66, Chancery-lane—An improved mode of and apparatus for desiccating wet or moist substances. (A com.)
2657. J. M. Henderson, Renfrew—Imp. in marine steam engines.

Dated 31st October, 1860.

2559. A. L. Chéradame and J. B. A. Lambert, 4, South-street, Finsbury—A life-preserver.
2663. J. C. Pearce, Bowling Iron Works, near Bradford—Imp. in steam engines and boilers.
2665. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of boots, shoes, and other coverings for the feet, and in apparatus connected with such manufacture. (A com.)

Patents Sealed.

[*From Gazette, November 9th*, 1860.]

November 9th.

1175. W. Basford.
1179. S. C. Salisbury.
1181. H. L. Lilley.
1216. J. Nicholson.
1218. A. Robertson and A. Ritchie.
1219. S. C. Salisbury.
1220. J. Cole.
1296. A. Hubart and V. Cantillon.
1300. G. De Laire and C. Girard.
1321. J. Dugdale and E. Dugdale.
1387. C. Stevens.
1388. C. Stevens.
1417. W. E. Newton.
1478. H. Nicholson.
1722. W. E. Newton.
1774. A. R. le M. Normandy.
1879. J. Higgin.
1960. A. V. Newton.
2000. D. Foxwell.
2022. F. R. Grumel.
2131. J. Hughes, W. Williams, and G. Leyshon.
2167. P. E. Aubertin.
2209. N. Thompson, jun.

[*From Gazette, November 13th*, 1860.]

November 13th.

1193. G. H. Barth.
1195. J. Higgins and T. S. Whitworth.
1201. D. S. Agata.
1203. J. Grant.
1210. W. Krutzsch.
1221. A. B. Ibbotson.
1229. S. Fielden and A. Fielden.
1235. J. Lees.
1242. C. J. De Meyer.
1242. J. Copcutt.
1268. M. Henry.
1273. P. E. Chevalier.
1295. J. Macintosh.
1331. E. A. L. D'Argy.
1379. E. Lavender and R. Lavender.
1957. A. V. Newton.
1959. A. V. Newton.
1961. A. V. Newton.
2042. J. Fleming.
2061. J. Arrowsmith.
2253. J. Hanson.
2261. W. E. Newton.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, November 9th*, 1860.]

November 5th.

2820. W. Macnab.
2843. H. C. Bartlett.

November 6th.

2824. J. Adams.

[*From Gazette, November 13th*, 1860.]

November 8th.

2534. W. J. Elwin.
2841. J. T. Way.
2842. J. Harrington.
2874. J. F. Spencer.

November 10th.

2837. T. Rowcliffe.
2850. A. J. Davis.
2878. W. Cossage.
2978. J. Howard.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, November 13th*, 1860.]

November 10th.

2614. W. Steel.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Registry.	Date of Registration.	Title.	Proprietors' Name.	Address.
4298	Nov. 2	Pouch or Purse for containing tobacco and other articles	John William Mott	Lea Bridge-road, Clapton, N.E.
4299	,, 3	Autosmic Cover	John Wilson	9, Buckingham-street, W.C.

LIST OF PRESENTS.

The following presents have been made to the Society during the past year. The thanks of the Society have been forwarded to the donors:—

Presents.	Donors.
Specifications of Patents up to the present time, and indexes	Commissioners of Patents.
Abridgements of ditto.....	,,
Commissioners of Patents Journal ...	,,
A short sketch of the Life of J. W. Klein	The Rev. Wm. Taylor.
On the Education of the Blind, especially those in the opulent classes	,,
On the Relation of the Blind to the world around them	,,
Answers to Lord Overstone's Questions on Decimal Coinage, by Gen. Sir C. W. Pasley, K.C.B., R.E. ...	The Author.
Report on the Eligibility of Milford Haven for Ocean Steam Ships, and for a Naval Arsenal, by Thomas Page, C.E.....	The Author.
23rd Report of the Art Union of London (2 copies).....	Art Union.
Memoirs of the Geological Survey of India, Vol. ii., Part 1	The Superintendent.
Transactions of the Philosophical Institute of Victoria for 1858 ...	The Institute.
Annual Report of the Chambers of Commerce and Trade of the Kingdom of Wurtemburg for 1858. ...	Board of Trade and Commerce of Wurtemburg.
Catalogue of the library of the Corporation of London	Library Committee
Illustrations of Roman London, by Charles Roach Smith	C. Wentworth Dilke.
Pharmaceutical Journal, 2nd Series Vol. i., Nos. 1 to 12, Vol. ii., Nos. 1 to 5	Pharmaceutical Society.
The Reform of the Sewers; "Where shall we bathe? What shall we Drink?" or manure wasted and Land Starved, by G. Rochfort Clarke, M.A....	The Author.
The Commercial Companion and Peerage of Commerce for 1860, by D. Puseley	The Author.
Descriptive Catalogue of the Portraits in the possession of the Royal Society	C. R. Weld.
The Carriage Builders and Harness Makers' Art Journal	Messrs. Tallis and Co.
Statistics of New Zealand for 1858	Colonial Office, Auckland.
Transactions of the Silesian Society for National Culture for 1858 and for 1859...	B. Hebeler.
Report of Experiments with different Manures on Permanent Meadow Land, by J. B. Lawes and Dr. J. H. Gilbert	The Authors.
On the Construction of Artillery and other Vessels, to resist great Internal Pressure, by J. A. Longridge	Institution of Civil Engineers.
Transactions of the Royal Society of Edinburgh, Vol. xxii., part 1...	The Society.
Proceedings of ditto, Session 1858-9	,,
Specimens of Bank Note Engraving, by Henry Bradbury ...	The Author.
Synopsis of the Known Asiatic Species of Silk-producing Moths, with descriptions of some New Species from India, by F. Moore	The Author.
Journal of the Royal United Service Institution Vols. i., ii., iii., and Vol. iv., Nos. 12 and 13	The Institution.
Memoirs of the Royal Astronomical Society, Vols. xxvii. and xxviii....	The Society.
Report on the Railways of India to end of year 1852, by Juland Danvers...	The Author.
Proceedings of the Royal Irish Academy, Vol. 7, Nos. 1 to 8 ...	The Academy.
Transactions of ditto, Vol. xxiii., part 2	,,
A Series of Graduated Exercises adapted to Morell's Grammar and Analysis, by J. D. Morell	Messrs. Constable and Co.
School Geography, by James Clyde	,,
Book-keeping, by Double and Single Entry, by John Maclean	,,
Grammar and Analysis, by J. D. Morell	,,
Photograph of Life-boat, supposed to be proceeding to a Wreck off Scarborough	Royal National Life Boat Institution.
Map of the Metropolitan Railways, by Z. Macaulay	The Author.
Lectures to Young Men, 1860... ...	Young Men's Ch. Assoc. Lond.
Proceedings of the Literary and Philosophical Society of Manchester, 1858-9, Nos. 1 to 16	Society.
Memoirs of ditto, Vol. xv., Part 2 ...	,,
Engravings from Works of Deceased British Artists	Art Union of London.
Considérations relatives au Cable Transatlantique et exposé d'un Système dans lequel la Pression sur le fil conducteur se trouve écartée, par M. H. De Matthys ...	The Author.
Statistical Register of New South Wales from 1849 to 1858	Reg.-Gen. of New South Wales.
Tents, and Tent Life, by Major Godfrey Rhodes (a review)...	The Author.

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Journal of the Royal Geographical Society, Vol. xxix	Society.
L'Arte Della Paglia in Toscana ...	M. Mariotti.
Atti della I. E. R. Accademia Toscana di Arti e Manifatture, residente in Firenze, Vol. i.	Academy.
Archæologia: or, Miscellaneous Tracts relating to Antiquity—(38) (1)	Society of Antiquaries.
Proceedings of the Society of Antiquaries, Vol. iv., 1st series; Vol. i., No. 1, 2nd series	,,
Proceedings of the Literary and Philosophical Society of Liverpool (1859-60), No. 14...	Society.
Report of the British Association for the Advancement of Science (Aberdeen, 1859)	The Association.
United States Patent Office Reports: Mechanics vols. i., ii., iii. (1857), Vols. i., ii., iii. (1858); Agriculture Vols. for 1857-8-9...	United States Patent Office.
Report of the Superintendent of the United States Coast Survey for the year 1857	The Author.
Thirteen Maps from the United States Coast Survey Office	
Report of the Smithsonian Institution for 1858	Institution.
Memoirs of the American Academy of Arts and Sciences, Vol. vi., part 2; new series...	Academy.
Proceedings of ditto., pp. 89 to 248	,,
Proceedings of the American Philosophical Society, Nos. 59, 60, and 61	Society.
Transactions of ditto, Vol. xii., part 2,	,,
First Report of a Geological Reconnaissance of the Northern Counties of Arkansas, made during the years 1857-8	,,
The Cotton Trade of Great Britain; its Rise, Progress, and Extent, by J. A. Mann	Cotton Supply Association.
The Law of Patents for Inventions familiarly Explained, by William Carpmael	The Author.
Presse Scientifique des Deux Mondes; Revue Universelle du Mouvement des Sciences pures et appliquées, Vol. i., Nos. 1 to 5; Vol. ii., Nos. 1, 2, 3	—

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Proceedings of the Royal Geographical Society, Vol. iii., No. 6; Vol. iv., Nos. 1 to 4	Society.
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Journal of Proceedings of ditto, Vol. iv., Nos. 15 and 16 and Supplemental Geology, Vol. v., No. 17 .	,,
Quarterly Journal of the Geological Society, Vol. xvi., parts 1 to 4 ...	,,
Quarterly Journal of the Statistical Society, Vol. xxii., part 4; Vol. xxiii., parts 1, 2, and 3	,,
Proceedings of the Royal Society, Vol. x., Nos. 35 to 40...	,,
Quarterly Journal of the Chemical Society, Vol. xiii., Nos. 1, 2, and 3,	,,
Photographic Journal, from No. 91 to No. 102	Photographic Society.
Horological Journal, from No. 16 to No. 27	Horological Institute.
Canadian Naturalist and Geologist, Vol. iv., Nos. 3 to 6; Vol. v., Nos. 1 to 4	Montreal Natural History Society.
American Journal of Science and Art, Nos. 85 to 89	B. Silliman.
Journal of the Royal Agricultural Society, Vol. xx., part 2; Vol. xxi., part 1	Society.
Papers read at the Royal Institute of British Architects, 1859-60	Institute.
Journal of the Royal Asiatic Society, Vol. xvii., part 2; Vol. xviii., part 1	Society.
Proceedings of the Institution of Mechanical Engineers for 1859, Nos. 1, 2, and 3, 1860	Institution.
Proceedings of the Zoological Society Parts 1 and 2 (1860)	Society.
Notices of the Procedings of the Royal Institution, Part X.	Institution.
Canadian Journal of Industry, Science, and Art, Nos. 25 to 28 ...	Canadian Institute.
The Experience of Forty Years in Tasmania, by Hugh M. Hull ...	The Author.
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Gold Medal (Original) given by G. B. Lorimer, as a Prize for the best marksman among the Upper Nithsdale Volunteer Rifles, No. 3, 1860	G. B. Lorimer.

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Critic.
Engineer.
Engineers' Journal (Calcutta).
Gardeners' Chronicle.
Mechanics' Magazine.
Mining Journal.
North British Agriculturist.

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Cotton Supply Reporter.
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Bulletin de la Société d'Encouragement pour l'Industrie Nationale.
Civil Engineer and Architects' Journal.
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Newton's London Journal of the Arts and Sciences.
Pract. Mechanics' Journal.
Repertory of Patent Inventions.

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ERRATA.

Page 83, col. 1, line 53, for "Muir," read "Mechi."
„ 174, col. 1, in list of Local Board for Glasgow Mechanics' Institution, for "Mr. James Boyce, M.A., LL.D., F.G.S.," read "Mr. James Bryce, M.A., LL.D., F.G.S."
„ 275, col. 2, line 16, for "Thomas" read "Henry W."
„ 397, col. 1, line 20 from bottom, for "ten millions of *tons* of flax waste," read "ten millions of *pounds* of flax waste."
„ 405, col. 2, lines 1 and 2 from bottom, for "cents" read "pence;" and line 6 from bottom, for "£10,000," read "10,000 dollars."
„ 841, col. 1, lines 22 and 23, for "certainty with certainty," read "century with century."

Copies may be obtained GRATIS *on application to the Secretary of the Society of Arts, Adelphi, London, W.C.*

SOCIETY OF ARTS' UNION OF INSTITUTIONS.

PROGRAMME OF EXAMINATIONS

FOR 1861.

WITH AN APPENDIX.

Published by the Society of Arts,
ADELPHI, LONDON, W.C.

THE COUNCIL AND OFFICERS
OF THE
Society for the Encouragement of Arts, Manufactures, and Commerce,
FOR THE 107TH SESSION, 1860-61.

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THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE,

Was established in 1754, and Incorporated by Royal Charter in 1847, for "The Encouragement of the Arts, Manufactures, and Commerce of the Country, by bestowing rewards for such productions, inventions, or improvements, as tend to the employment of the poor, to the increase of trade, and to the riches and honour of the kingdom; and for meritorious works in the various departments of the Fine Arts; for Discoveries, Inventions, and Improvements in Agriculture, Chemistry, Mechanics, Manufactures, and other Useful Arts; for the application of such natural and artificial products, whether of Home, Colonial, or Foreign growth and manufacture, as may appear likely to afford fresh objects of industry, and to increase the trade of the realm by extending the sphere of British Commerce; and generally to assist in the advancement, development, and practical application of every department of science in connexion with the Arts, Manufactures, and Commerce of the country."

In prosecuting these objects, the Society has annually expended considerable sums in prizes, premiums, and pecuniary grants. In its Transactions there is abundant proof, on the one hand, that inventors and others have gladly availed themselves of the aid and countenance which the Society has thus afforded; and, on the other, that these premiums have done much to encourage and promote the Fine and Industrial Arts—have led to many important improvements in Manufactures, and have laid open many new and valuable sources of industry and Commerce, not only in the United Kingdom and its Colonies, but also in Foreign Countries.

The Society numbers about two thousand members; and more than three hundred Literary, Scientific, and Mechanics' Institutions, Local Educational Boards, and Chambers of Commerce in the United Kingdom and in the Colonies* are in connection with it.

The Society has a Board of Examiners, and holds Annual Examinations, as set forth in the following Programme.

From a very early period the Society has held exhibitions of various kinds, which, by showing what had already been done, and the degree of perfection that had been attained, have stimulated the progress of invention and design, and directed attention to points still requiring improvement. Those Exhibitions "prepared the way for that Great International Exhibition" of 1851, which was originated by the Society of Arts. The Society is now engaged in preparing for a second Great International Exhibition in 1862.

The Society enters into Correspondence and exchanges publications with Foreign and Colonial Societies.

The Society publishes a Weekly Journal, which contains Reports of the Society's Proceedings and Transactions, Reports of the Institutions in Union, and a variety of information connected with Arts, Manufactures, and Commerce.

Candidates for admission as Members† must be proposed and recommended by three Members of the Society, according to a form, in which the name, rank, and usual place of residence of the Candidate, should be stated. This form is read at an Ordinary Meeting of the Society, and afterwards hung up in the Society's room until the second following meeting, when the Candidate is balloted for. The Annual Subscription is Two Guineas, payable in advance, and commences from the quarter-day next preceding the date of election. There is no fee on admission. Any Member, by a payment of Twenty Guineas, may at any time commute his annual subscription. Foreigners and persons not resident in Great Britain may become Corresponding Members, without payment of any subscription, if proposed and elected in the usual manner. Ladies are eligible as members.

Every Member whose subscription is not in arrear is entitled—

To be present at, and take part in, the proceedings of all the Ordinary Meetings of the Society, and to introduce two visitors at such meetings.—To be present and vote at all General Meetings of the Society.—To have personal free admission to all the Society's Exhibitions.—To receive a copy of the Weekly Journal, or of any other work in which its Transactions or Proceedings shall be published by the Society subsequent to his election.—And to the use of the Library and Reading-Room.

The Session commences in November and ends in June. The ordinary meetings of the Society are held on Wednesday evenings during the Session, at eight o'clock. At these meetings papers on subjects relating to inventions, improvements, discoveries, and other matters connected with the Arts, Manufactures, or Commerce of the Country are read, and afterwards discussed.

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* For terms of Union see next page.

† Gentlemen or Ladies desirous of becoming Members should communicate with the Secretary, at the Society's House, Adelphi, London, W.C.

UNION OF INSTITUTIONS WITH THE SOCIETY OF ARTS.

This Union was established at a Conference held on the 8th of May, 1852. Its principal objects are:—

1. That the experience and information of each separate Institution be rendered available to the whole body.

2. That there be an Interchange of Privileges between the members of different Institutions, so that the Members of any one Institution being temporarily in the neighbourhood of any other may enjoy at that other, for a limited period, the privileges of admission to its Lectures, Library, Reading-room, and Exhibitions.

3. That facilities be afforded for effecting engagements with Lecturers.

4. That Books, Maps, Philosophical Instruments, &c., be procured at reduced rates.

5. That facilities be afforded, by interchange and otherwise, for the formation of Local Museums, Exhibitions, &c.

6. That, through the united action of the associated Institutions, the Laws which affect these bodies may be amended; and that their *status* be generally improved.

7. That the Institutions be assisted to become also places of systematic instruction, with systematic examinations and certificates of the results of studies.

The desire of the Council of the Society of Arts, is,—neither to govern the Institutions, nor to supersede their own efforts for improvement, but—to stimulate, assist, and supplement their efforts, and to endeavour to enhance their success.

The Annual Conference, the weekly *Journal of the Society of Arts*, which is supplied gratuitously to each Institution in Union, and constant Correspondence with the Institutions, tend largely to promote the attainment of the first of the objects stated above.

The second is, to some extent, provided for; a large number of the Institutions have agreed to the Interchange of Privileges. The Society of Arts also grants certain privileges in regard to its own Meetings and Exhibitions to Institutions in Union. Institutions within twelve miles of the General Post-office have three transferable admissions to each Meeting and Exhibition of the Society of Arts. Members of Institutions beyond this limit, on presenting during office hours (ten to four) a note, signed by their Secretary, may obtain similar privileges.

In reference to the third object, the Society publishes a General List of Lecturers, both Paid and Unpaid. The list gives the names and addresses of the Lecturers, and the subjects on which they lecture. It also contains information as to Apparatus and Diagrams suitable for the use of Lecturers, where they may be obtained, and at what cost. A copy of this list is furnished free to each Institution in Union.

The fourth object has been already attained to a considerable extent, the Council having made arrangements for supplying the associated Institutions with books at a reduction of 27½ per cent., and with Periodicals at a reduction of 25 per cent. on the published prices. The Committee of Privy Council on Education, at the request of the Council of the Society of Arts, have agreed to extend to Institutions in Union with the Society the privilege of purchasing books on the same very favourable terms as are now enjoyed by the schools under the inspection of the Committee of Council. The Society for the Diffusion of Pure Literature has also extended its privileges to the Institutions in Union with the Society.

With respect to the fifth object, several of the Institutions have agreed to interchange Specimens of Natural History, Manufactures, &c., for Museums. As regards Exhibitions, the Society of Arts has in circulation, on loan, specimens of Photography, of Nature Printing, of Chromo-Lithography, &c.

With reference to the sixth object, the Council direct attention to the very important Act, intituled "Literary and Scientific Institutions Act," which was passed in 1854, through the exertions of the Society.

In different parts of the country, where no Free Library exists, Mechanics' Institutions have been allowed by the Commissioners of Patents to become the depositaries of their valuable publications, the Specifications and Indexes of Patents, on the Institutions undertaking to allow them to be consulted at all reasonable hours daily by the public, free of all charge whatsoever. The donations are made to the local authorities for the use of the town, and they are permitted to place the publications in the Institutions for reference.

With reference to the seventh object, the Society has established the scheme of Examinations detailed in the following Programme.

Any Institution, or Provincial Union of Institutions, desirous of entering into Union with the Society of Arts, must fill up, sign, and return to the Secretary, a printed Form of Declaration, as under, accompanied with a copy of its Rules. When this form has been approved by the Council, the Institution is taken into the Union. The subscription is two guineas annually, and may be paid in either of the two following ways: the President, or any other analogous officer of the Institution, may be elected a member of the Society of Arts; or, the Institution or Provincial Union may contribute from its own funds the payment of two guineas. In the former case the gentleman so selected will enjoy all the privileges of a Member, and will, at the same time, give to his own Institution, so long as he continues to hold the same office in it, the advantages of the Union. In the latter case, the Institution itself will receive the advantages of the Union, but no individual member of the Institution will enjoy the full privileges of a member of the Society of Arts.

The managers of Village Libraries, Village Reading Rooms, Village Lectures, &c., (not being fully constituted Institutions,) in connection with any Provincial Union that is in Union with the Society of Arts, may obtain the existing advantages of Union with this Society in consideration of the payment of £2 2s. from the Provincial Union, but the Society relies on the officers of the Provincial Unions for a careful discrimination of those bodies which ought, from those which ought not, to be expected to subscribe separately for the advantages of the Union with the Society of Arts, and the Council reserve the power of re-considering the arrangements, if it should be found that bodies not contemplated herein are enabled to avail themselves of what is proposed.

FORM OF DECLARATION.

Name of Institution _____

Name and Address of Secretary } _____

The Managers of the _____

_____ hereby declare that they desire to place the said _____ in union with the Society of Arts, on the basis proposed in the Resolutions adopted at the Conference held on the 18th May, 1852.

The Managers engage that the required yearly payment to the Society of Two Guineas, in advance, shall be made (*as the case may be*) *from the funds of this Institution*, (*or*) *by* _____ _____ *of this Institution, who desires to be elected a member of the Society of Arts.*

(Signature) _____

Dated this _____ day of _____ 18

PROGRAMME OF EXAMINATIONS FOR 1861.

PRELIMINARY NOTICE.

I. The primary object of the Examinations described in the following programme is to encourage, test, attest, and reward efforts made for self-improvement by adult members and students of the Mechanics' Institutions, Athenæums, People's Colleges, Village Classes, and other bodies of the like character, that are in Union with the Society of Arts.* Such members and students are commonly mechanics, artisans, labourers, clerks, tradesmen and farmers not in a large way of business, apprentices, sons and daughters of tradesmen and farmers, assistants in shops, and others, of various occupations, who are not graduates or undergraduates of any University, nor following, nor intending to follow, a learned profession. To all such, male and female (not being under sixteen years of age), the Examinations are open on the general conditions explained below. (See paragraphs 1 and 2, next page.)

II. There are, however, in many places where there are either no Institutions, or none possessing sufficient funds to enable them to enter into Union, a large number of persons for whose admission to the Examinations the Council have found it necessary to make other arrangements, the details of which are given at paragraph 1 (B) and (C).

III. Persons also of a higher grade in society than those mentioned in the opening paragraph, are found to be desirous of having their knowledge tested by the Society's Examiners; and it has been decided to admit them to Examination on payment of a fee of 10s. 6d. for each Candidate. (For details see paragraph 1 (D). Such persons, however, and also Certificated Teachers, and Pupil Teachers, though they may be examined and receive Certificates, are precluded from competing for the Prizes offered by the Society of Arts. (See paragraphs 112 to 118, page 9.)

LIST OF SUBJECTS AND EXAMINERS FOR 1861.

*** Candidates, before choosing their subjects, should refer to the Time table, at page 6.

1. Arithmetic	Rev. Alexander Wilson, M.A., National Society, London.
2. Book-keeping	John Ball, Esq., of the firm of Messrs. Quilter and Ball.
3. Algebra	J. J. Sylvester, Esq., M.A., F.R.S., Professor of Mathematics at the Royal Military Academy, Woolwich.
4. Geometry	Rev. B. Morgan Cowie, M.A., Professor of Geometry at Gresham College; one of H.M. Inspectors of Schools.
5. Mensuration	John Sykes, Esq., M.A., Fellow of Pembroke College, Cambridge, Assistant Secretary to the Committee of Privy Council on Education.
6. Trigonometry	Rev. T. G. Hall, Professor of Mathematics in King's College, London.
7. Conic Sections	Rev. Bartholomew Price, M.A., F.R.S., Sedleian Professor of Natural Philosophy in the University of Oxford.
8. Navigation and Nautical Astronomy	John Riddle, Esq., F.R.A.S., Head Master of the Nautical Schools, Greenwich.
9. Principles of Mechanics	Rev. Jonathan Bates, M.A., Fellow of Gonville and Caius College, Cambridge, Vice-Principal of the Diocesan Training College, Chester.
10. Practical Mechanics	T. M. Goodeve, Esq., Professor of Mechanics at the Royal Military Academy, Woolwich.
11. Magnetism, Electricity, and Heat	Charles Brooke, Esq., M.A., F.R.S., Surgeon to the Westminster Hospital.
12. Astronomy	James Glaisher, Esq., F.R.S., Royal Observatory, Greenwich.
13. Chemistry	A. W. Williamson, Esq., Professor of Chemistry, University College, London.
14. Animal Physiology (in relation to Health).	John Marshall, Esq., F.R.S., F.R.C.S., Surgeon to the University College Hospital, and Lecturer on Anatomy in the Government Department of Science and Art.
15. Botany	Dr. Lindley, F.R.S., Professor of Botany in the University of London, and Hon. Sec. of the Horticultural Society.
16. Agriculture	J. C. Morton, Esq.
17. Mining and Metallurgy	J. Arthur Phillips, Esq., Civil Engineer, Graduate of the Imperial School of Mines of France, &c.
18. Political and Social Economy	Charles Neate, Esq., M.A., Professor of Political Economy in the University of Oxford.
19. Domestic Economy	The Very Rev. Richard Dawes, F.R.S., Dean of Hereford.
20. Geography	Wm. Hughes, Esq., F.R.G.S., Professor of Geography in Queen's College, London.
21. English History	C. H. Pearson, Esq., M.A., Professor of Modern History, King's College, London.
22. English Literature	Rev. Samuel Clark, M.A., F.R.G.S., Principal of the Training College, Battersea,
23. Logic and Mental Science	Rev. Wm. Thomson, D.D., Provost of Queen's College, Oxford.
24. Latin and Roman History	Rev. F. Temple, D.D., Head Master of Rugby School,
25. French	Alphonse Mariette, Esq., M.A., Professor of French, King's College, London.
26. German	Dr. Bernays, Professor of German, King's College, London.
27. Freehand Drawing	F. S. Cary, Esq.
28. Mechanical Drawing.	Thomas Bradley, Esq., Professor of Geometrical Drawing in King's College, London.
29. Theory of Music	John Hullah, Esq.

* For the terms of Union see preceding page.

Terms of Admission to the Examinations.

1. Every Candidate for Examination must (*a*) be admitted through a Local Educational Board connected with the Society of Arts, and must (*b*) be at least sixteen years of age.

(*A.*) Members of, or students of classes in, Institutions in direct Union with the Society of Arts, are admitted	Free.
(*B.*) Members of, or students of classes in, "Small Institutions"* not in direct Union with the Society of Arts, but connected with a Provincial Union that is "in Union" with the Society, are admitted on payment of a fee of.....	2s. 6d.
(*C.*) In districts where there are no Institutions at all, or only "small Institutions,"* Local Educational Boards, paying one guinea a year to the Society of Arts, may admit candidates on payment of a fee of.....	2s. 6d.
(*D*). Persons of a higher class of society than those described in paragraph I (Preliminary Notice), are admitted to the Examinations on payment of a fee of	10s.6d.

N.B.—The Council in all cases leave it to the Local Boards to decide whether a candidate is or is not liable to this fee.

2. Candidates coming under the head (D), and teachers certificated by the Committee of Council on Education and Pupil Teachers, though they may be examined and receive certificates, cannot compete for the prizes of which details are given at page 9.

3. It will be seen that, in any locality, whether there be an Institution in union with the Society of Arts or not, the first thing to be done in order to enable any person to take advantage of the Society's Examinations, is the formation of a Local Educational Board.

Local Educational Boards.

4. The Managers of Institutions in Union with the Society of Arts, and other persons who may be desirous to co-operate with the Society in promoting the instruction of adults, are invited to form Local Boards. Each Local Board must consist of at least three members; and, with advantage, may be much more numerous. There must be a Chairman and a Secretary. The district for which the Board is to act should be defined; and every Educational Institution† within those limits ought to be represented in the Board. It is of great importance that each Local Board should include the representatives of more Institutions than one, and that there should not be more than one Local Board in each locality. The composition of the Board must be such as to command the respect and confidence of the neighbourhood. Where gentlemen of high literary and scientific attainments are willing to serve on the Board, their services are of great value; but the necessary work may be done by any well-educated persons of high character and good sense.

5. A detailed list of the chairman, secretary, and other members of each Local Board, giving not only their names but their addresses and designations, should be submitted to the Council of the Society of Arts before the 1st of January, 1861. In some cases the Local Educational Boards comprise such large districts that, for the convenience of the Candidates, Branch Local Boards have to be formed within the Districts. Wherever this is the case, the names and addresses of the members, both of the District Board and of its Branch Boards, must be forwarded to the Secretary of the Society of Arts. All changes in the composition of the various Boards now in existence, or to be formed hereafter, should be immediately notified to the Society of Arts.

6. Local Educational Boards in connexion with the Society of Arts need make no payment to the Society, unless they desire to exercise the power of admitting candidates (see par. 1 *C.*) where there are no Institutions in union with the Society of Arts; in which case a subscription of one guinea a year must be paid.

7. The object of the formation of these Local Boards will be more completely understood from the following paragraphs.

8. The Society's system of Examinations consists of (1) Previous Examinations by the Local Boards, and (2) Final Examinations by the Examiners of the Society of Arts, under the supervision of the Local Boards.

Previous Examinations by the Local Boards.

9. These Examinations are (1) to test the handwriting and spelling of the Candidates, their knowledge of English Grammar, composition, and the common rules of arithmetic, and (2) to ascertain whether their knowledge of those special subjects in which they seek to be examined by the Society's Examiners is such as to offer some fair prospect at least of their obtaining certificates.* The Previous Examinations may be either wholly written, or partly oral and partly written, at the discretion of each Local Board.

10. Handwriting.—A bold, even round-hand, without loops, long tails, or flourishes, should be preferred.

11. Spelling, English Grammar, and Composition.—An extract from some standard English author should be set, into which errors of spelling, grammar, and punctuation should be introduced. Some faulty grammatical constructions in common use, and vulgarisms, should be submitted for correction.

12. Arithmetic.—A knowledge of the elementary rules, including the Rule of Three, should be required.

13. No Candidate can be admitted to the final Examination without a certificate (see Form No. 4 in Appendix) from his Local Board, that he has satisfactorily "passed" its previous Examination in the elementary subjects specified in paragraphs 10, 11, 12, and in the special subjects in which he wishes to be examined by the Society's Examiners.

14. The previous Examinations must be held by the Local Boards sufficiently early in the year 1861 to allow the results to be communicated to the Council, on a Form which will be furnished on application (See Form No. 2 in Appendix, page 10), on or before the 2nd April, *i.e.*, four weeks before the commencement of the final Examinations.

15. Unreserved communications between the Society and the Local Boards will be requisite to secure to the "passes" of the various Local Boards throughout the Union such an uniformity of value as may be attainable; and it is hoped that their standard may be raised, carefully and gradually, from year to year.

Final Examination by the Society's Examiners.

16. The Forms (see Form No. 4, in Appendix, page 10), containing the names of the "passed" candidates, and the

* Small Institutions are defined as those which have an income of less than £75 a year.

† These Educational Boards, besides superintending the Examinations of the Society of Arts, may advantageously assist in promoting various other plans for the furtherance of Education in their districts (see note to Par. 9); it is, therefore, desirable that they should include representatives not only from the various Institutions for the promotion of adult instruction, but also from the principal schools in the locality.

* The following resolution was passed at the Conference between the Representatives of Institutions in Union and the Council, held on the 22nd June, 1860:—"That in the opinion of this Conference it is highly desirable that the Local Boards should hold Annual Examinations of persons under 16 years of age who are not in regular attendance at day schools, and grant on their own authority certificates and prizes." Local Boards will, however, understand that the "pass" to the Final Examinations must not be given to children under 16, or to any Candidates above 16 whom the Local Boards consider to have no chance of obtaining certificates from the Society's Examiners.

subjects in which they desire to be examined, having been returned to the Secretary of the Society of Arts, not later than the first week in April, 1861, the printed papers of questions in the various subjects will be prepared by the Society's Examiners, and will be forwarded to the Secretaries of the Local Boards.

17. The whole of the papers appointed for each of the evenings of the Examination, according to the subjoined Time Table, will be contained in a separate sealed envelope, which is not to be opened till the Candidates are present, at half-past six on that evening.

18. The details of the mode in which the Final Examinations are to be conducted, are given in the "Letter of Instructions," (see Form No. 5, page 11, in appendix) and every member of each Local Board should make himself thoroughly acquainted with them.

19. The final Examinations must be held *simultaneously on the days, and at the hours specified in the following Time-table*, at those places where Local Boards are established.

20. In choosing the subjects in which they desire to be examined, candidates must take notice of the arrangements of this Time Table, as they *cannot* be examined in *two* subjects which are set down for the *same* evening.

TIME TABLE FOR 1861.

No Candidate may work more than one paper in each evening, and each paper must be worked on the particular evening appointed for it.

Tuesday, the 30th April, From 6 30 to 9 30 p.m.	Wednesday, the 1st May. From 6 30 to 9 30 p.m.	Thursday, the 2nd May. From 6 30 to 9 30 p.m.	Friday the 3rd May. From 6 30 to 9 30 p.m.
Arithmetic.	Book-keeping.	Algebra.	Geometry.
Trigonometry.	Navigation and Nautical Astronomy.	Practical Mechanics.	Mensuration.
Magnetism, Electricity, and Heat.	Conic Sections.	Astronomy.	Principles of Mechanics.
Agriculture.	Chemistry.	Physiology.	Botany.
Mining and Metallurgy.	*English Literature.	Political Economy.	Geography.
English History.	Music.	French.	Latin.
Mechanical Drawing.	Domestic Economy.	German.	Logic and Mental Science.
			Freehand Drawing.

*** Two Papers of one hour and a half each in this subject are considered as one.**

21. The Local Boards must see, and certify to the Council, in the form which the Council will furnish (see Appendix, Form No. 7), that the papers are fairly worked by each candidate, without copying from any other, and without books or other assistance; and must seal up and return the worked papers to the Council *immediately* on the close of each evening's Examination. The papers will then be submitted to the judgment of the Examiners, and certificates of three grades will be awarded.

22. The names of the candidates who obtain prizes and certificates will be published in the *Journal of the Society of Arts*, as soon as the Examiners have pronounced their judgment.

23. A candidate who has obtained from the Society a certificate of the 1st class in any subject, cannot again be examined in the same subject.

24. A candidate who has obtained a certificate of the 2nd or 3rd class may, on the recommendation of the Local Board, be examined in the same subject, in a subsequent year, without again passing the previous examination of the Local Board, but his name must always be returned in the proper form (No. 4 in the Appendix).

25. A candidate who, having obtained a certificate in any subject, desires to be examined in some other subject, in a subsequent year, may be "passed" by the Local Board, after examination in that subject, without re-examination in the elementary subjects, specified in paragraphs 10, 11, 12.

SUBJECTS OF EXAMINATION FOR 1861.

26. In the following paragraphs will be found a brief outline of the portions of the respective subjects in which the candidates will be examined, and their attention is especially drawn to this part of the programme. Though in most instances the Examiner has set down certain Text-books, in so doing he pronounces no opinion as to their merit. Real knowledge, however or wherever acquired, will be accepted by the Examiners.

I.—ARITHMETIC.

27. Practice — Simple and Compound Proportion — Interest — Discount — Insurance — Vulgar and Decimal Fractions; with the principles of a Decimal Notation in money on the basis of the pound unit.

28. The Examiner will take into account not only the correctness of the answers, but also the excellence of the methods by which they are worked out, and the clearness and neatness of the *working* (which must always be shown). Round, compact figures, as nearly like as possible to old-fashioned printed numerals, will be preferred.

29. Text Books:—Any of the Modern Treatises on Arithmetic, such as Hunter's Text Book (*National Society*), Colenso (*Longmans*), or Barnard Smith (*Macmillan*).

II.—BOOK-KEEPING BY DOUBLE ENTRY.

30. Candidates should be prepared to answer questions as to the nature and use of the different books usually kept in a merchant's office. They should be prepared to journalise a series of transactions from a waste book, and, having posted the entries to the ledger, to balance the accounts, to prove them by a trial-balance, and finally to exhibit an account of profit and loss, with a balance-sheet.

31. Candidates should be prepared to draw the usual commercial forms, such as receipts, bills of exchange, promissory notes, invoices, account sales, accounts current, bills of parcels, and to explain the meanings of technical terms used in general business.

32. Text Books:—Book-keeping, Irish School Series. (*Groombridge.*)
Rudimentary Book-keeping. (*Weale's Series.*)
Kelly's Elements of Book-keeping. (*Simpkins and Co.*)

III.—ALGEBRA.

33. Elementary Operations and Fractions. Simple and Quadratic Equations and Problems leading to them. Involution and Evolution. Surds. Arithmetical and Geometrical Series.

34. Text Books:—Todhunter's Algebra (*Macmillan*); Colenso's Algebra (*Longmans*), or any other modern treatise on Algebra.

IV.—GEOMETRY.

35. A facility in solving geometrical theorems and problems, deducible from the first six books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

36. Text Book:—Euclid, Books I., II., III., IV., VI., XI., and XII. Potts' smaller edition (*Parker*).

V.—MENSURATION.

37. The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines, and the surfaces and solid contents of cones, cylinders, spheres, &c. Candidates will be expected to be familiar with the different rules for measuring and estimating artificers' work, such as joiners', bricklayers',

masons', slaters', and plumbers' work, and to be able to prepare estimates of such work from given quantities.

38. Text Books:—Tate's Mensuration. Young's Treatise on Mensuration (*Simms and M'Intyre*).

VI. Trigonometry.

39. In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangles, and the use of logarithmic tables, &c.

40. Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

41. Text Books:—Snowball's Trigonometry (*Macmillan*), Hall's Trigonometry for Schools (*Christian Knowledge Society*), or any of the modern treatises on Algebraical Trigonometry. Mathematical Tables (*Chambers' Series*).

VII.—Conic Sections.

42. The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

43. Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

44. Text Books:—Puckle's Conic Sections (*Macmillan*). Todhunter's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans*). Drew's Conic Sections (*Macmillan*). Whewell's Conic Sections (*Parker*).

VIII.—Navigation and Nautical Astronomy.

45. A good knowledge of Plane and Spherical Trigonometry, of the definitions and terms used in Nautical Astronomy, and of the various measurements of time and their mutual conversions will be required, as well as skill in the use of logarithmic tables, and neatness, order, and accuracy in the numerical solutions of problems. The candidate should understand the construction of charts; the nature and laws of circular storms; great circle sailing, &c.; the methods of determining the latitude, longitude, variation of the compass, and error and rate of a chronometer by astronomical observations, with the demonstrations of the formulæ employed; the use of Nautical Astronomical Instruments, &c.

46. Text Books:—The Nautical Almanac. (*Murray.*) Riddle's Navigation and Nautical Astronomy. (*Law*, Essex-street.)

IX. Principles of Mechanics.

47. The properties of matter, solid, fluid, and gaseous.

48. Statics: The composition, resolution, and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

49. Dynamics: Gravitation; collision; constrained motions; projectiles; oscillations.

50. Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

51. Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

52. Hydrodynamics: Motion and resistance of fluids in tubes, &c.: waves and tides.

53. Pneumatics: Mechanical properties of the air; the barometer.

54. Text Books:—Todhunter's Statics, or Parkinson's Mechanics. Goodwin's Mathematics. Miller's, Phear's, or Webster's Hydrostatics. Webster's Theory of Fluids. The treatise on this subject in Orr's Circle of the Sciences. Golding Bird's Elements of Natural Philosophy, by C. Brooke (*Churchill*). Lardner's Handbooks on Natural Philosophy.

X.—Practical Mechanics.

55. The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

56. Text Books:—Lardner on the Steam Engine. Scott Russell on the Steam Engine. Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery. (*Weale.*) Goodeve's Elements of Mechanism. (*Longmans.*)

XI.—Magnetism, Electricity, and Heat.

57. Construction and Properties of Magnets; Magnetic Instruments; Terrestrial Magnetism; Diamagnetism.

58. Statical or Franklinic Electricity; Voltaic Electricity; Electro-dynamics; Electro-telegraphy; Electro-metallurgy; Thermo-Electricity; Organic Electricity.

59. Conduction, Convection, and Radiation of Heat Instruments for Measuring Heat; Specific and Latent Heat; Reflection and Refraction of Heat; Diathermancy.

60. Text Books:—Lardner's Handbooks of Natural Philosophy. (*Walton and Maberly.*)

Golding Bird's Elements of Natural Philosophy, by C. Brooke. (*Churchill.*)

Herschel's Discourse on the Study of Natural Philosophy (*Longmans*) for a *general* view of the subject.

XII. Astronomy.

61. The principles of Plane Astronomy.

62. Text Books:—Herschel's Astronomy. (*Longmans.*) First chapters.

Airy's Lectures on Astronomy.

Maddy's Elements of Astronomy.

XIII.—Chemistry.

63. Physical. Elementary laws of heat, light, and electricity, in connection with chemical action.

Inorganic. Chemistry of the metalloids and metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

64. Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron, and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

65. Text Books:—Fownes' Manual of Elementary Chemistry. Miller's Elements of Chemistry.

XIV.—Animal Physiology, in relation to Health.

66. The general principles of Animal Physiology and the application of them to the preservation of health and to the wants and emergencies of daily life.

67. Text Books:—Carpenter's Animal Physiology, 1859. (*Bohn.*)

Lardner's Animal Physics. (*Walton and Maberly.*)

Translation of Milne Edward's Manual of Zoology. (*Renshaw.*)

Marshall's School Physiology (*Longmans*), to be published before Christmas, 1860. Marshall's Description of the Human Body, with Atlas (*Day and Sons*), for details of Anatomy.

XV.—Botany.

68. Sect. I. Vegetable Physiology. The general Structure of a Plant. The manner in which the organs perform their several functions; and the external agents which influence them. The nature of the tissues employed in manufactures. The application of such facts to practical purposes.

69. Text Books:—Lindley's Theory and Practice of Horticulture (*Longmans*); or the same author's School Botany, the edition of 1854, or any later one. (*Bradbury and Evans.*)

70. Sect. II. Practical Botany. The Meaning of Botanical Terms. The general facts relating to Botanical Classification, excluding that of Linnæus. The Distinctions of some of the principal English Natural Orders of Plants. Naming Plants at sight. The art of Describing Plants correctly. (For this living specimens will be provided.)

71. Text Books: Lindley's School Botany, and Descriptive Botany. (*Bradbury and Evans.*)

72. Candidates will be expected to answer correctly six questions in Section I. and eight questions in Section II.; each Botanical description standing for one answer. The questions in both sections will have reference exclusively to subjects having some practical application. No one can pass who is not able to answer fairly the questions in Section II., proficiency in which will be rated higher than in Section I. Students are recommended to study diligently "Descriptive Botany" and the Physiological Aphorisms at the end of "School Botany."

XVI.—Agriculture.

73. The Examination in the theory of agriculture will include both the advantages and results of tillage operations, and the influence and operation of particular manures and foods. The questions on farm practice will test a knowledge of the cultivation of our most important crops, and of the management of our principal domesticated animals.

74. Text Books:—Low's Elements of Practical Agriculture. (*Longmans.*)

Johnston's Agricultural Chemistry. (*Blackwood and Sons.*)

Morton's Cyclopædia of Agriculture. (*Blackie and Son.*)

Stephens' Book of the Farm. (*Blackwood and Sons.*)

XVII. Mining and Metallurgy.

75. Candidates should be able to identify with facility the ores of the more common metals and should be acquainted with their chemical compositions. The forms of occurrence of the various metallic ores, and the usual methods employed for their extraction and subsequent purification by crushing, stamping, and washing, &c. Underground surveying, principles of ventilation, particularly as applicable to collieries. A knowledge of furnace assaying, and a general acquaintance with the metallurgy of the more important metals.

76. First-class certificates can be given to those only who have either acquired some practical knowledge of mining, or who possess a special acquaintance with the metallurgy of at least one of the useful metals.

77. Text Books:—Dana's Mineralogy (*Trübner and Co.*, Paternoster-row). Mitchell's Assaying (*Baillière*). Manual of Metallurgy (*Griffin*). Useful Metals and their Alloys (*Houlston and Wright*). Ure's Dictionary of Arts, Manufactures, and Mines (*Longmans*).

XVIII.—Political and Social Economy.

78. Text Books:—Elements of Political Economy, by James Mill. Principles of Political Economy, by John Stuart Mill.

The Phenomena of Industrial Life. Edited by the Dean of Hereford. (*Groombridge.*)

Whateley's Lectures on Political Economy. (*Parker.*)

79. Some knowledge of the Commercial, Financial, and Statistical History of the United Kingdom will be required, for which "Porter's Progress of the Nation," and "M'Culloch's Commercial Dictionary" may be consulted.

N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first-class Certificate.

XIX. Domestic Economy.

80. By this is meant a knowledge of the management of household matters, and the principles on which they are conducted; the "why and the wherefore" of everything under this head. For instance, as regards food, animal and vegetable, how differing in nutriment, &c., cookery, &c.

81. Clothing of various kinds, how best fitted for varying climates, seasons, and occupations, &c.

82. The Sanitary regulations of the house, such as ventilation, warming and lighting, drainage, &c. A knowledge of the weights and measures by which the prices of provisions, &c., are regulated. In fact, how to make the most of a small income.

83. A knowledge also of the principles of the Savings' Bank, and of the accumulation of small savings, of the Benefit Society, of present and deferred annuities.

84. Text Books:—A Manual of Domestic Economy, by Tegetmeier. (*Home and Colonial School Society.*)

Good Times, or the Savings Bank and the Fireside. (*Groombridge and Son.*)

Domestic Economy, by Esther Copley. (*Groombridge and Son.*)

XX.—Geography.

85. All candidates will be expected to possess a sound knowledge of Elementary Geography, both physical and descriptive. Such knowledge will of necessity embrace an acquaintance with at least the outlines of the great natural features of the globe, the political divisions of countries, and the localities of towns and other places of importance. This kind of knowledge will be looked for in fuller extent with regard to the British Islands, and the various portions of the British Empire, than in respect of other countries. Among the tests applied to it, will be the requirement of the candidate to make, from memory, a sketch, showing the chief features of any particular country in Europe named by the Examiner, and also to sketch a map of the county in which the candidate may be resident. It will not of course be expected that such sketches should show accuracy of detail, but they should at least show the general direction of coast-lines, mountain-chains, or river-courses, with the localities and names of the principal towns. The map of any particular locality should embody the chief natural features which the district may include (with the situation of coal-fields, if any), and should have marked upon it any localities which are distinguished as seats of manufacturing or commercial industry.

86. In addition to the above, candidates who aim at the highest class of certificate should be prepared to answer questions bearing upon Geography in its relation to the Physical Sciences and the History of Mankind—such questions, that is, as involve a general acquaintance with the subject of Climate, the laws of Meteorology. the Distribution of Plants and Animals over the Globe, the leading outlines of Geology, the Ethnographic Division of the Human race, and the commercial resources of different lands. This kind of knowledge is looked for, not in place of geographical knowledge of a more elementary kind, but as supplementary to the latter, and throughout based upon it.

87. Text Books:—

Manual of Geography, by William Hughes. (*Longmans.*)

Guyot's Earth and Man. (*Parker and Son.*)

Mrs. Somerville's Physical Geography. (*Murray.*)

Physical Geography of the Sea, by Maury. (*Philip & Son.*)

Page's Introductory Text Book of Geology. (*Blackwood.*)

The General Atlas (*published by the National Society.*)

The School Physical Atlas (*either Johnstone's or that published by the National Society.*)

Maps illustrating British Geography (*published by the National Society.*)

XXI.—English History.

88. A general knowledge of the outlines of English History. A special knowledge of English History during the reign of Charles I.

89. Text Books:—Guizot's History of the English Revolution (*Bogue.*)

Creasy's Rise and Progress of the English Constitution. (*Bentley.*)

The Student's Hume (*Murray.*)

XXII.—English Literature.

90. Any two, but not more than two, of the authors in the following list may be taken up for examination:—

Chaucer. The Knightes Tale.

Shakspeare. Othello ; Richard III. ; As you like it.
Bacon. Essays.
Milton. Paradise Lost, Books I. to VI.
Pope. Essay on Man ; Essay on Criticism ; Rape of the Lock.

91. Or one of the following works may be taken, with one of the above-mentioned authors :—
Craik's History of the English Language.
Trench's English Past and Present.

92. Candidates are recommended to make a very careful study of the text of the authors they may select. The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject-matter and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXIII.—Logic and Mental Science.

93. Logic : Candidates will be expected to answer questions on the different processes of thought, and on the connexion of thought and language. Every Candidate must attempt to analyse examples of reasoning, and to detect fallacies.

94. Text Books :—Whateley's Elements of Logic, or Thomson's Outline of the Laws of Thought.

95. A Candidate for a second or third-class Certificate will be expected to prepare, in addition, any one of the following books which he may select :—Bacon's Novum Organum, Book I. (English Translation) ; Bishop Butler's Sermons ; Paley's Moral Philosophy ; Dugald Stewart's Philosophy of the Human Mind, Volume I.

96. A Candidate for a first-class Certificate will be expected to prepare any two of these works which he may select.

XXIV.—Latin and Roman History.

97. Livy, Book iii.
Virgil. Æneid, Book viii.
Roman History to the death of Augustus Cæsar.

98. Text Book :—Liddell's History of Rome (in one volume.)

XXV.—French.

99. The Examination paper will be divided into three parts.

100. The first will comprise questions on any portion of the French Grammar (to be answered in French, if possible), and an extract from a modern French writer to be translated into English. Candidates, in order to obtain a 3rd class certificate, should do full justice to this first part.

101. The second part will comprise an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English, or *vice versâ*. This should be done satisfactorily by the candidate who aims at a second class certificate.

102. In the third part, candidates for the 1st class certificate will have, in addition to the above, to answer properly some *elementary* questions on the three following subjects :
(1.) French literature in the 17th century (from Malherbe to Massillon).
(2.) French Weights and Measures, as compared with the English.
(3.) The Reigns of Henri IV. and Louis XIII.

103. Books recommended :—Roche, Ecrivains Français. (*Williams and Norgate*, London and Edinbro'.) Durny : Histoire de France. (*Williams and Norgate.*)

XXVI.—German.

104. Schiller's Geschichte des Dreissigjahrigen Krieges.
Schiller's Braut von Messina.
Göthe's Egmont.
Kohlrausch's Deutsche Geschichte.

105. Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First-class certificates will be given to those only who translate well from English into German, and write in German a good essay relating to German history since the Reformation, the subject of which will be given to them when they come up for examination.

XXVII.—Freehand Drawing.

106. In freehand drawing the candidate will be required to show a practical knowledge of the principles usually applied to the imitation of natural and artificial forms, such as geometrical models, furniture, manufactured articles, foliage, and the human form.

XXVIII. Mechanical Drawing.

107. Mechanical or Geometrical Drawing required by the Mechanist, Engineer, Builder, and all in any way employed in the arts of construction. The candidate will be examined in Practical Plane Geometry, right line figures of given areas, curve lines required in the arts, &c., in Practical Solid Geometry, Elementary Problems on the line and plane, and their combinations, the representation by orthographic projection of simple solids from conditions, and in the principles of Development as used in the construction of Maps, &c., and in Elementary Perspective Projection as far as it is required by the Architect.

108. Text-books :—Geometry, Plain, Solid, and Spherical (*Library of Useful Knowledge*) is especially recommended as a work to be studied on Theoretical Geometry. Practical Plane Geometry.—Burchett's Practical Geometry, Practical Geometry, Linear Perspective and Projection (*Library of Useful Knowledge*). For Descriptive Geometry. —Hall's Elements of Descriptive Geometry for Students in Engineering. Heather's Descriptive Geometry. Also the following French Works, which are mentioned in consequence of the great deficiency of English Works on Geometrical Drawing :—Elémens de Géométrie Descriptive, par S. F. Lacroix ; Traité de Géométrie Descriptive, par Levebure de Fourcy ; Nouveau Cours raisonné de Dessin Industriel, par Armengaud, ainé, et Armengaud, jeune, et Amouroux ; Bardin's Works on Descriptive Geometry.

XXIX.—Theory of Music.

109. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

110. The Elements of Harmony.

111. Arrangements must be made, in the Previous Examination by the Local Boards, to test Candidates, by oral examination, in their knowledge or appreciation of the *sound* of musical successions and combinations. A form of the test to be used for this purpose by the Local Board at the Previous Examination will sent by the Council to such Local Boards as may *apply for it*, in due time before the Examination.

PRIZES FOR 1861.*

112. The following Prizes are offered to the Candidates, viz. :

One First Prize of £5, and one Second Prize of £3, in each of the twenty-nine subjects of Examination.

113. No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

* The fund for the prizes is raised annually by subscription from Members of the Society of Arts, and others interested in the success of the Examinations. Annual subscriptions and donations to the Prize Fund may be forwarded to Mr. Samuel Thomas Davenport, the Financial Officer, Society of Arts, John-street, Adelphi, London, W.C.

114. The Prize will be given in money or in books, at the option of the Candidate.

115. The following Prizes are offered to the Institutions, viz.:—

To the Institution whose Candidate obtains the above-mentioned First Prize of £5 in any of the 29 Subjects, one Prize of £5. An Institution can take more than one such Prize: but no such Prize can be taken by an Institution unless the Council of the Society of Arts is satisfied that the Candidate, in respect of whom the Prize is claimed, has received in a class at the Institution systematic instruction in the subject for a period of not less than three months.

116. The following Prizes are offered to the Local Boards, viz:—

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than twenty), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £10.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than sixteen), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £8.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than twelve), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £6.

To the Local Board where the total number of Certificates awarded to the Candidates at the Final Examination (these Candidates being not fewer than eight), bears the largest proportion (not less than three-fourths) to the total number of subjects in which they were examined;—One Prize of £4.

117. No Local Board can receive more than one of these Prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted.

118. No Prize of any kind can be awarded to, or in respect of, any certificated teacher, any pupil teacher, or any person belonging to a higher grade of Society than those referred to in paragraph I. of the Preliminary Notice.

APPENDIX.

The following forms, that will be forwarded at the proper time to the Local Boards, are here published, in order that the Boards may know beforehand what arrangements they will have to carry out in co-operation with the Council of the Society of Arts.

FORM No. 1.

Society of Arts, Adelphi, London, W.C.

SIR,—I forward to you a return (No. 2), which I shall be obliged by your filling up and re-posting to me, as soon as possible, in order that the necessary Forms (No. 4) may be forwarded to you.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

To the Secretary, Local Board of_____

FORM No. 2.

_____Local Board.
_____, 1860.

SIR,—I beg to inform you that, on the*_____ of_____† Candidates underwent the Previous Examination; that†_____ of these Candidates passed the Examination satisfactorily; and that†_____of them desire to present themselves at the Final Examinations. I have also to inform you that, in addition to the above-mentioned Candidates, †_____ Candidates, who have, in former years, received Certificates from the Society of Arts, desire to present themselves for Examination. I have, therefore, to beg that you will furnish me with_____† of the Forms (No. 4), being one for each Candidate.

I am, Sir, your obedient servant,

(Signed)_____

Secretary, Local Board.

To P. Le Neve Foster, Esq., Secretary of the Society of Arts.

FORM No. 3.—Circular taking out supply of Forms No. 4 to Local Boards.

Society of Arts, Adelphi, London, W.C.

SIR,—I am directed by the Council of the Society of Arts to forward the accompanying_____forms (No. 4) for the Candidates who are reported by your Local Board as qualified for the Final Examination.

I am to request that these forms may be filled up, signed, and returned to me as soon as possible, not later than the 2nd of April, as the number of papers to be prepared, and other important details of the Final Examination, cannot be settled until the returns from all the Local Boards are complete.

One of the forms now sent to you is to be filled up, partly, as you will perceive, by, and partly on behalf of, each candidate. Every such Candidate must carefully remember the number entered, in red ink, at the head of the form which is given to him, as this number (and not his name) will have to be entered on each of his papers at the Final Examination, and by it alone will his work be known to the Examiners. Cards bearing numbers corresponding with those at the head of the forms, will be sent from this office to you for distribution to the respective Candidates.

You will have the goodness to keep a list of the Candidates, *with the number of each, opposite his name*, for reference in case of difficulty. A copy of this list should also be hung up, in some conspicuous place, in the Examination room, which may be specially consulted by the Candidates on the days of the Final Examination.

Detailed instructions (Form No. 5) as to the regulations adopted by the Council to secure uniformity and fair dealing in the arrangments for the Final Examination, will be hereafter forwarded to you.

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

FORM No. 4.—Candidate's Return.

1. Candidate's name in full_____
2. Age last birthday_____
3. Residence_____
4. Occupation (present or proposed)_____

* Insert Date. † Insert Number.

5. Member of _____ Institution.
or
6. Student of a Class in _____ Institution.
7. Number of years at school _____
8. Number of years since leaving school _____
9. Father's name _____
10. ,, occupation _____

I, the above-named _____ declare that the above returns are correct, and that I desire to present myself as a Candidate at the ensuing Examination, to be held by the Society of Arts at _____.

N.B.—The above return must be entered by the Candidate in his own handwriting.

* I HEREBY CERTIFY that the above-named _____ has passed a satisfactory previous Examination *in Handwriting, English Grammar, and Composition, the elementary Rules of Arithmetic, including the Rule of Three, and* in the special subjects, opposite to which, in the margin, I have placed my initials.

Signed _____

On behalf and by authority of the Local Board of ... } _____

Dated this _____ day of _____ 1861.

To P. Le Neve Foster, Esq.

FORM No. 5.—(Letter of Instructions.)

Society of Arts, Adelphi, London, W.C.

SIR,—I am directed by the Council of the Society of Arts to inform you that the papers for the ensuing final Examination of Candidates for the Society's Certificates will be forwarded by post, on the of , in a parcel addressed to you at _____

You will have the goodness to let me know by post or *by telegraph* if necessary, if the parcel is not duly delivered to you in the morning of the inst., so that I may, if required, send duplicate papers in time for the Examination.

The outer wrapper of this parcel should be opened as soon as received, when you will find the papers for each evening enclosed in a separate envelope, with the number of papers in each subject endorsed upon it. *The seal of each separate envelope is to be broken, in the presence of the assembled Candidates, at the comencement of the time appointed* in the Time-table. This direction, as well as the *order* and *hours* of Examination laid down in the Time-table, must be *strictly* observed. It is absolutely necessary, for the proper working and success of these Examinations, that there should not be the least suspicion as to the perfect fairness and equality with which they are conducted by the different Local Boards; and such suspicions can only be obviated by the *simultaneous* opening of the separate envelopes, and by the *simultaneous* working of the *same* set of papers before each Local Board. On this, and on the firmness and fidelity with which the members of the Local Board discharge the simple, though somewhat onerous, duties required of them to prevent the possibility of any dishonest dealing on the part of any Candidate while under examination, the success of the present system depends.

I am, therefore, to invite your most careful attention to the "Advice to Candidates" which you will find printed at the foot of the enclosed copies of the Time-table, and to the terms of the Forms of Declaration which will be sent with the examination papers, one of which Forms *for each subject* will have to be filled up and returned to me, after it has been signed by at least two members of the Local Board. To provide for this it will be necessary that you should immediately make arrangements with your colleagues on the Local Board, to secure the attendance of a sufficient number of them in rotation on the different evenings of the Examination.

It will further be necessary that the Local Board should provide writing-paper, of foolscap size, scribbling-paper for rough drafts, and blotting-paper, for the use of the Candidates, who should be desired to bring their own pens and a small inkstand to the examination room, but nothing else. They must be required, on entering the examination room, to give up all books, papers, memoranda, writing-books, or blotting-paper which they may have brought with them, under the penalty of immediate exclusion from the Examination and the rejection of *any* papers they may have worked, if any such articles should thereafter be found in their possession. After such notice, the plea of accident or forgetfulness cannot be admitted.

Stationery should be supplied to each Candidate, at the rate of three or more sheets of foolscap, and one of scribbling-paper, for every paper which he works, together with one sheet of blotting-paper, which should serve for the whole of the Examination. Ruled paper will be forwarded by me for the use of those Candidates who are to be examined in Book-keeping.

The Time-table has been drawn up to meet the general convenience of the whole number of the Candidates who will assemble at the different Local Boards; and *no variation* of the Time-table can *possibly* be allowed.

The Candidates should sit, in the order of their numbers, as far apart from each other as the space at your command will allow. If you cannot spread them out so as to prevent the *possibility* of communications passing between them, it will be well to disregard the numerical order, and arrange alternately the Candidates who take different subjects.

Three hours *only* are allowed for each paper.

All writing must cease at the end of the three hours, to *a moment;* and, if there is no clock in the room, notice should be given to the Candidates when one and two hours have elapsed, and again when they are within ten minutes of the end of each sitting.

The Candidates should leave their answers at their seats, after having carefully fastened them altogether, in order, through the upper left-hand corner. A supply of twine and some large needles should be provided for this purpose.

The papers should then be collected—those on each subject separately—and arranged in the order of the Candidates' numbers. After a *separate* Declaration has been filled up and signed, in reference to the papers on *each subject*, it should be tied up with them; the whole set, or sets, worked each evening should be forwarded that evening, or the following morning, either by post (if the numbers are small), or by railway, in *one* parcel addressed to me at this office, with an entry on the cover stating the number and subjects of the papers which it contains. The Council would also be glad if you could conveniently transmit, by the post of the same day on which each parcel is sent off, a separate letter, to announce the despatch of such parcel, and mentioning, (1) the number of papers in each subject which it contains, and (2) whether it has been forwarded by post or rail.

The Council regret to have to trouble you with the observance of so many minute directions, but as it is impossible, in the multiplicity of particulars which a simultaneous Examination involves, to rectify any serious mistake

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* If the Candidate has obtained any Certificate from the Society in a former year, each Certificate obtained, with the year in which it was obtained, must be stated in the left-hand margin of this paper. If the Candidate only desires to be re-examined in any subjects in which he may have obtained second or third-class Certificates in former years, the whole of this paragraph may be erased, but if he desires to be examined in any new subjects, the words in *italics* only should be erased. In *all cases*, however this paper must be *signed* on behalf of the Local Board, and the subjects in which the Candidate desires to be examined, must be distinctly marked in the list in the right hand margin of this paper. [This paper will include a list of the subjects of Examination.]

or omission, the responsibility of every one engaged, whether in arranging or carrying out the details, becomes great in proportion.

A Numbered Card and a copy of the Time Table are enclosed for each Candidate; these should be distributed to the Candidates immediately.

I am, Sir, your obedient servant,

P. LE NEVE FOSTER, Secretary.

FORM No. 6.—Time-table.

SOCIETY OF ARTS' EXAMINATIONS. UNION OF INSTITUTIONS. 1861.

The Examinations will be held on the evenings of the 30th April, and the 1st, 2nd, and 3rd of May, 1861.

The hours of Examination will be from half-past six o'clock to half-past nine, and they must be strictly adhered to.

No Candidate will be admitted after the Examination shall have commenced.

TIME TABLE FOR 1861.

(See page 6.)

ADVICE TO CANDIDATES.

Read over the Time-table carefully, and note the hours appointed for the subjects in which you are to be examined. Be at your seat in the Examination Room *five minutes before the hour appointed* for each Paper which you are to work.

When the Paper is given to you, *first* look to the instructions printed at the head of it, and *then* read the questions carefully over, marking those which you think you can answer best. Do them first, and if any time remains, you may try some of the others, but do not exceed the number of questions appointed to be answered. Remember that a few accurate and sensible answers will gain a higher number of marks than a great number of indifferent attempts.

As soon as notice is given (10 minutes before the end of the time) finish your Papers, see that they are numbered rightly, and in their proper order, fasten them with twine at the upper left hand corner, and leave them UNFOLDED at your seat.

CAUTION.

Any Candidate attempting to take unfair advantages such, for example, as having in his possession *any* book or written paper, or seeking or receiving assistance from another, will be immediately expelled, and *all* papers worked by him will be rejected.

Stationery, including blotting paper, will be furnished by the Local Board for the use of the Candidates. No one can therefore be permitted to bring *anything* into the Room with him, except an inkstand and a supply of pens.

No Candidate may speak to another Candidate, on any pretence whatever, under pain of immediate expulsion.

If a Candidate has any question to ask, or wants anything in the course of the Examination, he should not leave his place; *but should stand up and call out his number*, when some one will attend to him.

No Candidate will be allowed to resume the working of a Paper after he has once left the room in the course of the time appointed for that Paper.

Whoever gives assistance will be treated in the same manner as he who receives or asks for it.

The Papers should be carefully and neatly written.

Ill-spelt Papers will be rejected by the Society's Examiners.

FORM No. 7.—(Declaration.)

It is *particularly* requested that in all cases a *separate* Declaration be forwarded with the papers in *each subject*.

DECLARATION.

Local Board of_____

We, the undersigned, hereby declare that the_____ [a] papers on_____ [b] which are forwarded herewith, were worked, in our presence, by the Candidates whose numbers they respectively bear, without any assistance whatever, from books, notes, or memoranda, from each other, from ourselves, or from any other person. We declare that not more than three hours were occupied in working these papers; that they were worked at the time appointed for them in the Time-table issued by the Society, and were sealed by us at the conclusion of the sitting; that no Candidate was allowed to resume, or complete, a paper after having left the Examination room in the course of the time assigned to that paper; We further declare that the paper of questions given to each Candidate was taken from the envelope in which it was transmitted from the Society of Arts, the seal of this envelope being broken in our presence, and in that of the assembled Candidates, at the commencement of the time appointed for the paper in the Time-table issued by the Society; and, finally, we declare that we were present during the whole time that the Candidates were engaged on these papers.

Name, designation, and address of members of Local Board who were present during the working of the papers referred to in the above declaration.*

_____
_____
_____
_____
_____

N.B. The members of the Local Boards will appreciate the importance of this Declaration. To sign it without a certainty of its truth, would be to attempt a fraud on the Society of Arts, on the Examiners, on the Candidates, and on the public at large. The Council is confident that the Local Boards will not only act with perfect good faith, but will use such scrupulous care and caution, that errors in their "Declarations" will be impossible.

MEMORANDUM RESPECTING LOCAL BOARDS.

At the seventh and eighth Annual Conferences of the representatives of the Institutions in Union with the Society of Arts, the constitutions and functions of the Local Educational Boards were fully discussed, and the following points are noted for the use of the Boards, and of persons desiring to form Boards:—

It is alleged that the Society's system of Examinations, and the existence and objects of the Local Boards, are not, in general, sufficiently known to the persons for whose benefit the Examinations are intended; and it is suggested that, if possible, there should be in each locality a public notification of a person, and a place, from whom, and at which, information may be sought and copies of the programme may be obtained. A supply of the programmes will be sent by the Council to every Local Board that applies for them.

It has been strongly recommended that the Local Boards should concern themselves, wherever their assistance would be welcome, in preparing Candidates for the Examination, by advising them respecting their studies, and by inspecting the classes from time to time.

(a) Insert Number. (b) Insert Subject.

* This declaration must be signed, in every case, by, at least, *two* of the members of the Local Board; and when more than twenty Candidates are examined in any one sitting, by, at least, *three* such members. It must not, in any case, be signed by a member of the Board from whom any of the Candidates have received instruction in the subject of the paper to which it refers.

EXAMINATIONS, 1860.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.

PRIZES.

Arithmetic ...	1st Prize ...	£5	To No. 472—William Vaughan, aged 19, Sussex Hall Evening Classes—Clerk
	2nd Prize...	3	,, 531—Michael Shillito, aged 17, Leeds Young Men's Christian Institute—Mechanic
Book-keeping	1st Prize ...	5	,, 333—Francis Joseph Thomas Moore, aged 25, London Mechanics' Institution—Book-keeper
	2nd Prize...	3	,, 491—Robert Pearce, aged 20, Ipswich Mechanics' Institution—Accountant's Clerk
Algebra	1st Prize ...	5	,, 523—Thomas Hick, aged 19, Leeds Young Men's Christian Institute—Teacher
	2nd Prize ..	3	,, 378—Joseph William Mills, aged 17, Watt Institute, Portsea
Geometry ...	1st Prize ...	5	,, 557—Walter Robinson, aged 22, Leeds Young Men's Christian Institute—Mechanic
	2nd Prize ..	3	,, 656—Charles Herbert Ellerby, aged 18, Manchester Mechanics' Institution—Mechanical Draughtsman
Mensuration ..	...		*No Prizes awarded* ‡
Trigonometry	...		*No Prizes awarded.*‡
Conic Sections	1st Prize ...	5	,, 325—Hugh Battle, aged 39, Leicester Church of England Institute—Missionary
			No Second Prize Awarded.†
Navigation & Nautical Astronomy.....	...		*No Prizes Awarded.*‡
Principles of Mechanics...	...		*No Prizes Awarded.*‡
Practical Mechanics	...		*No Prizes Awarded.*‡
Magnetism, Electricity, and Heat ...	1st Prize ...	5	,, 183—Archibald Simon Lang Macdonald, aged 20, Glasgow Mechanics' Institution—Mercantile Clerk
	2nd Prize ..	3	,, 328—William Scott, aged 26, London Mechanics' Institution—Inland Revenue Officer.
Astronomy ...	...		*No Prizes Awarded.*‡
Chemistry ...	1st Prize ...	5	,, 328—Wm. Scott, aged 26, London M. I.—Inland Revenue Officer.
	2nd Prize ..	3	,, 443—William Croudson Barnish, aged 20, Wigan Mechanics' Institution—Clerk
Animal Physiology	...		*No Prizes Awarded.*‡
Botany	1st Prize ...	5	,, 185—Alexander McKinlay, aged 19, Glasgow Mechanics' Institution—Solicitor's Clerk
	2nd Prize ..	3	,, 143—John Gibbs, aged 37, Chelmsford Literary and Mechanics' Institution—Woolsorter
Political and Social Economy.....	...		*No Prizes Awarded.*‡
Geography ...	1st Prize ...	5	,, 357—John Dix Suggett, aged 17, Lynn Athenæum—Banker's Clerk
	2nd Prize ..	3	,, 454—Charles Walker, aged 18, York Institute—Telegraph Clerk
English History	1st Prize ...	5	,, 240—Robert Clark, aged 22, Glasgow Athenæum—Clerk
	2nd Prize ..	3	,, 115—Joseph Seed Roberts, aged 19, Bradford Mechanics' Institution—Cabinet-maker
English Literature	1st Prize ...	5	,, 68—Henry Simpson, aged 19, Birmingham and Midland Institute—Clerk
	2nd Prize ..	3	,, 73—Howard Shakespeare Pearson, aged 21, Birmingham and Midland Institute—Stationer
Logic	1st Prize ...	5	,, 408—Frederic Reeves, aged 19, Messrs. Chances' Library—Glass-cutter
	2nd Prize ..	3	,, 414—David Bailey, aged 25, Bilston Institution—Schoolmaster
Latin and Roman History.	1st Prize ...	5	,, 627—John Naismith Russell, aged 24, Glasgow Institution—Assistant teacher
	2nd Prize ..	3	,, 139—Charles Steer, aged 29, Croydon Literary Institute—Printer
French.....	1st Prize ...	5	,, 201—Abraham Shekelton, aged 33, Glasgow Mechanics' Institution—Book-keeper
	2nd Prize ..	3	,, 164—Andrew Farm, aged 29, Glasgow Mechanics' Institution—Pattern-drawer
German	1st Prize ...	5	,, 465—Walter Robert Clark, aged 20, Sussex Hall Evening Classes—Clerk
			No Second Prize Awarded.†
Music	1st Prize ...	5	,, 607—William Hugh Smith, aged 24, Glasgow Institution—Clerk
	2nd Prize ..	3	,, 429—John Walter Asquith, aged 31, Wakefield Mechanics' Institution—Teacher

‡ No Candidate obtained a First-class Certificate in this Subject.
† The Candidate standing Second in this Subject did not obtain a First-class Certificate.

PRIZES TO INSTITUTIONS.*

One Prize of £5 to the Sussex Hall Evening Classes, in respect of Candidate No. 472, William Vaughan, who obtained the First Prize in Arithmetic.

One Prize of £5 to the Leeds Young Men's Christian Institute, in respect of Candidate No. 523, Thomas Hick, who obtained the First Prize in Algebra.

One Prize of £5 to the Leeds Young Men's Christian Institute, in respect of Candidate No. 557, Walter Robinson, who obtained the First Prize in Geometry.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 183, Archibald Simon Lang Macdonald, who obtained the First Prize in Magnetism, Electricity, and Heat.

One Prize of £5 to the London Mechanics' Institution, in respect of Candidate No. 328, William Scott, who obtained the First Prize in Chemistry.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 185, Alexander McKinlay, who obtained the First Prize in Botany.

One Prize of £5 to the Glasgow Athenæum, in respect of Candidate No. 240, Robert Clark, who obtained the First Prize in English History.

One Prize of £5 to the Birmingham and Midland Institute, in respect of Candidate No. 68, Henry Simpson, who obtained the First Prize in English Literature.

One Prize of £5 to the Glasgow Institution, in respect of Candidate No. 627, John Naismith Russell, who obtained the First Prize in Latin and Roman History.

One Prize of £5 to the Glasgow Mechanics' Institution, in respect of Candidate No. 201, Abraham Shekelton, who obtained the First Prize in French.

One Prize of £5 to the Sussex Hall Evening Classes, in respect of Candidate No. 465, Walter Robert Clark, who obtained the First Prize in German.

One Prize of £5 to the Glasgow Institution, in respect of Candidate No. 607 William Hugh Smith, who obtained the First Prize in Music.

No Prizes are awarded to Institutions in respect of the Candidates who obtained First Prizes in Book-keeping, Conic Sections, Geography, and Logic, it having been ascertained that these Candidates had not received "systematic instruction" in these subjects at their respective Institutions "for a period of not less than three months," as required by the conditions.

* The conditions were as follows:—

"The following Prizes are offered to the Institutions, viz.:—To the Institution whose Candidate obtains the First Prize of £5 in any of the 25 Subjects, one Prize of £5. An Institution can take more than one such Prize; but no such Prize can be taken by an Institution unless the Council of the Society of Arts are satisfied that the Candidate, in respect of whom the Prize is claimed, has received in a class at the Institution systematic instruction in the subject for a period of not less than three months.

"The following Prizes are offered to the Local Boards, viz.:—To the Local Board whose Candidates (not fewer than twenty) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £10. To the Local Board whose Candidates (not fewer than sixteen) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £8. To the Local Boards whose Candidates (not fewer than twelve) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £6. To the Local Board whose candidates (not fewer than eight) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £4. No Local Board can receive more than one of these prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted. No Prize of any kind can be awarded to, or in respect of, any of the persons referred to in the second and third paragraphs of the Preliminary Notice."

PRIZES TO LOCAL BOARDS.

The Prize of £10 to the Local Board at the Glasgow Mechanics' Institution.

The Prize of £8 to the Local Board at Bradford.

The Prize of £6 to the Local Board at the Glasgow Institution.

The Prize of £4 to the Local Board at the London Mechanics' Institution.

CERTIFICATES.

The following is an Alphabetical List of the Candidates who obtained Certificates:—

(1st) after a subject	signifies a	First-class	Certificate.
(2nd) ,,	,,	Second-class	,,
(3rd) ,,	,,	Third-class	,,

(The occupations stated are either present or proposed.)

No.
636—Adams, John Henry, aged 18, Pembroke Dock M.I., Shipwright's Apprentice—Arithmetic (3d)
150—Allan, Michael, jun., aged 25, Glasgow M.I., Warehouseman—French (3rd)
151—Allan, Robert, aged 29, Glasgow M.I., Book-keeper—English Literature (3rd); Logic (3rd)
645—Allen, Edward, aged 28, Manchester M.I., Silkweaver—Arithmetic (3rd); Book-keeping (3rd)
235—Allison, David, aged 23, Glasgow Athenæum, Clerk—Book-keeping (3rd)
153—Anderson, James, aged 22, Glasgow M.I., Clerk—Algebra (2nd); Trigonometry (3rd)
581—Anderson, James, aged 38, People's College, Sheffield, Bootmaker—English History (2nd); Geography (2nd)
6—Anderson, William, aged 22, Aberdeen M.I., Bookseller—Arithmetic (3rd)
524—Andrew, John James, aged 17, Leeds Young Men's Christian I., Clerk—Book-keeping (2nd)
71—Aris, Robert Hamilton, aged 19, Birmingham and Midland I., Clerk—Arithmetic (2nd)
398—Armstrong, Matthew Watson, aged 19, Skipton M.I., Cabinetmaker—Arithmetic (3rd)
429—Asquith, John Walter, aged 31, Wakefield M.I., Teacher—Music (1st) with 2nd Prize
300—Atkinson, Henry, aged 22, Leeds M.I., Draper—Arithmetic (3rd)
331—Aumonier, Frederic, aged 22, London M.I., Salesman at Paperstainer's—Arithmetic (2nd)
390—Badger, William, aged 19, Rotherham Young Men's Christian I., Practical Engineer—Practical Mechanics (3rd)
414—Bailey, David, aged 25, Bilston Inst., Schoolmaster—Logic (1st) with 2nd Prize
459—Bailey, George, aged 16, York I., Railway Clerk—German (3rd)
385—Baker, John, aged 22, Kingston-on-Thames M.I., Carpenter—Arithmetic (2nd)
518—Balme, Henry, aged 20, Halifax W.M.Coll., Warehouseman—Arithmetic (3rd)
474—Banister, Albert, aged 17, Sussex-hall Evening Classes—English History (1st)

678—Barker, Mark, aged 20, Halifax M.I., Card Printer—Arithmetic (3rd)
327—Barlow, Thomas Kendall, aged 24, Leicester Church of England I., Solicitor's Clerk—Arithmetic (1st); Book-keeping (2nd); Algebra (3rd)
443—Barnish, William Croudson, aged 20, Wigan M.I., Druggist—Chemistry (1st) with 2nd Prize
157—Barr, Thomas Morrison, aged 25, Glasgow M.I., Land Surveyor—Magnetism, Electricity, and Heat (3rd)
488—Barrett, Edwin, aged 23, Ipswich M.I., Bookseller—English Literature (3rd)
483—Bateman, Francis, aged 16, Canterbury Church of England Young Men's Lit. I., Apothecary—English History (1st); Geography (2nd)
325—Battle, Hugh, aged 39, Leicester Church of England I., Missionary—Conic Sections (1st) with First Prize; Trigonometry (2nd)
145—Baty, John, aged 20, Darlington M.I., Railway Clerk—Animal Physiology (2nd)
504—Bayly, John, aged 23, Devonport M.I., Shipwright—Arithmetic (1st); Algebra (3rd); Mensuration (3rd)
106—Bearder, George, aged 26, Bradford M.I., Millwright—Arithmetic (2nd)
345—Bell, Joseph Carter, aged 20, Royal Polytechnic Inst. Classes, Clerk—Chemistry (3rd)
83—Beresford, William Freeman, aged 19, Birmingham and Midland I., Teacher—English History (1st)
614—Berry, Thomas, aged 22, Glasgow I., Warehouseman—Logic (1st)
314—Bew, John James, aged 22, Liverpool I., Commercial Cashkeeper—Logic (3rd)
576—Biggin, Isaac, aged 22, People's College, Sheffield, Warehouseman—Arithmetic (3rd)
416—Boden, George, aged 19, Stourbridge M.I., Reporter—French (3rd)
118—Bonny, Charles, aged 23, Brompton Ch. of Eng. Young Men's Inst., Ropemaker—Arithmetic (3rd)
307—Booth, John Burnett, aged 20. Leeds M.I., Bookseller—Arithmetic (3rd)
243—Bosworth, Thomas, aged 18, Glasgow Athenæum, Clerk—Book-keeping (3rd)
108—Bottomley, Robert, aged 16, Bradford M.I., Warehouseboy—Arithmetic (2nd); Mensuration (3rd)
532—Bradbury, David Addison, aged 17, Leeds Young Men's Christian Institute, Pupil Teacher—Geography (2nd); French (3rd)
99—Bradley, Oliver, aged 19, Bradford M.I., Warehouseman—English History (2nd)
589—Bramhall, John, aged 21, People's College, Sheffield, School Assistant—Arithmetic (2nd)
583—Bramwell, John Henry, aged 18, People's College, Sheffield, File Cutter—French (3rd)
506—Brear, William, aged 16, Halifax W. M. College, Warehouseman—Arithmetic (2nd)
657—Bridge, James, aged 16, Manchester M.I.—Arithmetic (3rd)
440—Bridge, Thomas, aged 16, West Bromwich Young Men's Christian Association, Chemist and Druggist's Apprentice—Arithmetic (3rd)
156—Brodie, William, aged 17, Glasgow M.I., Colour Maker—Chemistry (2nd)
533—Brooke, Henry, aged 19, Leeds Young Men's Christian Institute, Draper—Book-keeping (3rd); French (3rd)
546—Brooks, Joseph, aged 19, Leeds Young Men's Christian Institute, Mechanic—Arithmetic (3rd)
225—Brosnahan, William, aged 21, Glasgow Athenæum, Inland Revenue Officer—English History (3rd)
261—Brown, Ben, aged 19, Holmfirth M.I., Slubber—Arithmetic (3rd)
421—Brown, James, aged 19, Wolverhampton W. M. College, Railway Clerk—Bookkeeping (3rd)
359—Brown, Jeremiah, aged 21, Athenæum, King's Lynn, Clerk—Book-keeping (3rd)
74—Brown, Herbert, aged 22, Birmingham and Midland I., Manufacturer—English Literature (2nd)
155—Brown, John, aged 16, Glasgow, M.I., Clerk—French (3rd)
336—Brown, John James, aged 28, St. Stephen's Westminster I., Assistant-Master—Arithmetic (3rd)
154—Brown, Robert, aged 18, Glasgow M.I., Clerk—Arithmetic (1st); French (3rd)
120—Browne, Henry Edward, aged 19, Brompton Church of England Young Men's I., Shipwright (Apprentice)—Algebra (2nd); Trigonometry (2nd)
5—Bruce, Andrew, aged 16, Aberdeen M.I., Clerk—Arithmetic (3rd)
540—Bryer, Richard, aged 17, Leeds Young Men's Christian I., Apprentice in Cloth Warehouse—French (3rd)
445—Bucknall, Samuel George, aged 33, Wigan M.I., Bookseller and Stationer—Book-keeping (3rd)
55—Bulloch, Alexander, aged 18, People's Reading Room, Belfast, Clerk—Book-keeping (2nd)
457—Bulmer, Richard, aged 19, York Institute—Geography (3rd)
484—Bunce, John Friend, aged 26, Canterbury Church of Eng. Young Men's L.I., Turner—Arithmetic (2nd); French (2nd)
403—Burden, William Henry, aged 16, Messrs. Chances' Library, Clerk—Arithmetic (3rd)
597—Burdett, Thomas, aged 18, Bury Athenæum, Factory Operative—Arithmetic (3rd)
353—Burgess, Robert, aged 19, Louth M.I., Ironmonger—Algebra (2nd)
554—Burnell, William, aged 17, Leeds Young Men's Christian I., Clerk—Book-keeping (1st)
426—Butler, James Henry, aged 17, Wolverhampton Working Men's College, Presser and Stamper—Algebra (3rd); Book-keeping (3rd)
670—Butterworth, Joseph, aged 16, Selby M.I., Wheelwright—Arithmetic (2nd)
127—Buttifant, John George, aged 18, Carlisle Ch. of Eng. Inst., Organist—Music (3rd)
146—Byers, George Steele, aged 18, Darlington M.I., Clerk—Arithmetic (3rd)
423—Caddick, James, aged 22, Wolverhampton Working Men's College, Clerk—Arithmetic (2nd); Book-keeping (2nd); French (3rd)
131—Cameron, John, jun.—aged 20, Carlisle Church of England Lit. I., Clerk—Arithmetic (1st); French (2nd); Book-keeping (2nd)
476—Carpenter, Joseph Marshall, aged 19, Sussex Hall Evening Classes, Clerk—English Literature (1st)
251—Casebourne, Henry, aged 25, West Hartlepool L. and M.I., Mechanical Engineer—Practical Mechanics (3rd)
7—Chalmers, Andrew, aged 19, Aberdeen M.I., Warehouseman—English Literature (2nd)
615—Chalmers, Thomas, aged 20, Glasgow I., Clerk—Book-keeping (2nd)
342—Chandler, Henry Parry, aged 18, Royal Polytechnic Inst. Classes, Clerk—Chemistry (2nd)
67—Chapman, James, aged 36, Birmingham and Midland I., Clerk—Algebra (3rd)
46—Chedzoy, Charles William, aged 16, Barnet L. and S. I.—Arithmetic (1st)
299—Child, Wallace, aged 18, Leeds M.I., Pupil-teacher—Arithmetic (2nd); Geography (3rd)
635—Christie, Charles Augustus, aged 19, Pembroke Dock M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
240—Clark, Robert, aged 22, Glasgow Athenæum, Clerk—English History (1st), with 1st Prize
503—Clark, Robert George, aged 21, Devonport M.I., Shipwright—Arithmetic (1st); Algebra (2nd); Geometry (3rd)

465—Clark, Walter Robert, aged 20, Sussex-hall Evening Classes, Clerk—German (1st) with 1st Prize
90—Clarkson, Elizabeth, aged 20, Blackburn M.I., Teacher—Geography (3rd)
471—Clementson, Alfred Bland, aged 19, Sussex-hall Evening Classes, Wholesale Stationer—Arithmetic (1st)
515—Cockroft, Henry, aged 18, Halifax Working Men's College, Clerk—Book-keeping (3rd)
258—Conder, James, aged 20, Hitchin M.I., Land Surveyor—Book-keeping (2nd); Astronomy (2nd); English History (2nd)
295—Cook, William, aged 17, Leeds Church of England I., Pupil Teacher—Arithmetic (2nd)
31—Cooper, Arthur, aged 29, Aberdeen M.I., Labourer—Magnetism, Electricity, and Heat (3rd)
84—Coote, Thomas, aged 16, Bishop's Stortford L.I., Merchant's Clerk—Arithmetic (3rd)
399—Cornthwaite, Robert, aged 23, Skipton M.I., Book-keeper—Arithmetic (3rd); Algebra (3rd)
406—Cotterell, John, aged 16, Messrs. Chances' Library, Glass Painter—Arithmetic (3rd)
566—Cowell, Charles, aged 20, Leeds Young Men's Christian I., Compositor—English Literature (3rd)
158—Craig, John, aged 18, Glasgow M.I., Clerk—Chemistry (2nd)
160—Crawford, John, jun., aged 19, Glasgow M.I., Clerk—Chemistry (1st)
289—Crawshaw, John William, aged 17, Leeds M.I., Clerk—German (2nd)
252—Crouch, John, jun., aged 19, Hertford L. and S. I., Attorney's Clerk—Arithmetic (1st)
413—Crowther, George, aged 18, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
159—Crum, John, aged 28, Glasgow M.I., Pay Clerk—Magnetism, Electricity, and Heat (2nd)
453—Crumbie, George, aged 17, York I., Attorney's Clerk—English History (2nd)
561—Curtis, Arthur, aged 16, Leeds Young Men's Christian I.,—German (3rd)
233—Cuthbertson, William Reid, aged 17, Glasgow Athenæum, Clerk—Book-keeping (3rd)
217—Cuthill, William, aged 20, Glasgow Athenæum, Engineer—Practical Mechanics (3rd)
287—Dalby, Edward, aged 17, Leeds M.I., Mechanic—Arithmetic (2nd); Algebra (2nd); Geometry (3rd)
227—Dansken, John, aged 24, Glasgow Athenæum, Measurer—Logic (2nd)
475—Dart, Richard Henry, aged 26, Sussex-hall Evening Classes, Draper—French (3rd)
313—Davidson, Andrew, aged 21, Liverpool I., Joiner—Arithmetic (3rd)
553—Dean, Thomas, aged 18, Leeds Young Men's Christian Institute, Clerk—Book-keeping (2nd)
442—Dean, William, aged 22, Wigan M.I., Clerk—Arithmetic (2nd)
550—Denny, Charles Edward, aged 18, Leeds Young Men's Christian Institute, Clerk—Bookkeeping (3rd)
498—Derrick, Thomas, aged 18, Bristol Young Men's Christian Institute, Clerk—Arithmetic (2nd); Geography (2nd)
114—Dibb, Charles Henry, aged 16, Bradford M.I., Wool sorter—Geography (2nd)
163—Dickson, James, aged 21, Glasgow M.I., Clerk—Algebra (2nd)
631—Dippy, Thomas, aged 18, Pembroke Dock M.I., Shipwright's Apprentice—Arithmetic (1st); Algebra (3rd); Geography (3rd)
8—Dow, James, aged 20, Aberdeen M.I., Engineer—English Literature (3rd)
1—Dow, Thomas, aged 18, Aberdeen M.I., Blacksmith—English Literature (2nd)
584—Dufty, Joseph, aged 17, People's College, Sheffield, Confectioner—French (3rd)
162—Dunn, William, aged 17, Glasgow M.I., Book-keeper—Arithmetic (1st)
123—Edgar, James, aged 17, Carlisle Church of Eng. I., Attorney's Clerk—Arithmetic (3rd); Book-keeping (3rd)
79—Edmonds, George, aged 18, Birmingham and Midland I., Clerk—English Literature (2nd)
315—Edwards, Timothy Evan, aged 18, Liverpool I., Lithographer—Geometry (2nd)
656—Ellerby, Charles Herbert, aged 18, Manchester M.I., Mechanical Draughtsman—Geometry (1st) with 2nd Prize; Practical Mechanics (2nd)
405—England, George, aged 17, Messrs. Chances' Library, Birmingham, Chemist and Druggist—English History (3rd)
667—Entwistle, James, aged 18, Manchester M.I., Clerk—Arithmetic (3rd)
316—Evans, Rowland, aged 17, Liverpool I., Clerk—Political and Social Economy (3rd)
246—Ewart, William Routledge, aged 26, Stockton-on-Tees M.I., Draper's Assistant—Arithmetic (2nd); Book-keeping (3rd)
164—Farm, Andrew, aged 29, Glasgow M.I., Pattern Drawer—French (1st) with 2nd Prize
419—Farnworth, William, aged 33, Wolverhampton Working Man's College, Shingler—Arithmetic (3rd)
556—Farquhar, George, aged 23, Leeds Young Men's Christian I., Clerk—Geography (2nd)
626—Finister, John, aged 24, Glasgow I., Stone Mason—Arithmetic (3rd)
17—Finlayson, Alexander, aged 18, Aberdeen M.I., Writer—English History (2nd)
43—Finn, Edward Cornelius, aged 19, S.E. Railway M.I., Railway Clerk—Arithmetic (2nd)
361—Firth, Caroline, aged 19, Macclesfield Useful Knowledge I.,—French (3rd)
464—Fisher, Benjamin, aged 17, Sussex-hall Evening Classes, Clerk—Arithmetic (2nd); Book-keeping (3rd)
51—Forsyth, Joseph, aged 30, People's Reading Rooms, Belfast, Assistant Draper—Astronomy (2nd)
599—Furness, John Thomas, aged 20, Bury Athenæum, Hatter—Arithmetic (2nd)
44—Garaway, Francis, aged 24, South Eastern Railway M.I., Schoolmaster (certificated)—Arithmetic (1st); Algebra (3rd); Chemistry (2nd); Geography (2nd)
231—Garner, George James, aged 18, Glasgow Athenæum, Clerk—Arithmetic (3rd); English Literature (3rd)
228—Gatheral, George, aged 20, Glasgow Athenæum, Warehouseman—French (2nd)
569—Gaunt, John, aged 23, People's College, Sheffield, File-cutter—Arithmetic (3rd)
412—Genner, Job, aged 20, Messrs. Chances' Library, Birmingham, Clerk—Book-keeping (3rd)
165—Gibb, Thomas, aged 20, Glasgow M.I., Mining Engineer—Arithmetic (1st); Algebra (2nd); Geometry (2nd)
143—Gibbs, John, aged 37, Chelmsford L. and M.I., Woolsorter—English History (1st); Botany (1st) with 2nd Prize
467—Gillingham, Alfred George, aged 26, Sussex Hall Evening Classes, Clerk—Book-keeping (1st)
326—Godfrey, Isaac, aged 18, Leicester Church of England I., Hosier—Arithmetic (2nd); Mensuration (3rd)
208—Govan, John, aged 16, Glasgow Athenæum, Clerk—French (2nd)
168—Govan, William Johnson, aged 17, Glasgow M.I., Clerk—French (2nd)
647—Gowan, James, aged 22, Manchester M.I., Clerk—Book-keeping (3rd)
297—Goyne, John, aged 25, Holbeck M.I., Teacher—Algebra (3rd); Geometry (3rd)
133—Graham, George, aged 25, Carlisle Church of England I., Grocer's Assistant—Arithmetic (3rd)
101—Greenhough, John Gershom, aged 17, Bradford M.I., Warehouseboy—English History (1st); Geography (1st)
166—Gregory, Jane Legendre, aged 26, Glasgow M.I., Governess—French (1st)

486—Greenstreet, Stephen Henry, aged 17, Canterbury Church of England Young Men's L.I., Pupil Teacher—Geography (2nd)
291—Greenwood, John William, aged 18, Leeds M.I., Pupil Teacher—Arithmetic (1st); Algebra (2nd); Geography (1st)
263—Greenwood, Pickles, aged 21, Ingrow cum Hainworth Young Men's Christian Improvement Society, Mechanic—Arithmetic (3rd)
514—Greenwood, Samuel, aged 20, Halifax Working Men's College, Card Writer—Book-keeping (3rd)
662—Gresty, Jonathan, aged 23, Manchester M.I., Warehouseman—Arithmetic (3rd); Book-keeping (3rd)
121—Griffith, John Joseph, aged 21, Brompton Church of England Young Men's I., Caulker—Arithmetic (2nd) Algebra (3rd)
65—Griffiths, Edwin, aged 35, Birmingham and Midland I., Dispensing Chemist—Chemistry (1st)
319—Griffiths, James, aged 19, Liverpool I., Teacher—Logic (3rd)
417—Griffiths, William, aged 20, Stourbridge M.I., Carpenter—Arithmetic (2nd); Algebra (3rd)
632—Griffiths, Henry, aged 18, Pembroke Dock M.I., Shipwright—Arithmetic (2nd); Algebra (3rd)
57—Hagan, Charles Henry, aged 17, People's Reading Room, Belfast, Engineer—Arithmetic (3rd)
562—Haigh, William Henry, aged 17, Leeds Young Men's Christian I., Cloth Finisher—German (3rd)
617—Hamilton, David, aged 16, Glasgow I., Pupil Teacher—Logic (2nd)
124—Hamilton, George, aged 19, Carlisle Church of England I., Tobacco Pipe Maker—Arithmetic (2nd); Geometry (2nd); Algebra (3rd)
609—Hamilton, James, aged 22, Glasgow I.—Latin and Roman History (1st)
460—Harding, James Staughton, aged 20, Evening Classes, Sussex-hall, Clerk—Arithmetic (2nd); French (2nd)
383—Hardwick, Joseph, aged 19, Kingston-on-Thames M.I., Bricklayer and Plasterer—Arithmetic (3rd)
218—Hargrave, Joseph James, aged 19, Glasgow Athenæum, Civil Engineer—Arithmetic (1st); Algebra (3rd)
216—Harper, James, aged 18, Glasgow Athenæum, Clerk—Latin and Roman History (2nd)
420—Harrington, Walter, aged 16, Wolverhampton Working Men's College—Arithmetic (3rd); Algebra (3rd)
232—Harris, James Reed, aged 22, Glasgow Athenæum, Ironmonger—Arithmetic (2nd); Book-keeping (3rd)
110—Harrison, Joseph, aged 18, Bradford M.I., Woolsorter—Astronomy (2nd); English Literature (2nd)
103—Harrison, William, aged 21, Bradford M.I., Compositor—Geography (2nd); English Literature (2nd)
573—Harrop, Alfred, aged 34, People's College, Sheffield, Bellows Manufacturer—Political and Social Economy (3rd)
66—Hart, Joseph, aged 33, Birmingham and Midland I., Dyer—Chemistry (3rd)
665—Hartley, Lewis, aged 19, Manchester M.I., Warehouseman—Political and Social Economy (2nd)
681—Hartley, Thomas, aged 18, Halifax M.I., Warehouseman—Book-keeping (3rd)
542—Hartley, William, aged 18, Leeds Young Men's Christian I., Clerk—Political and Social Economy (3rd); Logic (3rd)
463—Harvey, Joseph, aged 24, Evening Classes, Sussex-hall, Stationer—German (3rd)
571—Hasler, John, aged 27, People's College, Sheffield, Plane-maker—German (2nd)
377—Haves, John William, aged 17, Watt I., Portsea, Engineer Apprentice—Mensuration (2nd); Algebra (2nd); Trigonometry (3rd)
109—Hayward, Thomas, aged 19, Bradford M.I., Clerk—English History (1st)
558—Headland, Thomas, Jun., aged 17, Leeds Young Men's Christian Institute, Tailor and Draper—Arithmetic (3rd)
170—Henderson, Robert, aged 17, Glasgow M.I., Clerk to Commission Merchant—Arithmetic (1st)
172—Hennedy, David, aged 20, Glasgow M.I., Warehouseman—Music (3rd)
171—Hennedy, William, aged 22, Glasgow M.I., Manufacturer—Magnetism, Electricity, and Heat (3rd)
529—Heseldin, Francis Green, aged 16, Leeds Young Men's Christian I., Printer's Apprentice—Book-keeping (2nd)
523—Hick, Thomas, aged 19, Leeds Young Men's Christian I., Teacher—Algebra (1st) with 1st Prize; Geometry, (1st); Trigonometry (2nd); Conic Sections (2nd)
516—Highley, Matthew, aged 18, Halifax Working Men's College, Warehouseman—Book-keeping (3rd)
323—Highton, John, aged 17, Leicester Church of England I., School Assistant—Book-keeping (3rd); Geography (2nd); English History (3rd)
591—Hill, Charles, aged 21, People's College, Sheffield, Engraver's Tool Maker—Geography (3rd)
173—Hill, David, aged 16, Glasgow M.I., Clerk—Chemistry (1st)
519—Hill, Rowland, aged 19, Halifax Working Men's College, Woolstapler—Chemistry (3rd)
574—Hill, Thomas Vardy, aged 22, People's College, Sheffield, Clerk—Arithmetic (2nd)
253—Hills, Henry George, aged 17, Hertford L. and S.I., Printer—Arithmetic (1st)
340—Hind, Francis Henry Philip, aged 18, Royal Polytechnic, Banker's Clerk—Chemistry (2nd)
147—Hobson, William, aged 31, Darlington M.I., Railway Clerk—Animal Physiology (2nd)
85—Hodgson, James, aged 18, Blackburn M.I., Plasterer—Algebra (3rd)
81—Holdsworth, Matthew Henry, aged 19, Birmingham and Midland I., Mechanical Engineer—Arithmetic (2nd)
601—Holloway, William, aged 35, London M.I., Schoolmaster—English History (1st)
245—Holmes, John Emra, aged 20, West Hartlepool L. and M.I., Clerk H.M. Customs—English History (3rd)
649—Holmes, Peter, aged 16, Manchester M.I., Junior Clerk—Book-keeping (2nd)
209—Holmes, Robert Anderson, aged 17, Glasgow Athenæum, Clerk—English History (3rd)
38—Hood, James Wallace, aged 29, S. E. Railway M.I., Engine Fitter—Arithmetic (2nd); Book-keeping (3rd)
301—Hopwood, Herbert Jackson, aged 19, Leeds M.I., Clerk—Arithmetic (2nd)
473—Hoskins, Henry, aged 22, Sussex-hall Evening Classes, Clerk—Algebra (2nd)
169—Hunter, John, aged 23, Glasgow M.I., Clerk—Book-keeping (2nd)
229—Hunter, John, aged 19, Glasgow Athenæum, Warehouseman—English Literature (2nd)
219—Hutton, James, aged 20, Glasgow Athenæum, Accountant—English History (3rd)
580—Hutchinson, William Thomas, aged 30, People's College, Sheffield, Butcher—English History (1st)
673—Israel, Henry Ash, aged 19, Sussex-hall Evening Classes, Meat Salesman—Arithmetic (2nd)
341—Israel, Louis Ash, aged 21, Royal Polytechnic Inst. Classes, Commission Salesman—Chemistry (2nd)
148—Jackson, Henry, aged 26, Darlington Church of England I., Clerk—Arithmetic (1st); Algebra (3rd)
222—Jackson, John, aged 19, Glasgow Athenæum, Clerk—English History (1st)
444—Jackson, John, aged 19, Wigan M.I., Dispenser—Chemistry (3rd)
452—Jackson, Thomas, aged 20, York I., Attorney's Clerk—Book-keeping (3rd)

651—Jacob, Edward Westley, aged 20, Manchester M.I., Engineer—Arithmetic (2nd); Algebra (2nd); Chemistry (3rd); Principles of Mechanics (3rd)
259—Jeeves, Alfred, aged 24, Hitchin M.I., Solicitor's Clerk—Arithmetic (2nd); Book-keeping (2nd)
292—Jenkinson, Henry Irwin, aged 21, Leeds M.I., Clerk—Algebra (3rd)
634—Johns, Thomas Bowen, aged 20, Pembroke Dock M.I., Shipwright—Astronomy (2nd)
98—Johnson, Thomas, aged 21, Bradford M.I., Grocer's Assistant—Book-keeping (3rd)
100—Johnson, William, aged 21, Bradford M.I., Clerk—Arithmetic (1st); German (2nd); Algebra (3rd)
136—Johnston, Thomas B., aged 23, Carlisle Church of England Institute, Clerk—Arithmetic (3rd); Book-keeping (3rd)
330—Joseph, Isaac, aged 19, London M.I., Clerk—Arithmetic (1st); Book-keeping (2nd); Algebra (3rd)
102—Jowett, William Henry, aged 22, Bradford M.I., Letter-press Printer—English History (2nd)
397—Joy, Thomas Augustus, aged 19, Skipton M.I., Grocer—Arithmetic (3rd)
348—Keeble, Francis Henry, aged 20, Royal Polytechnic Inst. Classes, Cabinet Maker—Magnetism, Electricity, and Heat (2nd)
93—Kenyon, Thomas, aged 18, Blackburn M.I., Warehouseman—Arithmetic (3rd); Mensuration (3rd)
294—Kettlewell, John, aged 19, Leeds Church Institute, Pupil Teacher—Arithmetic (3rd); Geography (3rd)
72—Kidson, Samuel, aged 31, Birmingham and Midland I., Warehouseman—Botany (3rd)
62—King, John, aged 17, Berkhampstead M.I., Railway Clerk—English History (2nd)
620—Kinloch, David, aged 18, Glasgow I., Clerk—Book-keeping (2nd)
269—Knapton, William, aged 32, Leeds M.I., Mason—English History (2nd); German (3rd)
363—Kniveton, Charles, aged 21, Macclesfield Useful Knowledge Institution, Power-loom Weaver—Arithmetic (2nd)
175—Laidlaw, Robert, aged 18, Glasgow M.I., Clerk—Magnetism, Electricity, and Heat (3rd)
241—Laidlaw, Samuel, aged 20, Glasgow Athenæum, Clerk—English History (1st)
525—Lawrence, George Henry, aged 18, Leeds Young Men's Christian Institute, Clerk—Arithmetic (2nd); Book-keeping (2nd)
226—Lawson, John Yeaman, aged 22, Glasgow Athenæum, Draper—Arithmetic (2nd)
612—Leask, Thomas, aged 20, Glasgow I., Book-keeper—Book-keeping (3rd)
27—Ledingham, Alexander William, aged 29, Aberdeen M.I., Clerk—Chemistry (2nd)
389—Leonard, Edward, aged 16, Rotherham Young Men's Christian I., Pupil Teacher—Arithmetic (3rd); Geography (3rd)
674—Leslie, George Charles, aged 18, Sussex Hall Evening Classes, Clerk—Arithmetic (1st); Geography (3rd)
174—Lightbody, John, aged 21, Glasgow M.I., Clerk—Book-keeping (2nd); French (3rd)
425—Lilley, John, aged 19, Wolverhampton Working Men's College, Grocer—Arithmetic (3rd); Book-keeping (3rd)
132—Lindsley, William, aged 16, Carlisle Church of England I., Clerk—Arithmetic (2nd)
117—Lines, Francis, aged 17, Brompton Church of England Young Men's I., Shipwright Apprentice—Arithmetic (1st); Algebra (3rd)
221—Linn, William Campbell, aged 19, Glasgow Athenæum, Upholstery Trimming Manufacturer—Arithmetic (1st); Algebra (2nd); English Literature (1st)
644—Little, Charles, aged 18, Manchester M.I., Agent—Arithmetic (3rd)
427—Logan, Henry, aged 19, Wakefield M.I., Iron Moulder—Arithmetic (2nd)
76—Lucas, William, aged 33, Birmingham and Midland I., Clerk—Chemistry (2nd)
368—Lyall, William, aged 26, Newcastle-on-Tyne Church of England I., Letter-press Printer—Arithmetic (3rd)
183—Macdonald, Archibald Simon Lang, aged 20, Glasgow M.I., Mercantile Clerk—Principles of Mechanics (3rd); Practical Mechanics (2nd); Magnetism, Electricity, and Heat (1st) with 1st Prize
213—Macfadyen, James Ritchie, aged 17, Glasgow Athenæum, Merchant (proposed)—Arithmetic (1st); Book-keeping (3rd); French (3rd)
606—Macfarlane, David, aged 21, Glasgow, I., Clerk—Political and Social Economy (2nd)
180—MacGibbon, John Manderson, aged 17, Glasgow M.I., Architect's Apprentice—Arithmetic (1st)
248—Mackenzie, John James, aged 19, West Hartlepool, L. & M.I., Clerk—English History (3rd); Geography (2nd)
30—MacKillican, John, aged 27, Aberdeen M.I., Watchmaker—Algebra (3rd)
622—Main, John, aged 18, Glasgow I., Clerk—Arithmetic (3rd)
179—Mann, James, aged 18, Glasgow M.I., Clerk—French (1st)
375—Marcus, John Augustus Henry, aged 19, Watt Inst., Portsea, Pattern-maker—Arithmetic (3rd)
446—Marsden, William James, aged 33, Wigan M.I., Book-keeper—Book-keeping (2nd)
633—Marshall, James, aged 28, Pembroke Dock M.I., Soldier—Arithmetic (2nd); Mensuration (3rd); Algebra, (3rd)
178—Martin, Daniel Gay, aged 24, Glasgow M.I., Clerk—French (2nd)
629—Mason, George, aged 19, Pembroke Dock M.I., Shipwrights' Apprentice—Arithmetic (3rd); Geometry (3rd)
302—May, Thomas, aged 31, Leeds M.I., Mechanic—Algebra (3rd); Geometry (2nd); Trigonometry (3rd)
351—McAlister, Samuel, aged 20, Louth M.I., Clerk in Civil Service—Algebra (3rd); Geometry (2nd)
237—McCondach, Kenneth, aged 22, Glasgow Athenæum, Book-keeper—Arithmetic (1st); English Literature (2nd); Logic (2nd)
530—McCully, Richard, aged 29, Leeds Young Men's Christian Institute, Clerk—French (1st); Latin and Roman History (3rd)
186—McDougall, John, aged 26, Glasgow M.I., Mercantile Clerk—Book-keeping (2nd)
182—McKechnie, William, aged 20, Glasgow M.I., Colour Maker—Chemistry (1st)
181—McKellar, David, aged 18, Glasgow M.I., Ship Draughtsman—Arithmetic (3rd)
185—McKinlay, Alexander, aged 19, Glasgow M.I., Solicitor's Clerk—Botany (1st) with 1st Prize
628—McMillan, Andrew, aged 17, Glasgow I., Ironmonger—Book-keeping (1st)
184—McPherson, Daniel, aged 23, Glasgow M.I., Clerk—French (3rd)
536—Meek, William Todd, aged 17, Leeds Young Men's Christian I., Cloth Finisher—Arithmetic)3rd)
23—Middleton, William, aged 27, Aberdeen M.I., Law Clerk—Arithmetic (2nd); Book-keeping (2nd)
111—Midgley, John Whitworth, aged 32, Bradford M.I., House-agent—German (2nd); Book-keeping (2nd)
322—Miles, Alfred Ball, aged 20, Leicester Church of England I., Solicitor's Clerk—Book-keeping (1st)

176—Millen, Thomas Wilson, aged 21, Glasgow M.I., Book-keeper—Book-keeping (1st); Botany (3rd)
47—Miller, George William Neville, aged 30, Barnet I., Carpenter—Arithmetic (3rd)
378—Mills, Joseph William, aged 17, Watt I., Portsea—Algebra (1st) with 2nd Prize; Arithmetic (2nd); Navigation and Nautical Astronomy (2nd)
238—Mitchell, William, aged 24, Glasgow Athenæum, Pattern-maker—French (3rd)
333—Moore, Francis Joseph Thomas, aged 25, London M.I., Book-keeper—Book-keeping (1st) with 1st Prize
671—Moorshead, John Bayly, aged 19, Sussex-hall Evening Classes, Clerk—Arithmetic (1st)
672—Moorshead, William N. B., aged 16, Sussex-hall Evening Classes, Clerk—Arithmetic (2nd)
177—Morrison, Alexander, aged 20, Glasgow M.I., Book-keeper—Book-keeping (2nd)
97—Mort, Spencer, aged 20, Bradford M.I., Mechanic—Arithmetic (3rd)
603—Moses, Christopher, aged 29, Middlesbro' M.I., Brick and Tile Maker—Book-keeping (2nd)
528—Moss, Henry, aged 20, Leeds Young Men's Christian I., Stuff Salesman—Logic (3rd)
407—Mulcaster, George, aged 19, Messrs. Chance's Library, Glass Packer—Arithmetic (3rd)
210—Munro, John, aged 16, Glasgow Athenæum, Junior Clerk—English History (3rd)
355—Munson, Robert, aged 17, Athenæum, King's Lynn, Clerk—Book-keeping (3rd)
134—Murphy, Nicholas Bowman, aged 29, Carlisle Church of England Inst., Hairdresser—Latin and Roman History (2nd)
477—Nash, Robert George, aged 40, Sussex Hall Evening Classes; Clerk—Latin and Roman History (3rd)
534—Naylor, Edwin Rattenbury, aged 20, Leeds Young Men's Christian Institute, Clerk—Arithmetic (3rd); Book-keeping (3rd)
312—Neilson, George H., aged 26, Liverpool I., Letter Carrier—Arithmetic (2nd)
621—Nelson, Andrew, aged 18, Glasgow I., Draper—Arithmetic (3rd)
371—Norcross, John Jackson, aged 19, Oldham Lyceum, Piecer—French (3rd)
329—Norris, George M., aged 18, London M.I., Clerk—Arithmetic (2nd)
63—Norton, Philip, aged 19, Birmingham and Midland I., Sack Dealer—English Literature (2nd)
107—Nuttall, John, aged 19, Bradford M.I., Warehouseman—Algebra (2nd); Geometry (3rd)
39—Oliver, William, aged 23, S. E. Railway M.I., Railway Clerk—Arithmetic (2nd); Book-keeping (1st)
54—Parker, Alexander, aged 20, People's Reading Rooms, Belfast, Assistant in Warehouse—Book-keeping (3rd)
33—Parkin, Benjamin, aged 18, Ashbourne W. M. I., Organist—Music (2nd)
230—Parnie, James, aged 22, Glasgow Athenæum, Clerk—English Literature (2nd); Logic (2nd)
439—Partridge, Thomas, aged 16, West Bromwich Young Men's Christian Association, Brassfounder—Arithmetic (3rd)
494—Paterson, Hugh Wishart, aged 23, Glasgow Athenæum, Clerk—Book-keeping (3rd)
664—Patterson, James, aged 20, Manchester M.I., Assistant in Deaf and Dumb School—Arithmetic (3rd)
189—Paul, George Muir, aged 22, Glasgow M.I., Designer—French (2nd)
663—Payne, George, aged 21, Manchester M.I., Book-keeper—Book-keeping (3rd)
96—Payne, James, jun., aged 22, Blandford Institution, Attorney's Clerk—Arithmetic (1st); Geometry (3rd)
306—Payton, Joseph, aged 18, Leeds M.I., Clerk—Book-keeping (2nd); Algebra (3rd)
491—Pearce, Robert, aged 20, Ipswich M.I., Accountant's Clerk—Book-keeping (1st) with 2nd Prize
73—Pearson, Howard Shakespeare, aged 21, Birmingham and Midland I., Stationer—English Literature (1st) with 2nd Prize
257—Penn, William, aged 21, Hitchin M.I., Teacher—Arithmetic (2nd); Book-keeping (2nd); Geography (2nd); French (3rd)
436—Phelan, Edmond, aged 17, Waterford M.I., Accountant—Arithmetic (1st)
338—Phillips, John Foster, aged 20, St. Stephen's Westminster I., Compositor—Arithmetic (3rd)
526—Pickard, John Wood, aged 25, Leed's Young Men's Christian I., Cashier—Arithmetic (1st)
679—Pilling, Benjamin, aged 20, Halifax M.I., Tailor—Arithmetic (3rd)
544—Platt, James, aged 19, Leeds Young Men's Christian I., Clerk—Book-keeping (3rd)
441—Platt, James, aged 22, Wigan M.I., Attorney's Clerk—Arithmetic (3rd)
190—Potter, Lucy, aged 16, Glasgow M.I., Pupil Teacher—French (3rd)
344—Powers, Edward, aged 22, Royal Polytechnic Inst. Classes, Chemist and Druggist—Chemistry (1st)
431—Power, John, aged 16, Waterford M.I., Clerk—Arithmetic (2nd)
191—Prosser, Oswald, aged 19, Glasgow M.I., Law Clerk—Chemistry (2nd)
239—Purves, David Laing, aged 22, Glasgow Athenæum, Clerk—English History (1st)
195—Rae, Andrew Neill, aged 23, Glasgow M.I., Book-keeper—Botany (2nd)
660—Ratcliffe, Henry, aged 16, Manchester M.I.—Arithmetic (2nd); Geometry (3rd); Algebra (3rd)
335—Ravenscroft, Francis, aged 30, London M. I., Clerk—Arithmetic (3rd)
116—Redman, Edward, aged 23, Brompton Church of England Young Men's I., Shipwright—Arithmetic (2nd); Algebra (3rd)
505—Reed, Charles Frederick, aged 20, Devonport M.I., Bootmaker—Arithmetic (3rd)
244—Reed, John, jun., aged 25, West Hartlepool L. and M.I., Clerk—Book-keeping (3rd)
408—Reeves, Frederick, aged 19, Messrs. Chances' Library, Birmingham, Glass Cutter—Logic (1st) with 1st Prize
610—Reid, William, aged 17, Glasgow I., Joiner—Book-keeping (3rd)
308—Richardson, George Frederick, aged 17, Leeds M.I., Telegraph Clerk—Arithmetic (2nd)
192—Riley, Alexander, aged 20, Glasgow M.I., Mercantile Clerk—Book-keeping (3rd)
197—Rintoul, Robert, aged 21, Glasgow M.I., Clerk—French (2nd)
104—Rishworth, William, aged 19, Bradford M.I., Woolsorter—Arithmetic (3rd)
64—Robbins, Thomas, aged 20, Birmingham and Midland I., Clerk—Geography (2nd)
115—Roberts, Joseph Seed, aged 19, Bradford M.I., Cabinetmaker—English History (1st) with 2nd Prize; Book-keeping (3rd)
260—Roberts, William, aged 27, Holmfirth M.I., Woollen Cloth Weaver—Arithmetic (2nd); Music (2nd)
77—Robertson, John, aged 33, Birmingham and Midland I., Teacher—Chemistry (1st)
625—Robertson, William, aged 27. Glasgow I., Warper—Book-keeping (3rd)
552—Robinson, Charles, aged 23, Leeds Young Men's Christian I., Warehouseman—English History (1st); English Literature (2nd)
404—Robinson, James, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)

557—Robinson, Walter, aged 22, Leeds Young Men's Christian I., Mechanic—Geometry (1st) with 1st Prize
352—Roney, John, aged 18, Louth M.I., Attorney's Clerk—English History (3rd)
485—Roots, William, aged 26, Canterbury Church of England L.I., Forage Contractor—English History (3rd)
646—Rowland, Robert, aged 23, Manchester M.I., Warehouseman—Arithmetic (3rd).
347—Rudler, Frederick William, aged 19, Royal Polytechnic Inst. Classes, Solicitor's Clerk—Principles of Mechanics (3rd)
223—Runciman, William Aitcheson, aged 19, Glasgow Athenæum, Clerk—German (2nd).
334—Rundell, Joseph Benjamin, aged 26, London M.I., Clerk, Conic Sections (2nd).
198—Russell, George, aged 20, Glasgow M.I., Mechanical Engineer—Practical Mechanics (2nd).
214—Russell, John Lindsay, aged 18, Glasgow Athenæum, Book-keeper—Book-keeping (3rd).
627—Russell, John Naismith, aged 24, Glasgow I., Assistant Reader—Latin and Roman History (1st), with 1st Prize.
45—Samuels, Thomas, aged 24, Barnet I., Clerk, Chancery Registrar's Office—Arithmetic (2nd).
605—Sanders, Albert John, aged 20, Newbury I., Chemist's Assistant—Arithmetic (2nd); Chemistry (3rd).
428—Sanderson, John, aged 22, Wakefield M.I., Labourer—Arithmetic (3rd).
593—Savage, George, aged 21, Clerkenwell Working Man's I., Brass Finisher—Arithmetic (3rd).
138—Scott, James, aged 20, Carlisle Church of England I., Clerk—Book-keeping (3rd).
543—Scott, Thomas John, aged 18, Leeds Young Men's Christian I., Clerk—Arithmetic (2nd); Algebra (3rd).
328—Scott, William, aged 26, London M.I., Inland Revenue Officer—Chemistry (1st), with 1st prize; Magnetism, Electricity, and Heat (1st), with 2nd prize.
387—Scrimgeour, Daniel, aged 20, Kingston-on-Thames M.I., Clerk—Geometry (1st); Algebra (2nd); Trigonometry (2nd); Conic Sections (3rd).
3—Shanks, William Henderson, aged 21, Aberdeen M.I., Clerk—Book-keeping (2nd)
501—Shapland, Catherine Elizabeth, aged 22, Bristol Athenæum—German (2nd)
203—Shaw, Alexander, aged 21, Glasgow M.I., Clerk—French (1st)
356—Shaw, Samuel William, aged 19, Athenæum, King's Lynn, Clerk—French (3rd); German (2nd)
447—Shaw, Thomas, aged 21, Wigan M.I., Banker's Clerk—Book-keeping (2nd)
479—Shaw, Walter Henry, aged 18, Sussex-hall Evening Classes, Clerk—English History (3rd)
201—Shekelton, Abraham, aged 33, Glasgow M.I., Book-keeper—Book-keeping (2nd); French (1st) with 1st Prize
286—Sherwin, Hugh, aged 30, Leeds M.I., Clerk—Book-keeping (2nd)
531—Shillito, Michael, aged 17, Leeds Young Men's Christian I., Mechanic—Arithmetic (1st) with 2nd Prize Geometry (1st)
388—Shillitoe, Wilson, aged 17, Rotherham Young Men's Christian I., Pupil Teacher—English History (3rd)
40—Shingleton, William Henry, aged 29, S.E. Railway M.I., Railway Clerk, Book-keeping (3rd)
332—Shinn, Thomas, aged 18, London M.I., Clerk—Chemistry (1st)
590—Shutt, Richard, aged 37, People's College, Sheffield, Saddler—Algebra (3rd); Latin and Roman History (3rd)
438—Silvester, William, aged 20, West Bromwich Young Men's Christian Association, Clerk—Arithmetic (3rd)
68—Simpson, Henry, aged 19, Birmingham and Midland Institute, Clerk—English Literature (1st) with 1st Prize
200—Simpson, William, aged 16, Glasgow M.I., Junior Clerk—Arithmetic (1st)
41—Skelton, John Henry, aged 16, S. E. Railway M.I., Railway Clerk—Arithmetic (1st)
126—Skinner, John, aged 35, Carlisle Church of England Inst., Shopman—Arithmetic (3rd)
199—Sloan, Samuel, aged 17, Glasgow, M.I.—Arithmetic (2nd); Geometry (2nd)
311—Small, John McMillan, aged 22, Liverpool I., Clerk—Arithmetic (2nd); Geography (2nd)
410—Smith, Charles, aged 16, Messrs. Chances' Library, Birmingham, Accountant—Arithmetic (3rd)
608—Smith, David, aged 19, Glasgow M.I., Mechanic—Algebra (3rd); Geometry (3rd); Trigonometry (3rd)
602—Smith, David, aged 19, Middlesbro' I., Engine Fitter—Arithmetic (2nd)
480—Smith, Edmond Wm., aged 35, Shaw Farm Inst., Attendant on Machinery—Arithmetic (3rd); Geography (3rd)
320—Smith, Frederick, aged 16, Liverpool I., Estate Agent—Geography (3rd); English History (3rd); English Literature (3rd)
510—Smith, Henry, aged 19, Halifax W. M. College, Warehouseman—English Literature (3rd)
358—Smith, Henry William Faux, aged 18, Athenæum, King's Lynn, School Assistant—Arithmetic (2nd); Algebra (3rd); Chemistry (2nd)
624—Smith, John Henry, aged 19, Glasgow M.I., Compositor—English History (2nd)
613—Smith, John Stewart, aged 19, Glasgow M.I., Clerk—Arithmetic (2nd); Book-keeping (3rd)
648—Smith, Samuel, aged 16, Manchester M.I., Junior Clerk—Arithmetic (3rd)
466—Smith, Thomas, aged 18, Sussex Hall Evening Classes, Clerk—Arithmetic (2nd); Book-keeping (3rd)
12—Smith, William, aged 18, Aberdeen M.I., Iron Turner—Algebra (3rd)
49—Smith, William, aged 17, People's Reading Rooms, Belfast—Algebra (1st)
607—Smyth, William Hugh, aged 24, Glasgow I., Clerk—Music (1st) with 1st Prize.
324—Sneath, George, aged 18, Leicester Church of England I., Clerk—Arithmetic (2nd); Book-keeping (1st)
343—Solomons, Albert Elias, aged 20, Royal Polytechnic Inst Classes, Colonial Merchant—Chemistry (2nd)
669—Southern, James William, aged 20, Manchester M.I., Book-keeper—English Literature (3rd)
455—Sowden, Thomas Henry, aged 19, York I., Railway Clerk—Book-keeping (3rd); Mensuration (3rd)
517—Spencer, Norcliffe Blakey, aged 18, Halifax Working Men's College, Clerk—Book-keeping (1st)
369—Stanger, John, aged 29, Newcastle-on-Tyne Church of England I., Butler—Book-keeping (3rd)
59—Steele, William, aged 19, People's Reading Room, Belfast, Clerk—Arithmetic (3rd); Geometry (3rd); Political and Social Economy (3rd)
139—Steer, Charles, aged 29, Croydon Lit. I., Printer—Latin and Roman History (1st) with 2nd Prize.
202—Stewart, John, aged 22, Glasgow M.I., Clerk—French (3rd)
596—Stewart, William, aged 16, Clerkenwell Working Men's I., Solicitor's Clerk—Arithmetic (3rd)
604—Stillman, Augustus Octavius, aged 19, Newbury I.—Music (3rd)
129—Stoker, George Naylor, aged 21, Carlisle Church of England Lit. I., Clerk—Arithmetic (2nd); Geography (2nd)
357—Suggett, John Dix, aged 17, Athenæum, King's Lynn, Banker's Clerk—Geography (1st) with 1st Prize
512—Sutcliffe, William, aged 19, Halifax W.M. College, Damask-weaver—Arithmetic (2nd)
511—Sutton, James, aged 19, Halifax, W.M. College, Overlooker—Arithmetic (3rd); English Literature (3rd)

112—Swaine, Sidney, aged 17, Bradford M.I. Clerk—Arithmetic (2nd)
422—Sweetman, Edward John, aged 19, Wolverhampton, W.M. College, Tailor—French (3rd)
668—Taylor, James Crowther, aged 18, Manchester M.I., Clerk—Arithmetic (2nd)
650—Taylor, Joseph, aged 17, Manchester M.I., Junior Clerk—Arithmetic (3rd)
250—Taylor, William Henry, aged 20, West Hartlepool L. and M.I., Apprentice Draughtsman—Algebra (2nd); Music (3rd)
618—Tennant, George, aged 17, Glasgow I., Pupil teacher—Latin and Roman History (1st)
204—Tennent, James Binnie, aged 19, Glasgow M.I., Clerk—Algebra (3rd)
500—Thomas, Richard Coupland Fleming, aged 18, Bristol Young Men's Christian I., Architect's Pupil—Algebra; (3rd)
495—Thomas, William, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
430—Thompson, William S., aged 21, Waterford M.I., Lithographer—Arithmetic (3rd)
560—Thorp, Joseph, aged 18, Leeds Young Men's Christian I., Mechanic—Arithmetic (3rd); Algebra (3rd)
402—Tisley, Samuel Charles, aged 30, London M.I., Clerk—Arithmetic (2nd); Book-keeping (2nd); Practical Mechanics (3rd)
75—Tonks, Zephaniah, aged 17, Birmingham and Midland I., Pupil teacher—English History (3rd)
508—Toothill, Abel, aged 16, Halifax W.M. College, Designer—Arithmetic (3rd)
677—Toothill, James Arnold, aged 22, Halifax M.I., Assistant Teacher—Geography (2nd); English History (3rd)
555—Trant, William, jun., aged 16, Leeds Young Men's Christian I., Apprentice—Arithmetic (3rd); Geometry (3rd); Astronomy (3rd)
630—Trevena, Henry Albert, aged 20, Pembroke Dock M.I., Shipwright—Trigonometry (3rd)
545—Turner, Andrew, aged 19, Leeds Young Men's Christian I., Letter-press Printer—Arithmetic (2nd)
215—Turner, John, aged 23, Glasgow Athenæum, Warehouseman—English Literature (2nd)
303—Turner, Thomas Burton, aged 20, Leeds M.I., Solicitor's Clerk—Book-keeping (2nd); Algebra (2nd) Geometry (2nd)
409—Underhill, Charles, aged 16, Messrs. Chances' Library, Birmingham, Clerk—Arithmetic (3rd)
598—Unsworth, William, aged 32, Bury Athenæum, Boot and Shoe Maker—Music (3rd)
19—Urquhart, John, aged 19, Aberdeen M.I., Clerk—Arithmetic (2nd)
21—Valentine, John Sutherland, aged 17, Aberdeen M.I., Clerk—Algebra (3rd)
655—Varley, Henry, aged 26, Manchester M.I., Warehouseman—Algebra (3rd)
478—Vaughan, George, aged 16, Sussex Hall Evening Classes, Clerk—Arithmetic (1st)
472—Vaughan, William, aged 19, Sussex Hall Evening Classes, Book-keeper—Arithmetic (1st) with 1st Prize
535—Wainwright, Henry, aged 16, Leeds Young Men's Christian I., Engineer—Arithmetic (3rd)
256—Wakenell, James Frederick, aged 17, Hitchin M.I., Coal Merchants' Clerk—Book-keeping (2nd); Arithmetic (3rd)
454—Walker, Charles, aged 18, York I., Telegraph Clerk—Geography (1st), with 2nd prize; English Literature, (2nd)
509—Walker, John, aged 20, Halifax W.M. Coll., Warehouseman—English Literature (2nd)
113—Walker, Richard Felvus, aged 17, Bradford M.I., Clerk—Arithmetic (3rd)
293—Walker, William, aged 19, Leeds M.I., Painter—Arithmetic (3rd)
305—Ward, George, aged 26, Leeds M.I., Chemist and Druggist—Chemistry (1st)
310—Warden, Henry, aged 16, Liverpool I., Shopman—Geography (3rd); English Literature (3rd)
105—Webster, John, aged 17, Bradford M.I., Civil Engineer—Arithmetic (3rd)
492—Weetman, John, aged 21, Ipswich M.I., Clerk—French (1st); German (2nd)
122—Wildish, James, aged 18, Brompton Church of England Young Men's I., Shipwright's Apprentice—Algebra (3rd)
653—Williams, Thomas, aged 18, Manchester M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
502—Wills, Sophia Ann, aged 41, Bristol Athenæum, Governess—French (2nd); English Literature (2nd); German (3rd)
458—Wilson, Albert William, aged 16, York I., Arithmetic (1st)
572—Wilson, John, aged 38, People's Coll., Sheffield, Penblade Grinder—Political and Social Economy (2nd)
565—Wilson, John William, aged 18, Leeds Young Men's Christian I., Solicitor's Clerk—Book-keeping (2nd)
588—Wing, John Unwin, aged 20, People's Coll., Sheffield, Accountants' Clerk—Arithmetic (2nd); Book-keeping (2nd)
449—Wood, James Lee, aged 17, Wigan M.I., Clerk—Arithmetic (3rd)
654—Wood, Joseph, aged 18, Manchester M.I., Clerk—Arithmetic (2nd); Book-keeping (1st)
513—Wood, Ralph, aged 17, Halifax Working Men's College, Reedmaker—Arithmetic (2nd)
521—Wood, William Hanson, aged 26, Halifax Working Men's College, Warehouseman—Geography (3rd)
587—Wood, William Martin, aged 31, People's College, Sheffield, Grocer—English Literature (1st)
42—Woodland, Richard, aged 17, S.E. Railway M.I., Railway Clerk—Arithmetic (1st)
376—Woodman, Samuel James, aged 17, Watt Institute, Portsea, Engineer's Apprentice—Mensuration (2nd); Trigonometry (3rd)
82—Woodward, Charles Josiah, aged 21, Birmingham and Midland I., Chemical Teacher's Assistant—Principles of Mechanics (3rd)
149—Woodward, Robert, aged 17, Darlington M.I., Railway Clerk—English History (2nd)
141—Wren, William, aged 40, Carshalton Mutual Improvement Society, Gardener—Arithmetic (3rd); Botany (2nd)
541—Wright, John, aged 25, Leeds Young Men's Christian I., Teacher—Geometry (3rd)
522—Wright, Murrell, aged 17, Leeds Young Men's Christian I., Attendant in Cloth Warehouse—Book-keeping (2nd)
537—Yeadon, Oliver, aged 17, Leeds Young Men's Christian I., Mechanic—Astronomy (3rd)
236—Young, Robert, aged 17, Glasgow Athenæum, Stationer's Assistant—English History (3rd); Book-keeping (3rd)

TABLE I.—COMPARATIVE RESULTS OF THE EXAMINATIONS OF 1858, 1859, AND 1860.

Name of Local Board.	No. of Candidates Examined at the previous Exmin. at Local Board.			No. of Candidates who passed the previous Examinations.			No. of Candidates Examined at the Final Examination.			No. of Candidates who passed Final Examination.			No. of Papers Worked at the Final Examination.			No. of 1st Class Certificates Awarded.			No. of 2nd Class Certificates Awarded.			No. of 3rd Class Certificates Awarded.			No. of Prizes Awarded to Candidates.			No. of Prizes Awarded to Local Boards.			No. of Prizes Awarded to Institutions.			No. of Unsuccessful Candidates.		
	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860
Aberdeen	...	48	33	...	39	30	...	32	26	...	18	14	...	60	33	...	...	...	...	4	8	...	19	7	...	...	...	...	...	...	...	...	...	...	14	12
Andover	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ashbourne, Lit. I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ashbourne, W.M.I.	...	4	4	...	4	4	...	4	5	...	2	1	...	4	5	...	...	...	...	...	1	...	2	...	...	...	...	...	...	...	...	...	...	...	2	4
Ashford	...	4	9	...	2	6	...	2	7	...	2	7	...	4	12	...	2	4	...	...	5	...	2	3	...	...	...	...	...	...	...	...	...	...	...	...
Bacup	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Banbury	2	4	...	2	4	...	2	3	...	2	1	...	4	4	...	2	...	...	2	...	...	...	2	...	2	...	...	...	...	...	2	...	...	...	2	...
Barnet	...	...	3	...	...	3	...	...	3	...	...	3	...	...	3	...	...	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Basingstoke	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Bedford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Belfast	...	18	9	...	17	9	...	13	8	...	7	6	...	21	12	...	...	1	...	1	2	...	7	5	...	...	...	...	...	...	...	...	...	...	6	2
Berkhampstead	10	...	4	10	...	3	8	...	3	6	...	1	8	...	3	...	...	...	3	...	1	3	...	...	...	...	...	...	...	...	...	...	2	...	2
Birmingham and Midland I.	...	27	14	...	22	14	...	18	19	...	14	17	...	22	19	...	3	5	...	8	7	...	6	5	...	1	2	...	...	...	...	1	1	...	4	2
Bishop's Stortford	...	...	1	...	...	1	...	...	1	...	...	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...
Blackburn	15	9	12	5	9	8	4	5	6	2	1	3	10	7	8	1	...	...	2	1	...	3	1	4	...	...	...	...	...	...	...	...	...	2	4	3
Blandford	...	6	...	...	3	...	...	3	1	...	3	1	...	5	2	...	...	1	...	1	...	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...
Bradford, Yorks.	23	24	18	17	22	12	17	20	19	16	19	19	26	33	28	1	4	5	13	6	14	9	20	9	...	1	1	...	...	1	...	...	1	1	1	...
Brighton, for Sussex	3	3	...	3	3	...	2	1	...	2	1	...	4	2	...	...	...	...	2	1	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Bristol Athenæum	11	16	5	11	14	5	9	14	4	8	12	4	15	29	7	3	9	...	8	8	5	3	8	2	2	7	...	...	1	...	1	...	...	1	2	...
Brompton, (near Chatham)	...	...	7	...	...	7	...	...	7	...	...	6	...	...	11	...	...	1	...	...	4	...	...	5	...	...	...	...	...	...	...	...	...	...	...	1
Bucks and Berks Lecturers' Asso.	...	...	24	...	...	3	...	...	2	...	...	1	...	...	4	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1
Burnley, E. Lancashire Union	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bury, Athenæum	...	6	1	...	4	1	...	4	4	...	4	3	...	4	4	...	...	...	...	2	1	...	2	2	...	...	...	...	...	...	...	...	...	...	...	1
Canterbury	...	3	6	...	2	5	...	2	5	...	1	4	...	2	8	...	...	1	...	1	4	...	...	1	...	...	...	...	...	...	...	...	...	...	1	1
Carlisle	...	4	16	...	4	16	...	3	14	...	1	11	...	3	23	...	...	1	...	...	8	...	1	9	...	...	...	...	...	...	...	...	...	...	2	3
Carshalton	...	2	3	...	2	3	...	2	3	...	2	2	...	4	6	...	2	1	...	...	1	...	3	1	...	...	1	...	...	...	...	...	...	...	...	1
Chelmsford	...	1	2	...	1	1	...	1	1	...	1	1	...	1	2	...	...	2	...	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...
Darlington	...	...	5	...	...	5	...	...	5	...	...	5	...	...	6	...	...	1	...	...	3	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Derby	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Devonport	...	...	3	...	...	3	...	...	3	...	...	3	...	...	8	...	...	2	...	...	1	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...
Dover	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Frome	...	3	...	...	3	...	...	3	...	...	2	...	...	4	...	...	1	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1	...
Glasgow, M.I.	...	48	65	...	42	45	...	41	53	...	36	47	...	63	65	...	8	17	...	21	22	...	24	19	...	2	4	...	1	1	...	2	3	...	5	6
,, Athenæum	...	24	40	...	24	39	...	24	36	...	17	31	...	29	48	...	4	9	...	10	14	...	7	19	...	2	1	...	...	...	...	...	...	...	7	5
,, Institution	...	4	24	...	4	22	...	3	21	...	2	19	...	3	25	...	...	6	...	...	6	...	2	10	...	...	2	...	1	...	...	...	2	...	1	2
Greenwich	1	...	...	1	...	...	1	...	...	1	...	...	2	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Halifax, M.I.	35	4	6	17	4	6	12	4	4	10	4	4	18	5	5	3	4	...	7	...	1	4	1	4	1	3	...	...	1	...	...	1	...	2	...	...
,, W.M. College	67	28	14	21	14	13	15	14	16	11	12	14	23	20	19	1	3	1	4	4	4	10	7	10	...	...	...	...	...	...	...	...	...	4	2	2
Hanley, "Potteries," M.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hartlepool (West)	5	4	9	3	4	8	2	4	6	2	3	6	5	7	11	...	...	...	2	...	3	3	5	6	...	...	...	...	...	...	...	...	...	...	1	...
Hertford	...	...	6	...	...	2	...	...	2	...	...	2	...	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hitchin	...	2	4	...	2	4	...	2	5	...	2	4	...	3	12	...	...	...	...	...	9	...	3	2	...	...	...	...	...	...	...	...	...	...	...	1
Holbeck (in con. with Leeds York. Un.)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Holmfirth	...	1	3	...	1	2	...	1	2	...	1	2	...	3	3	...	...	...	...	...	2	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...
Ingrow and Hainworth	...	...	6	...	...	6	...	...	6	...	...	1	...	...	6	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	5
Ipswich	7	10	5	6	8	5	5	4	3	4	2	3	11	6	4	...	1	2	5	...	1	10	2	1	...	...	1	...	...	...	...	...	...	...	...	...
Leeds M.I. (Yorks. Union)	13	5	39	10	4	39	10	4	22	8	4	19	22	10	37	2	...	3	6	2	15	7	6	14	2	...	...	...	...	...	1	...	...	2	2	3
,, Y.M. Christian I.	14	42	47	14	39	41	14	37	40	11	29	35	43	68	60	5	9	9	9	8	14	10	32	27	3	2	3	...	1	...	2	...	2	3	7	5
Leicester, Ch. of Eng. I.	...	13	2	...	13	2	...	13	6	...	13	6	...	21	13	...	5	4	...	8	5	...	6	4	...	1	1	...	...	...	...	...	...	...	...	...
*Lewes	2	...	...	2	...	...	1	...	...	1	...	...	5	...	...	...	...	...	2	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...

* Not now in Union.

TABLE I.—COMPARATIVE RESULTS OF THE EXAMINATIONS OF 1858, 1859, AND 1860.—(*Continued.*)

Name of Local Board.	No. of Candidates Examined at the previous Exmin. at Local Board.			No. of Candidates who passed the previous Examinations.			No. of Candidates Examined at the Final Examination.			No. of Candidates who passed Final Examination.			No. of Papers Worked at the Final Examination.			No. of 1st Class Certificates Awarded.			No. of 2nd Class Certificates Awarded.			No. of 3rd Class Certificates Awarded.			No. of Prizes Awarded to Candidates.			No. of Prizes Awarded to Local Boards.			No. of Prizes Awarded to Institutions.			No. of Unsuccessful Candidates.		
	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860	1858	1859	1860
Liverpool	35	21	13	35	19	12	32	15	11	16	12	9	56	29	21	3	...	...	8	4	4	17	16	9	...	...	...	...	...	...	...	...	...	16	2	2
Lockwood	1	2	...	1	2	...	1	2	1	1	1	...	2	2	1	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	1
London, Roy. Poly.	29	20	6	8	14	6	14	11	9	12	10	8	29	18	10	4	4	1	4	3	5	13	7	2	2	2	...	...	...	...	...	1	...	2	1	1
,, Clerkenwell	...	...	6	..	...	4	...	...	4	...	...	2	...	...	4	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	2
,, Crosby Hall, new Met. Ev. Cl., Sussex Hall	27	35	21	25	35	20	24	34	22	17	25	19	39	48	27	11	5	9	8	11	7	19	17	7	6	2	2	1	...	...	3	1	2	7	9	3
,, Domestic Mission	1	2	...	1	2	...	1	2	...	1	1	...	3	2	...	...	...	...	2	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	1	...
,, Jews' and General L.I.	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,, Mech. I.	12	10	11	8	10	7	6	9	10	5	8	10	13	12	16	4	1	6	6	3	6	1	6	3	...	...	3	1	...	1	...	...	1	1	1	...
,, St. Stephen's M.	...	...	4	...	...	3	...	...	3	...	...	2	...	..	3	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	1
,, Tailor's Labour Agency L.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
* ,, West Brompton	4	...	...	4	...	...	3	...	...	3	...	...	6	...	...	...	...	...	3	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Longton	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Louth	4	3	5	4	3	5	4	3	5	4	2	3	5	4	8	...	...	...	...	1	2	4	1	2	...	...	...	...	...	...	...	...	...	...	1	2
Lymington	1	...	...	1	...	...	1	...	...	1	...	...	5	...	...	1	...	...	3	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...
Lynn (King's)	...	3	4	...	3	4	...	3	5	...	3	5	...	7	8	...	1	1	..	3	3	...	1	4	...	...	1	...	...	...	...	...	...	...	...	...
Macclesfield	83	...	16	83	...	10	8	...	7	4	...	2	12	...	7	1	...	...	...	...	1	5	...	1	...	...	...	...	...	...	...	...	...	4	...	5
Manchester, M.I.	32	36	31	32	31	27	24	26	27	10	21	21	39	48	42	...	3	2	8	10	8	10	22	21	...	1	1	...	...	...	...	...	...	14	5	6
,, Inst., Association	591	...	...	100	...	...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Middlesborough	...	..	2	...	...	2	...	...	2	...	...	2	...	..	2	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Neath, M.I.	..	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Newbury	...	...	2	...	...	2	...	...	2	...	...	2	...	...	6	...	...	...	...	...	1	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
Newcastle-on-Tyne	3	7	...	3	7	...	3	7	2	3	6	2	5	14	2	...	...	...	1	2	1	3	6	2	...	...	...	...	...	...	...	...	...	...	1	...
*Northowram	1	1	...	1	1	..	1	1	...	1	1	...	4	3	...	...	...	...	...	1	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...
Oldham	...	...	4	...	...	4	...	...	4	...	...	3	...	...	8	...	...	...	...	...	2	...	...	5	...	...	..	...	...	...	...	...	...	...	...	1
Paisley	...	2	...	...	2	...	...	2	...	...	1	...	...	3	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Pembroke Dock	4	5	7	4	5	7	4	5	8	...	4	8	13	9	16	1	1	1	5	2	3	6	4	11	...	1	...	...	...	...	...	...	...	...	1	...
Portsmouth	2	5	4	2	5	4	2	5	4	2	5	4	13	15	12	3	2	1	5	4	5	4	6	3	3	...	1	...	...	...	4	...	...	...	...	...
Richmond (Surrey)	...	5	12	...	4	9	...	4	6	...	4	3	...	7	9	...	1	1	...	2	3	...	2	2	...	1	...	...	...	...	...	...	...	...	...	3
Rotherham	...	...	7	...	...	7	...	...	3	...	...	3	...	...	5	...	...	...	...	...	...	...	...	4	...	...	...	...	...	...	...	...	...	...	...	...
Salford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury	1	...	...	1	...	...	1	...	...	1	..	...	4	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Selby	10	12	1	9	10	1	9	7	1	3	5	1	11	15	1	...	1	...	2	1	1	2	8	...	...	...	..	...	...	...	...	...	...	6	2	...
Sheerness	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sheffield	20	42	13	18	35	11	16	32	23	9	26	15	23	47	26	3	2	2	3	12	8	5	23	8	3	1	...	...	...	...	...	1	...	7	6	8
Skipton	...	2	6	...	2	6	...	2	7	...	2	3	...	4	9	...	...	...	...	2	...	...	2	4	...	...	...	...	...	...	2	...	...	...	...	4
Slough	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
South Staffordshire	...	...	36	...	...	24	...	...	24	...	...	21	...	...	32	...	...	2	...	...	3	...	...	22	...	...	2	...	...	...	...	...	...	...	...	3
†Messrs. Chances' Library	2	14	..	2	7	...	1	7	...	1	2	...	3	8	...	...	2	...	1	...	...	1	1	...	...	1	...	...	...	...	...	...	...	...	5	...
Wakefield	4	4	3	4	2	3	4	2	3	3	2	3	6	3	4	...	...	1	...	2	1	5	1	1	...	...	1	...	...	...	...	...	...	1	...	...
Warminster	1	3	...	1	2	...	1	1	...	1	1	...	2	1	...	...	...	...	1	...	...	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...
Waterford	...	25	12	...	16	6	...	6	5	...	2	3	...	6	5	...	...	1	...	2	1	...	...	1	...	...	...	...	...	...	...	...	...	...	4	2
West Bromwich	...	...	8	...	...	3	...	..	3	...	...	3	...	...	3	...	...	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...
Wigan	9	5	9	6	5	7	6	5	9	5	2	8	11	6	9	...	...	1	2	...	3	5	2	4	...	...	1	...	...	...	...	...	...	1	3	1
Windsor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wirksworth	...	3	...	...	2	..	...	2	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
York	11	7	8	7	6	8	7	6	8	5	6	7	14	6	10	3	2	2	2	1	2	5	1	5	...	...	1	...	...	...	...	...	...	...	2	1
Total	1107	641	700	501	544	574	288	480	586	197	368	478	516	768	821	53	78	110	132	154	234	176	308	312	25	28	30	2	4	4	16	7	12	79	112	108

* Not now in Union.

† This Board is now merged in that for South Staffordshire.

EXAMINERS' REMARKS.

The Examiner in Arithmetic remarks:—"The papers this year, as a whole, were characterised by much cleverness and judgment, some of them being among the very best which have come under my notice as an Examiner. If I may be allowed to hazard a conjecture, I would add that some of the Institutions appear to be doing their work, as far as arithmetic is concerned, extremely well, while others, I regret to say, appear to have spent but little time or means in preparing candidates for the Examination. I draw this inference from considerable similarity of working and results in groups, both of successful and unsuccessful candidates."

The Report of the Examiner in Book-keeping by Double Entry says:—"The number of candidates in this branch continues to increase. In 1856, it was 2; in 1859, it was 84; and now, in 1860, it is 103, to 95 of which certificates have been awarded. Of the 95 examinants to whom certificates have been awarded, 68 are persons to whose efficiency in their respective callings a knowledge of book-keeping by double entry has a direct relation. Some few of the papers exhibit very decided merit, and the average result is satisfactory."

The remarks of the Examiner in Algebra are as follow—"In successive years I have made the paper more and more simple, and I am disposed to think that in the present year I may have erred a little in that direction. Two or three questions of a severer character might possibly have made wider differences amongst some of the higher candidates, but of this I am not sure. I am led to make the remark by the fact of the intervals between successive candidates having been very small throughout the whole list. On the whole, the performances of the examinees were respectable. There were few, though there were some, of whom I should say that they ought not to have presented themselves, and there were none whose performances impressed me as being of unusual excellence. I found in this, as in former years, a very fair acquaintance with the methods of performing the simpler algebraical processes, and with respect to the large majority of candidates, I should suppose that the production of this result is the most satisfactory proof of the utility of the Examination."

The Examiner in Geometry says:—"The number of candidates was much smaller this year than last, and, with a few exceptions, I think the quality of the performances rather below the standard of last year. There was much less evidence of power of dealing with geometrical problems. At the same time, those who were in the first division all showed some geometrical skill, as well as an accurate knowledge of the elements. There was, generally speaking, evidence of a careful study of the subject on the part of the candidates who are ranked in the first two classes, but I do not find that any of the papers deserve special mention for any remarkable ingenuity or power."

The Examiner in Mensuration reports:—"My impression of this year's Examination in Mensuration is, that it has not been very satisfactory. Not one of the candidates has succeeded in obtaining a place in the first class. Great inaccuracy characterised the work of several of them; others showed that they had had little or no practice in Examinations on paper. I did not find so much technical knowledge as I had expected. The small number of candidates adds to the belief that, however useful a knowledge of mensuration may be, the subject is by no means popular. Having taken no part in previous Examinations, I can make no comparison between the work of this year and that of former years."

The report of the Examiner in Trigonometry, says:—"The general character of the answers was creditable, and above the average in freedom from gross blunders, which are so often seen in Examinations, and which are generally indicative as much of bad teaching as of bad learning. At the same time, no very remarkable talent exhibited itself."

The Examiner in Conic Sections reports:—"The questions in Conic Sections were answered by few, but the papers for the most part showed that the subject had been well studied, both geometrically and analytically. There was a readiness in translating the algebraical results into their corresponding geometrical theorems which was very creditable to the candidates, and afforded evidence that neither the geometrical demonstrations were learnt by rote, nor that the analytical proofs were the results of mere algebraical manipulation. I think that the subject thus mastered is an excellent discipline, and deserves all the encouragement that the Society of Arts can give it."

The Report of the Examiner in Navigation and Nautical Astronomy is as follows:—"After three years' experience as your Examiner in Navigation and Nautical Astronomy, I am left only to speculate on the almost total absence of candidates for the Society's certificates in these subjects. This may arise either from the limited number of students, or from all the requisites of such examinations being fully supplied in other quarters. Masters and mates of merchant ships are compelled to undergo examination, and are certificated for their particular grades; so, also, are a few young teachers attached to schools under the control of the Board of Trade; but of such teachers there are not one-fiftieth of the number requisite for the proper training of the youth intended for sea. In the royal navy provision is made both for teaching and examining young officers; and recently the merchants of Liverpool have exhibited a laudable example to our great seaports, in the establishment of their school-ship 'Conway,' for the training of respectable boys intended to hold the rank of officers in their ships. But I have long been convinced that shipowners and shipmasters generally, are alike indifferent to any scientific preparation on the part of boys whom they employ; such preparation is left to the ambition of those who may desire to occupy a creditable position in the profession they have chosen. Where do the masters and mates of ships obtain even the scanty supply of professional knowledge necessary to pass their examination? Generally, from the cramming schools, whose sole object is to coach the candidates through the narrow routine of the examination, without any pretence of sound teaching. With such appliances as at present exist there would be ample grounds for the operations of the Society's examinations were there any hearty appreciation of these important subjects in our public or private schools (always excepting Greenwich). There would then be many young teachers and scholars who would gladly avail themselves of the advantages offered by the Society's examinations, no special provision being made for these in any other quarter. It remains a matter of regret and astonishment that so little attention is paid to Navigation and Nautical Astronomy, in a country whose prosperity depends, so largely as ours does, on its commerce beyond sea. Bad navigation is the cause of a large number of the lamentable shipwrecks with which the newspapers teem. It has been suggested to me that the modern system of insurance has tended to diminish the interest which wealthy and educated shipowners would otherwise have felt in the proper education of those to whom they entrust the care of their property."

The Examiner in the Principles of Mechanics writes:—"I beg to state my satisfaction with the general character of the papers submitted to me for examination. They evince a considerable amount of reading, and impress me with the idea that a further attention to the subjects already studied, and especially a more frequent use of examinations such as those offered by the Society, will enable the candidates of this year to display their resources more efficiently than they have at present done. The questions attempted merely, or wholly unanswered, will discover to them the direction which their future reading will most profitably take; and the respectable amount of acquaintance they have shown with regard to the present subjects of examination affords hope for the future."

The Examiner in Practical Mechanics reports:—"The examination in the present year has been more satisfactory than upon any previous occasion, and certain of the candidates nearly obtained a first-class certificate."

The Examiner in Magnetism, Electricity, and Heat, reports that the number of competitors has this year been considerably augmented, and that the results of the examination are generally satisfactory; but that the standard of excellence is somewhat lower than at the previous examination. The two first candidates are so nearly equal that it required careful discrimination to draw the line between them.

The Examiner in Astronomy says:—"I am unable to add any specific remarks to my report, beyond an expression of satisfaction at the general display of ability and industry, even on the part of a few candidates in a subject which is not professional or practical, showing that it is cultivated from a desire for intellectual improvement."

The Examiner in Chemistry says:—"I have much pleasure in remarking a decided improvement in the general character of the papers since last year."

The Examiner in Animal Physiology says:—"I have little to remark concerning the Examination in Animal Physiology beyond what I had to report last year. It is but fair, however, to add that the answers of the candidates who passed afford evidence of diligent reading of elementary books; and, in one case, while but few answers are given, they show greater accuracy and completeness than those submitted to me in any former year."

The Examiner in Botany says:—"Some of the papers are extremely good, and the others passed are creditable. But it is evident that the candidates are better acquainted with vegetable physiology, which can be got up from books, than with practical botany, to be acquired only in the field. This is shown by 5 out of 11 not having even attempted to answer Question 5 in Section II., by 3 out of 11 having passed over Question 6 in Section I., and by many of the attempts at answering Question 6 in Section II. having been complete failures; and yet they were all easy questions. Therefore, I am of opinion that the paragraph in the Programme referring to this subject will require alteration before another Programme is issued, Systematical (or Practical) Botany being made a subject distinct from Vegetable Physiology."

The Examiner in Political and Social Economy says:—"I thought there was some improvement since last year, and that there was a good deal of ingenuity and logical power, as well as knowledge of principles, in some of the papers, but I would still recommend a greater attention to the historical and statistical part of Political Economy, and a more frequent reference to such books as M'Culloch's Dictionary of Commerce, his account of the British Empire, Porter's Progress of the Nation, and the Blue Books of miscellaneous statistics, published under the superintendence of Mr. Fonblanque."

The Examiner in Geography reports:—"The results of this year's Examination are, upon the whole, highly satisfactory, more so than those of any preceding year. It affords me much gratification to be able to express this opinion. There is still, as might naturally have been expected, sufficient room for further improvement, but the average merit of the papers is decidedly higher than upon former occasions. Of a total of 34 papers, I find only two which fall under the head of "Not Passed," while as many as sixteen (or nearly 50 per cent. of the whole number) entitle their writers to second-class certificates, and there is evidence of thoughtful care bestowed on the subject in the great majority of instances, and real work has evidently been gone through by most, if not by all, of the writers in the course of preparation for their task. I could undoubtedly have wished to find that a greater number of the candidates were entitled to first-class certificates, but the high average merit of the entire series of papers more than counterbalances any regret on this head. I believe that the progress indicated by this year's Examination (looking at its results by comparison with those of preceding years) is entirely in the right direction, and I have nothing to add to the suggestions on the score of preparation made in my last year's report. A determination to master thoroughly the elementary details of the subject before aiming at its higher departments—a diligent and unremitting study of the map, and a reference of every geographical fact to its legitimate place in the great framework which the physical features of the globe, regarded as a whole, exhibit—constitute the indispensable preliminaries to the attainment of distinction on the part of the student of geography."

The Examiner in English History reports:—"The answers given by the students to the questions in this subject, were, on the whole, very creditable to their industry and ability. Very few candidates were rejected, and those who passed in the first class had fairly earned their places by a sound knowledge of the books in which they were examined. Those who failed to get the highest place, generally showed want of judgment or of accuracy rather than want of industry. Students intending to offer themselves next year, will do well to remember that a single question, well answered, counts more than several pages of vague generalities, and, on the other hand, that facts irrelevant to the question ought never to be introduced. Commonly, where a candidate has only a partial knowledge of a question, he had better leave it untouched. Again, it is worse than useless to answer a question on the Norman Conquest by a prefatory sketch on Anglo-Saxon history. Lastly, the student must accustom himself to think over and discriminate what is important from what is comparatively valueless. For instance, a question as to "the principal provisions of Magna Charta," is not properly answered when the writer puts down confusedly all the clauses he can remember. It is clear that the article on taxation and the article on weirs in rivers are not of equal importance, and ought not to be classed together as 'principal provisions.'"

The Examiner in English Literature says:—"I am happy to state that the papers on this subject of the present year have been, on the whole, more satisfactory than those of last year. They have shown a much stricter acquaintance with the text of the authors that have been read, and a larger proportion of the answers have been pointed and correct. Several, however, of the most diligent and intelligent candidates have made their answers too long and diffuse, and seem hardly to have mastered the distinction between writing an essay and answering a question in an examination paper. I am apprehensive that, in this way, some three or four have failed to do justice to the extent of their acquirements, and occupy a lower place in the class list than they might else have done. Out of 39 candidates, 5 have been placed in the first-class, 14 in the second, and 11 in the third. Nine have failed."

The Report of the Examiner in Logic is as follows:—"The logic papers are on the whole very creditable to the candidates. Those which gained the highest distinction showed a full and accurate knowledge of the subject, with much power both of thought and expression; indeed better papers could hardly be expected. Almost all the rest were entitled to some praise from some special merit. In the application of logical rules to the criticism of examples, few of the candidates seemed to have too much practice. This was the weakest point, although it is obviously one of the most important."

The Examiner in Latin and Roman History says:—"The work has decidedly improved this year. The parsing was very much better, and the translations quite as good."

The Examiner in French writes:—"I have been much pleased with the French papers this year. There is a steady improvement, and I think that by raising gradually the standard, and making the examination in French

something earnest and practical, we have at once asserted the daily increasing claims of a great modern classical language, (I use the word classical deliberately,) and have enabled our candidates to show what they can do, if only rightly directed and stimulated. The number of certificates awarded in French this year is relatively about the same as last year, when there was a great increase on the preceding years, but the number of 1st class certificates is this time larger in proportion, a result both gratifying and hopeful."

The Examiner in German says:—"I have perceived with pleasure a decided improvement in the work of the candidates. It displays a most creditable knowledge of the German language, both theoretical and practical. There is, however, one thing I would wish to see more attended to by the students of German of the class which comes under our inspection, viz., a closer study of the authors; since the least profit a man ought to derive from the study of a foreign tongue, is an ability to understand such writers in it as he would understand in his own language."

The Examiner in the Theory of Music writes:—"I am glad to be able to report considerable improvement in the music papers. The number of them is but small; but several are far superior to any, and none are so faulty as some, of those I examined last year. Fewer candidates have attempted the Harmony paper without preparation; and the answers generally show not only more knowledge, but a better measure, on the part of each individual candidate, of what he might safely attempt."

TABLE III.

This Table shows the Ages of the 625 Candidates whose Return Papers were received; of these 586 underwent the Final Examination.

Age.	No. of Candidates.	Age.	No. of Candidates.
16	66	30	7
17	81	31	7
18	90	32	3
19	98	33	8
20	70	34	3
21	41	35	4
22	39	36	1
23	27	37	3
24	15	38	2
25	14	39	1
26	19	40	2
27	6	41	1
28	5	48	1
29	11		

TABLE II.—Return of the Number of Papers Worked in Each Subject, in the Five Years, with the Result for the Year 1860.

SUBJECTS.	1856.	1857.	1858.	1859.	1860. No. of Papers Worked.	1860. No. of First Class Certificates.	1860. No. of Second Class.	1860. No. of Third Class.	1860. No. of Papers in respect of which no Certificate was given.
Mathematics	27	...	..	...	...	...	...	...	...
Arithmetic	...	77	159	232	263	36	71	91	65
Book-keeping	...	46	48	84	103	11	34	50	8
Algebra	...	58	74	82	77	3	17	38	19
Geometry	...	52	53	} 45 {	27	5	8	11	3
Mensuration	...	42	44		11	...	2	6	3
Trigonometry	...	25	27	17	15	...	4	8	3
Conic Sections	...	14	14	4	5	1	2	1	1
Navigation, &c.	...	4	5	...	2	...	1	1	...
Physics	...	...	...	...	...	...	...	...	...
Statics, Hydrostatics	...	11	14	17	...	...	...	...	...
Mechanics	13	...	...	...	...	...	...	...	...
Principles of Mechanics... ...	...	...	...	...	7	...	...	4	3
Practical Mechanics	...	9	8	7	7	...	3	4	...
Magnetism, &c.	...	9	4	5	11	2	2	4	3
Astronomy	...	...	5	...	6	...	4	2	...
Chemistry	16	22	13	28	28	10	11	6	1
Physiology	6	1	6	2	5	...	2	...	3
Botany	2	1	2	2	11	2	2	2	5
Agriculture...	4	2	0	...	...	...	..	...	...
Political and Social Economy ...	...	6	3	14	7	...	3	4	...
Geography	23	28	...	28	34	4	16	12	2
Descriptive Geography	...	...	29	...	...	...	...	...	...
Physical Geography	...	...	17	...	...	...	...	...	...
English History	38	24	43	38	43	14	10	16	3
English Literature...	17	17	33	30	39	5	15	10	9
Logic	...	...	...	...	12	3	4	5	...
Latin and Roman History... ...	15	19	12	18	10	4	2	3	1
French	17	38	68	87	69	7	10	23	29
German	7	15	13	14	16	1	9	6	...
Drawing	7	...	...	...	...	...	...	...	...
Free-hand Drawing	...	4	37	...	...	...	...	...	...
Mechanical Drawing	...	3	34	...	...	...	...	...	...
English Grammar and Composition.	11	...	...	...	...	...	...	...	...
Music	...	...	...	12	13	2	2	5	4
Totals				766	821*	110	234	312	165

* This total includes Seven Papers disqualified.

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